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# Tables for Rocket and Comet Orbits

Samuel Herrick



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# Introduction

The anticipated development of rocket navigation has directed serious attention, for the first time, to rectilinear motion in the two-body problem. The accompanying tables of  $\sin E$  and  $1 - \cos E$  with argument  $E - \sin E$  and the parallel tables in the hyperbolic functions make it possible to determine position and velocity from the time, for rectilinear orbits. This is accomplished, moreover, by direct interpolation, without the aid of series expansions or successive approximations. The inverse process—the determination of the time from position or velocity—is solved by inverse interpolation; the tables were designed primarily for the first of these processes, the more common of the two.

The tables may be used also in connection with nearly rectilinear motion, that is, motion in ellipses and hyperbolas whose eccentricities are near unity. Orbits of these types—cometary orbits—have generally been treated as “nearly parabolic”; that is to say, they have been handled by special tables, based upon series expansions, that correct the position and velocity that would be obtained for a parabola having the same perihelion distance. The “worm’s eye view” resemblance of these orbits to the parabola near perihelion is illusory; actually they are more closely and simply related to rectilinear orbits of the same major axis.

Astronomers will be tempted, upon first consideration, to suspect that the tables will not work near perihelion for “nearly parabolic” orbits. Surprisingly enough, they do. The critical test is not the “nearly parabolic” orbit but the rectilinear one; for both kinds of orbits the device that makes the table usable is its subdivision into “ranges”, the first of which, designated by “ $n \geq 5$ ”, may be used over and over again like a logarithm table or a table of powers (which it is), and yields at least eight significant figures, no matter how closely the moving object may approach to perihelion, perigee, or coincidence. Actually, these tables provide a treatment that is more general than the “nearly parabolic” one; it will handle the parabola, whereas the latter cannot handle the rectilinear orbit. The functions tabulated, moreover, have more general interest and broader application than those of the nearly parabolic tables.

Although the tables are designed for eccentricities near unity, they are usable actually for all values thereof, including zero (cf. section 4). Tables of  $\cos E$  and  $\sin E$  with argument  $E$  will generally be found preferable, of course, when the eccentricity is small.

So far as I have been able to ascertain, tables such as these, giving  $1 - \cos E$  and  $\sin E$  with argument  $E - \sin E$ , etc. have not been previously considered in connection with rectilinear or “nearly parabolic” orbits. I was pleased to discover, however, in a recent study (April 1949) of some papers of Willard Gibbs, which had been stored for 45 years in the vaults of the Yale University Library and recently unearthed by L. P. Wheeler, that his thoughts had been similarly directed. A single sheet in his “astronomical miscellany” indicates that he contemplated a table of  $(E - \sin E)/\sin E$ , or of  $\log (E - \sin E)$ , or of  $\log [(E - \sin E)/\sin^3 E]$ , with argument  $\log \sin E$ .

## 1. Rectilinear Motion; Origin of the Functions

The equations relating time, position, and velocity in the two-body problem reduce to the following when the motion is rectilinear:

<i>Ellipse</i>	<i>Parabola</i>	<i>Hyperbola</i>	} (1)
$M = k(m_1 + m_2)^{1/2} a^{-3/2} (t - T)$	$M = k(m_1 + m_2)^{1/2} (t - T)$	$M = k(m_1 + m_2)^{1/2} (-a)^{-3/2} (t - T)$	
$= E - \sin E$	$= \frac{1}{2} D^3$	$= \sinh F - F'$	
$r = a(1 - \cos E)$	$r = \frac{1}{2} D^2$	$r = -a(\cosh F - 1)$	
$r\dot{r} = a^{3/2} \sin E$	$r\dot{r} = D$	$r\dot{r} = (-a)^{1/2} \sinh F$	

where  $a$  is the length of the transverse or major axis ( $-a > 0$  for the hyperbola);  $k$  is the Gaussian gravitational constant, or a similar constant for geocentric orbits;  $m_1$  is the mass of the sun or earth and is usually taken as unity;  $m_2$  is the mass of the comet or rocket, usually zero;  $t$  is the time;  $T$  is the time of coincidence (=perihelion or perigee passage in nonrectilinear orbits);  $M$  is the mean anomaly for the ellipse and is not named for the other two;  $E$  is the eccentric anomaly for the ellipse;  $F$  is the corresponding angle for the hyperbola;  $D$  is a new auxiliary for the parabola;  $r$  is the radius vector;  $r = dr/dt[k(m_1 + m_2)t]$ . For those unfamiliar with the idea of rectilinear ellipses, parabolas, and hyperbolas, the first is a rectilinear orbit of finite length  $2a$  for which  $\dot{r} = 0$  when  $r = 2a$ ; the second is infinite with  $\dot{r} \rightarrow 0$  as  $r \rightarrow \infty$ ; the third is infinite with  $\dot{r} > 0$ , hypothetically, when  $r = \infty$ .

From eq (1) it is clear that the tabulation of  $1 - \cos E$  and  $\sin E$  with argument  $E - \sin E$  will enable us to obtain  $r/a$  and  $r\dot{r}/a^{3/2}$  by direct interpolation. The accompanying table is designed to give always about the same number of significant figures; whatever the size or "range" of  $E - \sin E$ . Similar remarks apply to the tabulation of  $\cosh F - 1$  and  $\sinh F$  with argument  $\sinh F - F$ .

When  $E$  and  $F$  are sufficiently small, it is evident from the well-known series for sine, cosine, hyperbolic sine, and hyperbolic cosine that eq (1) reduce to:

<i>Ellipse</i>	<i>Hyperbola</i>	}	(2)
$M = \frac{1}{6}E^3$	$M = \frac{1}{6}F^3$		
$r = \frac{1}{2}aE^2$	$r = \frac{1}{2}(-a)F^2$		
$r\dot{r} = a^{3/2}E'$	$r\dot{r} = (-a)^{3/2}F'$		

For sufficiently small values of  $E$  and  $F$ , then, it is evident that our elliptic and hyperbolic tables will be the same, and that they will be giving, in fact,  $\frac{1}{2}E^2$  and  $E$  with argument  $\frac{1}{6}E^3$  (or similarly in  $F$ ). Since the numerical values will repeat, except for the shifting of the decimal point, moreover, it is necessary to give values for only a limited range and to provide a device for shifting the decimal point, as in any other table of powers

Before discussing this device, however, we shall note that the parabolic eq (1) may be solved by the same tables as are used for small values of  $E$  and  $F$ . These tables, that is, may be used to obtain  $\frac{1}{2}D^2$  and  $D$  if entered with the argument  $\frac{1}{6}D^3$ . In fact, if we replace  $a^{1/2}M$  or  $(-a)^{1/2}M$  by  $M = k(m_1 + m_2)^{1/2}(t - T)$ , and  $a^{1/2}E$  or  $(-a)^{1/2}F$  by  $D$ , we find that eq (2) reduce exactly to the parabolic equations of (1). Thus for sufficiently small values of  $E$  and  $F$  elliptic, parabolic, and hyperbolic rectilinear motion are practically indistinguishable. In computation, however, it is preferable to use the elliptic and hyperbolic equations of (1) or (2), since there is no certainty at the start that  $E$  or  $F$  is sufficiently small to permit use of the parabolic form.

The following definitions and general notations have been adopted:

<i>Ellipse</i>	<i>Parabola</i>	<i>Hyperbola</i>	}	
$U = E - \sin E$	$U = \frac{1}{6}D^3$	$U = \sinh F - F$		
$C_e(U) = 1 - \cos E$	$C_p(U) = \frac{1}{2}D^2$	$C_h(U) = \cosh F - 1$		
$S_e(U) = \sin E$	$S_p(U) = D$	$S_h(U) = \sinh F$		
$X_e(U) = E$	$X_p(U) = D$	$X_h(U) = F$		

The following quantities are tabulated for the argument  $u = 10^{2n}U$ :

<i>Ellipse</i>	<i>Parabola</i>	<i>Hyperbola</i>	}	
$c_e = 10^{2n}C_e(U)$	$c_p = 10^{2n}C_p(U)$	$c_h = 10^{2n}C_h(U)$		
$s_e = 10^n S_e(U)$	$s_p = 10^n S_p(U)$	$s_h = 10^n S_h(U)$		
$x_e = 10^n X_e(U)$	$x_p = 10^n X_p(U)$	$x_h = 10^n X_h(U)$		

Since  $U = E - \sin E$  goes through 0 and  $\pi$  with  $E$ , its tabulation as far as  $\pi$  makes the table complete for the ellipse; multiples of  $2\pi$  should be rejected to locate  $U$  between  $-\pi$  and  $+\pi$ . Then the  $X$ 's and  $S$ 's of eq (3) take the sign of  $U$  for the ellipse as well as the parabola and hyperbola; the  $C$ 's are always positive.

The parabolic portion of the table is also complete, since it is essentially a table of powers, usable for any value with only a shift of the decimal point.

The hyperbolic values are carried as far as  $U = \sinh F - F \approx 300$ . For values of  $U$  beyond 300 Dr. Blanch recommends the following series (the terms shown being sufficient for at least the fifth decimal place):

$$\left. \begin{aligned} C_h &= U - 1 + \log_e 2U + U^{-1}(\frac{1}{2} + \log_e 2U) - \frac{1}{2}U^{-2}(\log_e 2U) (-1 + \log_e 2U) + \dots \\ S_h &= U + (\log_e 2U) [1 + U^{-1} - U^{-2}(-1 + \frac{1}{2} \log_e 2U) + \dots] \\ X_h &= (\log_e 2U) [1 + U^{-1} - U^{-2}(-1 + \frac{1}{2} \log_e 2U) + \dots] \end{aligned} \right\} \quad (5)$$

The tables are arranged to show the first differences

$$\delta c_{i+\frac{1}{2}} = c_{i+1} - c_i \text{ and } \delta s_{i+\frac{1}{2}} = s_{i+1} - s_i$$

on a level midway between the levels of the arguments and functions for subscripts  $i$  and  $i+1$ . The modified second differences,

$$\delta^2 c_i = \delta^2 - 0.184\delta^4, \quad (6)$$

are located as is usual with this central difference notation. That is,

$$\delta^2 c_i = \delta c_{i+\frac{1}{2}} - \delta c_{i-\frac{1}{2}}, \text{ etc. , and } \delta^2 c_i \text{ and } \delta^2 s_i$$

are on the same line as  $u_i$ ,  $c_i$ , and  $s_i$ . The tables are designed for use with Everett coefficients for the second differences, and the use of  $\delta^2 c^*$  in place of  $\delta^2$  reduces the error due to neglecting fourth differences to less than one-half unit of the last place, over and above the usual interpolation error. The differences of  $x$  are not included, since the nature of the functions makes the modified second differences of  $x$  the same as the modified second differences of  $s$ .

Linear interpolation will yield four-figure accuracy (relative error  $\leq 0.000041$ ) anywhere in the table.

## 2. Direct Interpolation

Given  $U$ , to obtain  $C$ ,  $S$ ,  $X$ , that is,  $C_e(U)$ ,  $S_e(U)$ ,  $X_e(U)$  for ellipse,  $C_p(U)$ ,  $S_p(U)$ ,  $X_p(U)$  for parabola, or  $C_h(U)$ ,  $S_h(U)$ ,  $X_h(U)$  for hyperbola. Select  $u$  from the "range table" (schedule A); then

$$u = .10^{3n} U. \quad (7)$$

Locate  $u$  between two tabular arguments,  $u_0$  and  $u_1$ , and take note of the functions and differences arranged as follows

$u_0$	$c_0$	$\delta^2 c_0$	$s_0$	$\delta^2 s_0$	$x_0$
	$\delta c_{\frac{1}{2}}$			$\delta s_{\frac{1}{2}}$	
$u_1$	$c_1$	$\delta^2 c_1$	$s_1$	$\delta^2 s_1$	$x_1$

Then

$$p = \frac{u - u_0}{u_1 - u_0}. \quad (9)$$

Interpolate the Everett coefficients  $E_0^c$  and  $E_1^c$  from (p. 99)

Then

$$c = c_0 + p\delta c_{1/2} + E_0^2\delta^2 c_0 + E_1^2\delta^2 c_1 \quad (10)$$

$$s = s_0 + p\delta s_{1/2} + E_0^2\delta^2 s_0 + E_1^2\delta^2 s_1 \quad (11)$$

$$x = (1-p)x_0 + px_1 + E_0^2\delta^2 x_0 + E_1^2\delta^2 x_1 \quad (12)$$

$$C = 10^{-2n}c \quad S = 10^{-n}s \quad X = 10^{-n}x \quad (13)$$

In the following examples, eq (7), (9), and (10) are employed, and  $k=0.017\ 202\ 098\ 95$ ,  $m_1=1.0$ ,  $m_2=0.0$ .

*Example 1. (Rectilinear Ellipse).* Given  $t-T=20^\circ.579\ 397$  and  $a=18.018\ 456$ , to find  $r$ ,  $r\dot{r}$ , and  $E$ .

$$U=M=0.004\ 628\ 4729 \quad (\text{Schedule A gives } n=1.)$$

$$u=4.628\ 4729 \quad E_0^2=-0.05821$$

$$p=0.284\ 729 \quad E_1^2=-0.04361$$

The following portion of the  $n=1$  range of the table is used.

$u$	$c_r$	$\delta c$	$\delta^2 c$	$s_r$	$\delta s$	$\delta^2 s$	$x_e$
4.600	4.545 5290		-4839	2.980 6777		-3173	3.026 6777
		65 3341			20 8428		
4.700	4.610 8631		-4703	3.001 5206		-3061	3.048 5206

$$c_r=4.564\ 1802$$

$$s_r=2.986\ 6441$$

$$x_e=3.032\ 9288$$

$$C_r=0.045\ 641\ 802$$

$$S_r=0.298\ 664\ 41$$

$$X_r=0.303\ 292\ 88$$

$$r=ac_r=0.822\ 394\ 80$$

$$r\dot{r}=a^{1/2}S_r=1.267\ 7752$$

$$E=X_e \text{ (in radians)}$$

*Example 2 (Rectilinear Hyperbola):* Given  $t-T=115^\circ.328\ 387$ ,  $a=-87.171\ 633$ , to find  $r$ ,  $r\dot{r}$ , and  $F$ .

$$U=M=+0.002\ 437\ 5576 \quad (\text{Schedule A gives } u=1.)$$

$$u=+2.437\ 5576 \quad E_0^2=-0.03890$$

$$p=-0.751\ 152 \quad E_1^2=-0.05455$$

The following portion of the  $n=1$  range of the table is used.

$u$	$c_h$	$\delta c$	$\delta^2 c$	$s_h$	$\delta s$	$\delta^2 s$	$x_h$
2.400	2.968 2018		-2837	2.454 4869		-2346	2.430 4869
		41 2058			17 2292		
2.450	3.009 4076		-2760	2.471 7161		-2267	2.447 2161

$$c_h=2.999\ 1797$$

$$s_h=2.467\ 4501$$

$$x_h=2.443\ 0746$$

$$C_h=0.029\ 991\ 797$$

$$S_h=0.246\ 745\ 01$$

$$X_h=0.244\ 307\ 46$$

$$r=-ac_h=2.614\ 4339$$

$$r\dot{r}=(-a)^{1/2}S_h=2.303\ 7533$$

$$F=X_h \text{ (in radians)}$$

*Example 3. (Rectilinear Parabola):* Given  $t-T=5^4.074985$ , to find  $r$  and  $r\dot{t}$ .

$$U=M= 0.087\ 3004 \quad (\text{Schedule A gives } n=1.)$$

$$u=87.3004 \quad E_0^2=-0.05117$$

$$p= 0.6502 \quad E_1^2=-0.06255$$

The following portion of the parabolic (or  $n \geq 5$  for ellipses and hyperbolas) range of the table is used:

$u$	$c_p$	$\delta c$	$\delta^2 * c$	$s_p$	$\delta s$	$\delta^2 * s$
86.000	32.166 4504		-38653	8.020 7793		-9637
		496 7914			61 7007	
88.000	32.663 2418		-37486	8.082 4800		-9275

$$c_p=32.489\ 90 \quad s_p=8.061\ 00$$

$$r=C'_p= 0.324\ 899 \quad r\dot{t}=S_p=-0.806\ 100 \quad [D=X_p=S_p]$$

### 3. Inverse Interpolation

Given  $C$ ,  $S$ , or  $X$ , that is,  $C_r(U)$ ,  $S_r(U)$ , or  $X_r(U)$  for ellipse, or  $C_h(U)$ ,  $S_h(U)$ , or  $X_h(U)$  for hyperbola - to obtain  $U$ . Select  $n$  from the "range table" (schedule A); then, if  $n \geq 5$ ,  $U=\frac{1}{4}S^3=\frac{1}{8}X^3=\frac{1}{4}(2C)^{3/2}$  as with the parabola, and it is not necessary to use the tables; if  $n < 5$ ,

$$c=10^{2n}C' \quad s=10^nS \quad x=10^nX \quad (14)$$

Locate  $c$ ,  $s$ , or  $x$  between two tabular values,  $c_0$  and  $c_1$ ,  $s_0$  and  $s_1$ , or  $x_0$  and  $x_1$ , and take note of the tabular entries arranged as follows:

$u_0$	$c_0$	$\delta^2 * c_0$	$s_0$	$\delta^2 * s_0$	$x_0$
		$\delta c_{1/2}$		$\delta s_{1/2}$	
$u_1$	$c_1$	$\delta^2 * c_1$	$s_1$	$\delta^2 * s_1$	$x_1$

With an approximation to  $p$ ,

$$p^* = \frac{c-c_0}{\delta c_{1/2}} \text{ or } p^* = \frac{s-s_0}{\delta s_{1/2}} \text{ or } p^* = \frac{x-x_0}{x_1-x_0} \quad (16)$$

or a modified value based upon these and anticipating the effect of the modified second differences, take  $E_0^2$  and  $E_1^2$ , (p. 99). Then

$$p = [c-c_0 - E_0^2 \delta^2 * c_0 - E_1^2 \delta^2 * c_1] \div \delta c_{1/2} \quad (17)$$

or

$$p = [s-s_0 - E_0^2 \delta^2 * s_0 - E_1^2 \delta^2 * s_1] \div \delta s_{1/2} \quad (18)$$

or

$$p = [x-x_0 - E_0^2 \delta^2 * x_0 - E_1^2 \delta^2 * x_1] \div (x_1-x_0). \quad (19)$$

If  $C$ ,  $S$ , and  $X$  are all available and are consistent, eq (17), (18), and (19) should check. Then

$$u = u_0 + p(u_1 - u_0) \quad U = 10^{-3n}u. \quad (20)$$

In the following examples eq (14), (16), and (17) are employed, and  $k=0.017\ 202\ 098\ 95$ ,  $m_1=1.0$ ,  $m_2=0.0$ .

*Example 1. (Rectilinear Ellipse):* Given  $r=0.822\ 394\ 80$  and  $a=18.018\ 456$ , to find  $t-T$ .

$$C_e=r/a=0.045\ 641\ 802 \quad (\text{Schedule A gives } n=1.)$$

$$c_e=4.564\ 1802$$

The following portion of the  $n=1$  range of the table is used:

$u$	$c_e$	$\delta c$	$\delta^2 c$
4.600	4.545 5290		-4839
		65 3341	
4.700	4.610 8631		-4703

$$c-c_0=18\ 6512$$

$$p^*=0.285$$

$$p=0.284\ 729$$

$$u=4.628\ 4729$$

$$M=U=0.004\ 628\ 4729$$

$$t-T=20^d.579\ 397$$

$$\begin{cases} E_0^2 = -0.05824 \\ E_1^2 = -0.04364 \end{cases}$$

*Example 2. (Rectilinear Hyperbola):* Given  $r=2.614\ 4339$ , and  $a=-87.171\ 633$ , to find  $t-T$ .

$$C_h=r/(-a)=-0.029\ 991\ 797 \quad (\text{Schedule A gives } n=1.)$$

$$c_h=2\ 999\ 1797$$

The following portion of the  $n=1$  range of the table is used:

$u$	$c_h$	$\delta c$	$\delta^2 c$
2.400	2.968 2018		-2837
		41 2058	
2.450	3 009 4076		-2760

$$c-c_0=30\ 9779$$

$$p^*=0.751$$

$$p=0.751\ 151$$

$$u=2.437\ 5576$$

$$M=U=0.002\ 437\ 5576$$

$$t-T=115^d.328\ 387$$

$$\begin{cases} E_0^2 = -0.03892 \\ E_1^2 = -0.05457 \end{cases}$$

#### 4. Nearly Rectilinear or "Nearly Parabolic" Motion

To appreciate the applicability of the tables to "nearly parabolic" orbits, it is useful to compare some of the basic formulas of the two-body problem as they are used for circular orbits (zero eccentricity), elliptic orbits of moderate eccentricity, elliptic orbits with eccentricity near unity ("nearly rectilinear" or "nearly parabolic"), and rectilinear elliptic orbits (unit eccentricity), as follows:

$e$	0	Moderate	Nearly 1	1
$M$	$E$	$E - e \sin E$	$E - \sin E + (1 - e) \sin E$	$E - \sin E$
$r$	$a$	$a(1 - e \cos E)$	$a[(1 - e) + e(1 - \cos E)]$	$a(1 - \cos E)$
$r$	$a \cos E$	$a(\cos E - e)$	$a[(1 - e) - (1 - \cos E)]$	$-a(1 - \cos E)$
$y$	$a \sin E$	$a(1 - e^2)^{1/2} \sin E$	$a(1 - e^2)^{1/2} \sin E$	0
$r\dot{r}$	0	$a^{1/2}e \sin E$	$a^{1/2}e \sin E$	$a^{1/2} \sin E$
$r\dot{z}$	$-a^{1/2} \sin E$	$-a^{1/2} \sin E$	$-a^{1/2} \sin E$	$-a^{1/2} \sin E$
$r\dot{y}$	$a^{1/2} \cos E$	$a^{1/2}(1 - e^2)^{1/2} \cos E$	$a^{1/2}(1 - e^2)^{1/2} \cos E$	0

Definitions:

$e$  = eccentricity

$a$  = semimajor axis or mean distance

$M$  = mean anomaly

$E$  = eccentric anomaly

$r$  = radius vector

$r = dr/d[k(m_1 + m_2)^{1/2}t]$

$x, y$  = rectangular coordinates referred to the orbit plane, with the  $x$ -axis directed to perihelion or perigee or like point. (Note: Transformation formulas for other axes are not pertinent to the discussion)

It should be apparent from eq (21) that the departures of the nearly rectilinear formulas from the rectilinear ones, when  $e$  is nearly 1, are of the same nature as the departures of the standard formulas from the circular ones, when  $e$  is nearly 0. Accordingly, if tables of  $\cos E$  and  $\sin E$  with argument  $E$  enable us to solve the problem when  $e$  is moderate, tables of  $1 - \cos E$  and  $\sin E$  with argument  $E - \sin E$  should enable us to do so when  $e$  is nearly 1. Techniques for the solution applicable to the one case will generally be applicable to the other.

The technique which we adopt for the solution of the nearly rectilinear problem is modeled upon that developed by L. J. Comrie for the solution of Kepler's equation when the eccentricity is not too near to unity [7].<sup>1</sup> For comparison we briefly sketch this process, slightly modified; it is convenient to divide it into two steps, the "search" and the "interpolation." For the first of these, it is convenient to write Kepler's equation in the form

$$\sin E = (E - M)/e. \tag{22}$$

It should be noted that  $e$  is assumed to be exact, so that  $1/e$  may be carried to as many significant figures as the calculation requires, even when  $e$  is very small. The number  $1/e$  is set up on the keyboard of a calculating machine and multiplied by  $-M$ ;  $-M/e$  then appears in the product register. The multiplier register is then cleared of  $-M$ ; no further clearances are made until  $E$  is located between two adjacent tabular arguments  $E_0$  and  $E_1$ .

For simplicity, we shall assume that we are using a table of sines with radian argument and that  $M$  and  $E$  are, or are treated as being, between 0 and  $\pi$ . From the table select a value of the argument,

<sup>1</sup> Figures in brackets indicate the literature reference on page XXIII

$E_a$ , slightly greater than  $M$ ; introduce this as multiplier, so that  $E_a$  will appear in the multiplier register and  $(E_a - M)/e$  on the product register. If  $\sin E_a$  is greater than the latter quantity, alter the digits of  $E_a$  to those of  $E_b$ , a somewhat larger value of the argument, and repeat. If

$$\sin E_t > (E_t - M)/e,$$

increase  $E_t$ , but if

$$\sin E_t < (E_t - M)/e,$$

decrease  $E_t$ . Eventually,  $E$  will thus be located between the two tabular arguments  $E_0$  and  $E_1$ .

The interpolation of  $E$  between  $E_0$  and  $E_1$  is accomplished by means of

$$E = E_0 + [M - E_0 + e \sin E_0] / (1 - e \cos E_0). \quad (23)$$

As a check we have Kepler's equation in its usual form:

$$M = E - e \sin E. \quad (24)$$

For nearly rectilinear elliptic orbits we may write Kepler's equation

$$M = U + \epsilon S \quad (25)$$

or

$$S = (M - U) / \epsilon, \quad (26)$$

where

$$U = E - \sin E \quad (27)$$

$$\epsilon = 1 - e \quad (28)$$

$$S = S_e(U) = \sin E \quad (29)$$

and, for later use,

$$C = C_e(U) = 1 - \cos E. \quad (30)$$

For simplicity, we shall assume that the accuracy obtainable from the accompanying tables by linear interpolation is sufficient, and that  $C$  and  $S$  are tabulated directly against  $U$ , as in schedule A and the  $n=0$  range. The "search" is then as follows:

Set  $1/\epsilon$  on the keyboard (carry  $1/\epsilon$  to seven or eight significant figures, even when  $\epsilon$  has fewer); multiply by  $M$  and clear the multiplier register; select a tabular  $U_a < M$ ; multiply by  $-U_a$  and check against  $S_a$ ; multiply by larger or smaller  $U_b$  by changing the digits of  $U_a$  without clearing and check against  $S_b$ , etc. If

$$S_t < (M - U_t) / \epsilon$$

increase  $U_t$ , but if

$$S_t > (M - U_t) / \epsilon$$

decrease  $U_t$ . Eventually,  $U$  will be located between the two tabular arguments  $U_0$  and  $U_1$ .

The interpolation between  $U_0$  and  $U_1$  is accomplished by means of

$$U = U_0 + [M - U_0 - \epsilon S_0] C'_0 / (\epsilon + e C'_0). \quad (31)$$

For check we have eq (25). This process is somewhat modified in the next two sections to meet the requirements of tabulation by ranges and of nonlinear interpolation.

The experienced computer will note that the foregoing process and the accompanying tables with argument  $U = E - \sin E$  eliminate, for all eccentricities, the difficulty encountered in Kepler's equation in its standard form, namely, the lack of sufficient figures in any table of  $\sin E$  to give accuracy in  $M = E - e \sin E$  when  $E$  is nearly zero and  $e$  nearly unity. A similar cancellation of significant figures never occurs in  $M = U + \epsilon S$ . He will also observe that modifications are possible in both of the foregoing procedures, and will adopt one to his taste.

The basic hyperbolic formulas that may be handled by the tables are the following:

$$\left. \begin{aligned}
 M &= e \sinh F - F = \sinh F - F + (e-1) \sinh F \\
 r &= -a(e \cosh F - 1) = -a[e(\cosh F - 1) + (e-1)] \\
 x &= a(\cosh F - e) = a[(\cosh F - 1) - (e-1)] \\
 y &= -a(e^2 - 1)^{1/2} \sinh F \\
 r\dot{r} &= (-a)^{3/2} e \sinh F \\
 r\dot{x} &= -(-a)^{1/2} \sinh F \\
 r\dot{y} &= (-a)^{3/2} (e^2 - 1)^{1/2} \cosh F,
 \end{aligned} \right\} \quad (32)$$

where  $M$  and  $F$  are the hyperbolic equivalents of the mean and eccentric anomalies, and the other quantities are defined after eq (21). These equations should be compared with those for the rectilinear hyperbola ( $e=1$ ), eq (1).

The general (nonrectilinear) parabola may also be handled by the tables, when the values encountered lie beyond the ranges or capacities of the tables of Subbotin, Stromgren, and Moller [3a, 4, 5, 6]. For this purpose, we note the following basic parabolic formulas:

$$\left. \begin{aligned}
 M &= \frac{1}{2}(2q)^{3/2} \left( \tan^3 \frac{v}{2} + 3 \tan \frac{v}{2} \right) = \frac{1}{2} D^3 + qD \\
 r &= q \left( 1 + \tan^2 \frac{v}{2} \right) = q + \frac{1}{2} D^2 \\
 x &= q \left( 1 - \tan^2 \frac{v}{2} \right) = q - \frac{1}{2} D^2 \\
 y &= 2q \tan \frac{v}{2} = \sqrt{2q} D \\
 rr &= \sqrt{2q} \tan \frac{v}{2} = D \\
 r\dot{x} &= -\sqrt{2q} \tan \frac{v}{2} = -D \\
 r\dot{y} &= \sqrt{2q} = \sqrt{2q}
 \end{aligned} \right\} \quad (33)$$

where  $q$  is the perihelion or perigee distance, and  $v$  is the true anomaly.  $D$  has been mentioned in connection with the rectilinear parabola ( $q=0$ ); cf. eq (1).

Equations (27), (28), (29), and (30) we shall parallel as follows:

$$\left. \begin{array}{l|l}
 \textit{Parabola} & \textit{Hyperbola} \\
 U = \frac{1}{2} D^2 & U = \sinh F - F \\
 \epsilon = q & \epsilon = e - 1 \\
 S = S_p(U) = D & S = S_h(U) = \sinh F \\
 C = C_p(U) = \frac{1}{2} D^2 & C = C_h(U) = \cosh F - 1
 \end{array} \right\} \quad (34)$$

with these definitions we shall be able to write identical formulas for the three kinds of orbit in many of the steps of the following sections.

## 5. Position and Velocity From Time

Given  $t-T$ ,  $e$ , and  $a$  or  $q=a(1-e)$ , to find  $r$ ,  $x$ ,  $y$ ,  $r\dot{r}$ ,  $r\dot{x}$ ,  $r\dot{y}$  for a parabola or a nearly rectilinear ellipse or hyperbola.

$$\left. \begin{array}{ll} \text{Ellipse:} & M=k(m_1+m_2)^{1/2}a^{-1/2}(t-T), & 1-e=\epsilon \\ \text{Parabola:} & M=k(m_1+m_2)^{1/2}(t-T), & q=\epsilon \\ \text{Hyperbola:} & M=k(m_1+m_2)^{1/2}(-a)^{-1/2}(t-T), & e-1=\epsilon \end{array} \right\} \quad (35)$$

For the determination of  $n$ , locate  $U$  between two successive values  $U_0$  and  $U_1$  in the appropriate part of schedule A, such that

$$\left. \begin{array}{l} S_0 < (M-U_0)/\epsilon \\ S_1 > (M-U_1)/\epsilon \end{array} \right\} \quad (36)$$

[Cf. more detailed instructions after eq (30). Restore  $M/\epsilon$  to the product register, then shift decimal point in this register until it reads  $10^{3n}M/\epsilon$ . Narrow the search, as above, in the  $n$  range of the appropriate part of the main table until  $u$  is located between two successive values  $u_0$  and  $u_1$  such that

$$\left. \begin{array}{l} 10^{2n}s_0 < (10^{3n}M-u_0)/\epsilon \\ 10^{2n}s_1 > (10^{3n}M-u_1)/\epsilon \end{array} \right\} \quad (37)$$

Then

$$u = u_0 + [10^{3n}M - u_0 - 10^{2n}\epsilon s_0] \div [e + 10^{2n}\epsilon c_0^{-1}] \quad (38)$$

$$p = \frac{u - u_0}{u_1 - u_0} \quad (39)$$

With this value of  $u$  take  $E_0^2$  and  $E_1^2$  from page 99; then interpolate  $s$  as in section 2:

$$s = s_0 + p\delta s_{1/2} + E_0^2\delta^2*s_0 + E_1^2\delta^2*s_1. \quad (40)$$

Check calculation by

$$10^{3n}M - u - 10^{2n}\epsilon s = 0. \quad (41)$$

If this check does not indicate that sufficient accuracy has been attained usually will not the first time except in rough calculations—repeat eq (38), using the approximate  $u$  and  $s$  in place of  $u_0$  and  $s_0$ , in order to obtain an improved value of  $u$ . [Note that the first bracket is the left-hand side of eq (41), and that in the second bracket  $c_0$  does not have to be revised.]

Repeat eq (39) with the improved  $u$ , but use the original  $u_0$  and  $u_1$ .

Repeat eq (40); usually it will not be necessary to revise  $E_0^2$  and  $E_1^2$ .

Repeat the check, eq (41). This second check should be sufficient if the calculation is free from error; if not, repeat eq (38), etc. Finally,

$$c = c_0 + p\delta c_{1/2} + E_0^2\delta^2*c_0 + E_1^2\delta^2*c_1 \quad (42)$$

Then

$$C = 10^{-2n}c, \quad S = 10^{-n}s \quad (43)$$

and

<i>Ellipse</i>	<i>Parabola</i>	<i>Hyperbola</i>	}
$r = a(\epsilon + eC)$	$r = q + C$	$r = -a(\epsilon + eC)$	
$x = a(\epsilon - C)$	$x = q - C$	$x = -a(\epsilon - C)$	
$y = a(1 - e^2)^{1/2}S$	$y = (2q)^{1/2}S$	$y = -a(e^2 - 1)^{1/2}S$	
$r\dot{r} = a^{1/2}eS$	$r\dot{r} = S$	$r\dot{r} = (-a)^{1/2}eS$	
$r\dot{x} = -a^{1/2}S$	$r\dot{x} = -S$	$r\dot{x} = -(-a)^{1/2}S$	
$r\dot{y} = a^{1/2}(1 - e^2)^{1/2}(1 - C)$	$r\dot{y} = (2q)^{1/2}$	$r\dot{y} = (-a)^{1/2}(e^2 - 1)^{1/2}(1 + C)$	

In the following examples  $k=0.017\ 202\ 098\ 95$ ,  $m_1=1.0$ ,  $m_2=0.0$ .

*Example 1. (Ellipse):* Given  $t-T=63^d.54400$ ,  $a=18.018\ 456$ ,  $e=0.967\ 645\ 67$ , to find  $r$ ,  $x$ ,  $y$ ,  $r\dot{r}$ ,  $r\dot{x}$ ,  $r\dot{y}$ . This is a Bauschinger example [3b, 12a] ( $q=0.582\ 975\ 07$ ).

$$\begin{aligned}\epsilon &= 0.032\ 354\ 33 & \epsilon^{-1} &= 30.907\ 764 \\ M &= +0.014\ 291\ 560 & M\epsilon^{-1} &= +0.441\ 720\ 16\end{aligned}$$

$U$  is now determined to be in the  $n=1$  range by means of the following data from the elliptic portion of schedule A:

$n$	$U$	$S$	$(M-U)/\epsilon$
1	0.000 15	0.096 413 944	+0.44
	0.15	0.831 121 61	-4.19

Thus

and since for

$$\begin{aligned}n=1, \quad 10^{3n}M\epsilon^{-1} &= +441.720\ 16, & 10^{2n}\epsilon &= +3.235\ 433, \\ u_0 &= 4.600 & (10^{3n}M - u_0)/\epsilon &= +2.995 \times 10^{2n} \\ u_1 &= 4.700 & (10^{3n}M - u_1)/\epsilon &= +2.965 \times 10^{2n},\end{aligned}$$

the following portion of the  $n=1$  range of the main table is selected:

$u$	$c_e$	$\delta c$	$\delta^2 c$	$s_e$	$\delta s$	$\delta^2 s$
4.600	4.545 5290		-4839	2.980 6777		-3173
			65 3341			20 8428
4.700	4.610 8631		-4703	3.001 5206		-3061

$$e + 10^{2n}\epsilon c_0^{-1} = +1.679\ 43$$

$$10^{3n}M - u_0 - 10^{2n}\epsilon s_0 = +0.047\ 777$$

$$u = 4.628\ 448$$

$$p = 0.284\ 48 \quad E_0^2 = -0.05819$$

$$s = 2.986\ 6389 \quad E_1^2 = -0.04357$$

$$10^{3n}M - u - 10^{2n}\epsilon s = +0.000\ 042$$

$$u = 4.628\ 473$$

$$p = 0.284\ 73$$

$$s = 2.986\ 6441$$

$$10^{3n}M - u - 10^{2n}\epsilon s = +0.000\ 000 \quad [\text{check}]$$

$$c = 4.564\ 1802$$

$$c' = 0.045\ 641\ 802$$

$$\begin{aligned}
S &= 0.298\ 664\ 41 \\
r &= 1.378\ 7618 & rr &= +1.226\ 757\ 21 \\
x &= -0.239\ 419\ 69 & rx &= -1.267\ 775\ 23 \\
y &= +1.357\ 815\ 28 & ry &= +1.022\ 138\ 72
\end{aligned}$$

From these values we may obtain also  $v = 100^0.000\ 01$ , which is apparently a slightly more accurate result than that of Bauschinger.

*Example 2. (Hyperbola):* Given  $t - T = 216^d.404\ 21$ ,  $a = -87.171\ 633$ ,  $e = 1.008\ 658$ , to find  $r$ ,  $x$ ,  $y$ ,  $rr$ ,  $rx$ ,  $ry$ . This is also a Bauschinger example [3c] ( $q = 0.754\ 732$ ).

$$\begin{aligned}
\epsilon &= +0.008\ 658 & \epsilon^{-1} &= 115.500\ 12 \\
M &= +0.004\ 573\ 8759 & M\epsilon^{-1} &= +0.528\ 2832
\end{aligned}$$

$U$  is now determined to be in the  $n = 1$  range by means of the following data from the hyperbolic portion of schedule A:

$n$	$U$	$S$	$(M - U)/\epsilon$
1	0.000 15	0.096 683 944	+0.51
	0.15	1.101 059 31	-16.79

Thus

$$n = 1, \quad 10^{3n}M\epsilon^{-1} = +528.2832, \quad 10^{2n}\epsilon = +0.8658,$$

and since for

$$u_0 = 2.400, \quad (10^{3n}M - u_0)/\epsilon = +2.511 \times 10^{2n},$$

$$u_1 = 2.450 \quad (10^{3n}M - u_1)/\epsilon = +2.453 \times 10^{2n},$$

the following portion of the  $n = 1$  range of the main table is selected:

$u$	$c_h$	$\delta c$	$\delta^2 * c$	$s_h$	$\delta s$	$\delta^2 * s$
2.400	2.968 2018		-2837	2.454 4869		-2346
		41 2058			17 2292	
2.450	3.009 4076		-2760	2.471 7161		-2267

$$e + 10^{2n}\epsilon c_0^{-1} = +1.300\ 35$$

$$10^{3n}M - u_0 - 10^{2n}\epsilon s_0 = +0.048\ 781$$

$$u = 2.437\ 514$$

$$p = 0.750\ 28 \quad E_0^2 = -0.03902$$

$$s = 2.467\ 4352 \quad E_1^2 = -0.05466$$

$$10^{3n}M - u - 10^{2n}\epsilon s = +0.000\ 057$$

$$u=2.437\ 557$$

$$p=0.751\ 14$$

$$s=2.467\ 4499$$

$$10^{3n}M - u - 10^{2n}\epsilon s = +0.009\ 001 \quad [\text{check}]$$

$$\left. \begin{array}{l} c = 2.999\ 1797 \\ C = 0.029\ 991\ 797 \\ S = 0.246\ 745\ 01 \end{array} \right\} \text{Result of an additional, hardly necessary, approximation.}$$

$$r = 3.391\ 8017 \quad r\dot{r} = 2.323\ 6992$$

$$x = -1\ 859\ 7019 \quad r\dot{x} = -2.303\ 7533$$

$$y = +2.836\ 5167 \quad r\dot{y} = +1.268\ 1866$$

From these values we may obtain also  $v=123^\circ\ 25000$ , to check Bauschinger's result.

*Example 3. (Parabola):* Given  $t-T=5^d.5436$ ,  $q=0.01$ ,  $e=1.0$ , to find  $r$ ,  $x$ ,  $y$ ,  $r\dot{r}$ ,  $r\dot{x}$ ,  $r\dot{y}$ .

$$\epsilon = q = 0.01 \quad \epsilon^{-1} = 100.0$$

$$M = +0.095\ 3616 \quad M\epsilon^{-1} = +9.536\ 16$$

$U$  is now determined to be in the  $n=1$  range by means of the following data from the parabolic portion of schedule A:

$n$	$U$	$S$	$(M-U)/\epsilon$
1	0.000 15	0.096 548 938	+9.521
	0.15	0.965 489 38	-5.463

Thus

$$n=1, \quad 10^{3n}M\epsilon^{-1} = +9536.16, \quad 10^{2n}\epsilon = +1.0,$$

and since for

$$u_0 = 86.000 \quad (10^{3n}M - u_0)/\epsilon = 9.3616 \times 10^{2n}$$

$$u_1 = 88.000 \quad (10^{3n}M - u_1)/\epsilon = 7.3616 \times 10^{2n}$$

the following portion of the parabolic (or  $n \geq 5$  for ellipses and hyperbolas) range of the main table is selected:

$u$	$c_p$	$\delta c$	$\delta^2 c$	$s_p$	$\delta s$	$\delta^2 s$
86.000	32.166 4504		-38653	8.020 7793		-9637
88.000	32.663 2418	496 7914	-37486	8.082 4800	61 7007	-9275

$$e + 10^{2n}\epsilon c_0^{-1} = +1.0311$$

$$10^{3n}M - u_0 - 10^{2n}\epsilon s_0 = +1.3408$$

$$u = 87.3004$$

$$\begin{aligned}
p &= 0.6502 & E_0^2 &= -0.05117 \\
s &= 8.06100 & E_1^2 &= -0.06255 \\
10^{2n}M - u - 10^{2n}\epsilon s &= 0.0002 & & \text{[check]}
\end{aligned}$$

Note: no further approximation is necessary to the accuracy desired here. Compare examples 1 and 2

$$\begin{aligned}
c &= 32.4899 \\
C &= 0.324\ 899 \\
S &= 0.806\ 100 \\
r &= 0.334\ 899 & r\dot{r} &= 0.806\ 100 \\
x &= -0.314\ 899 & r\dot{x} &= -0.806\ 100 \\
y &= +0.114\ 000 & r\dot{y} &= 0.141\ 421
\end{aligned}$$

For comparison with the Möller table [3a, 6], we find and check  $\tan v/2 = 5.7000$ . This is the last entry in the Möller table, beyond which, or for greater accuracy, the foregoing process is evidently useful.

### 6. Time from Position or Velocity

Given  $e$ ,  $a$  or  $q = a(1-e)$ , and some of  $r$ ,  $x$ ,  $y$ ,  $r\dot{r}$ ,  $r\dot{x}$ ,  $r\dot{y}$ , to find  $t - T$  for a parabola or a nearby rectilinear ellipse or hyperbola.

<i>Ellipse</i>	<i>Parabola</i>	<i>Hyperbola</i>	}
$\epsilon = 1 - e$	$\epsilon = q$	$\epsilon = e - 1$	
$C = (ra^{-1} - \epsilon)/e$	$C = r - q$	$C = [r(-a)^{-1} - \epsilon]/e$	
$= \epsilon - xa^{-1}$	$= q - x$	$= \epsilon - x(-a)^{-1}$	
$= 1 - r\dot{y}a^{-1/2}(1 - e^2)^{-1/2}$	$S = r\dot{r}$	$= r\dot{y}(-a)^{-1/2}(e^2 - 1)^{-1/2} - 1$	
$S = r\dot{r} a^{-1/2} e^{-1}$	$= -r\dot{x}$	$S = r\dot{r}(-a)^{-1/2}e^{-1}$	
$= -r\dot{x} a^{-1/2}$	$= y(2q)^{-1/2}$	$= -r\dot{x}(-a)^{-1/2}$	
$= y a^{-1}(1 - e^2)^{-1/2}$	$X = D = S$	$= y(-a)^{-1}(e^2 - 1)^{-1/2}$	
$X = E$		$X = F$	

For ellipse and hyperbola refer now to schedule A to find  $n$  and the proper range of the main table. For the parabola, and for ellipse and hyperbola if  $n \geq 5$ , we need not make use of the table, since

$$U = \frac{1}{2}S^2 = \frac{1}{2}X^2 = \frac{1}{2}(2C)^2 \tag{46}$$

Otherwise,

$$c = 10^{2n}C, \quad s = 10^nS, \quad x = 10^nX. \tag{47}$$

By inverse interpolation (cf. section 3) determine  $u$ . Then

$$U = 10^{-2n}u \tag{48}$$

$$M = U + \epsilon S \tag{49}$$

$$\left. \begin{aligned}
\text{Ellipse: } & t - T = Ma^{3/2}k^{-1}(m_1 + m_2)^{-1/2} \\
\text{Parabola: } & t - T = Mk^{-1}(m_1 + m_2)^{-1/2} \\
\text{Hyperbola: } & t - T = M(-a)^{3/2}k^{-1}(m_1 + m_2)^{-1/2}
\end{aligned} \right\} \tag{50}$$

In the following examples  $k=0.017\ 202\ 098\ 95$ ,  $m_1=1.0$ ,  $m_2=0.0$ .

*Example 1. (Ellipse):* Given  $e=0.967\ 645\ 67$ ,  $a=18.018\ 456$ ,  $x=-0.239\ 419\ 73$ ,  $y=+1.357\ 815\ 28$ , to find  $t-T$ . This is a Bauschinger example [3b, 12a] ( $q=0.582\ 975\ 07$ ,  $v=100^\circ.0000$ ).

$$\epsilon=0.032\ 354\ 33$$

$$C=0.045\ 641\ 802 \quad S=0.298\ 664\ 41 \quad (\text{Schedule A gives } n=1.)$$

$$c=4.564\ 1802 \quad s=2.986\ 6441$$

The following portion of the  $n=1$  range of the table is used.

$u$	$c_c$	$\delta c$	$\delta^2 c$	$s_c$	$\delta s$	$\delta^2 s$
4.600	4.545 5290		-4839	2.980 6777		-3173
		65 3341			20 8428	
4.700	4.610 8631		-4703	3.001 5206		-3061

$$c-c_0=18\ 6512 \quad s-s_0=5\ 9664$$

$$p^*=-0.285\ 474 \quad p^*=-0.286\ 257$$

$p^*=-0.285$  is adopted because the second difference terms will evidently reduce both of these values.

$$E_0^2=-0.058\ 24$$

$$E_1^2=-0.043\ 64$$

$$p=-0.284\ 729 \quad p=0.284\ 730$$

$$u=4.628\ 4729$$

$$U=0.004\ 628\ 4729$$

$$M=0.014\ 291\ 560 \quad t-T=63^d.54400$$

*Example 2. (Hyperbola):* Given  $e=1.008\ 658$ ,  $a=-87.171\ 6331$ ,  $x=-1.859\ 7019$ ,  $y=+2.836\ 5167$ , to find  $t-T$ . This is also a Bauschinger example [3c] ( $q=0.754\ 732$ ,  $v=123^\circ.25000$ ).

$$\epsilon=0.008\ 658$$

$$C=0.029\ 991\ 797 \quad S=0.246\ 745\ 01 \quad (\text{Schedule A gives } n=1.)$$

$$c=2.999\ 1797 \quad s=2.467\ 4501$$

The following portion of the  $n=1$  range of the table is used.

$u$	$c_h$	$\delta c$	$\delta^2 c$	$s_h$	$\delta s$	$\delta^2 s$
2.400	2.968 2018		-2837	2.454 4869		-2346
		41 2058			17 2292	
2.450	3.009 4076		-2760	2.471 7161		-2267

$$\begin{aligned}
c - c_0 &= 30\ 9779 & s - s_0 &= 12\ 9632 \\
p^* &= 0.751\ 785 & p^* &= 0.752\ 397 \\
p^* &= 0.751 \text{ is adopted because the second difference terms} \\
&\quad \text{will evidently reduce both of these values.} \\
E_0^2 &= -0.03892 \\
E_1^2 &= 0.05457 \\
p &= 0.751\ 151 & p &= 0.751\ 149 \\
u &= 2.437\ 5576 \\
U &= 0.002\ 437\ 5576 \\
M &= 0.004\ 573\ 8759 & t - T &= 216^d.40421
\end{aligned}$$

## 7. Method of Computation of the Tables <sup>2</sup>

Given

$$U = E - \sin E, \quad C_e(U) = 1 - \cos E, \quad S_e(U) = \sin E. \quad (51)$$

The power series for  $U$  and  $C_e(U)$  in terms of  $E$  are

$$\left. \begin{aligned}
U &= \frac{E^3}{3!} - \frac{E^5}{5!} + \dots \\
C_e(U) &= \frac{E^2}{2!} - \frac{E^4}{4!} + \dots
\end{aligned} \right\} \quad (52)$$

Let  $\omega = (6U)^{1/2}$ . It follows from (51) that  $E$  and  $S_e(U)$  have MacLaurin expansions in  $\omega$ ,  $C_e(U)$  has a MacLaurin expansion in  $\omega^2$ , and for  $\omega$  sufficiently small the series converge rapidly. It is enough to obtain either  $C = C_e(U)$  or  $S = S_e(U)$  in terms of  $U$ , and then to use the relation

$$S = \sqrt{1 - (1 - C)^2} = \sqrt{2C - C^2}.$$

Actually, the power series for  $C_e(U)$  was obtained by inverting (52):

$$C_e(U) = \sum_{n=1}^8 A_n \omega^{2n} + R,$$

where, for  $U \leq \frac{1}{2}$  (i. e.,  $\omega^2 \leq 1$ ),  $|R| < 10^{-10}$ . We give the values of  $A_n$ :

$$A_1 = \frac{1}{2} = .5$$

$$A_2 = -\frac{1}{2^3 \cdot 5} = -.025$$

$$A_3 = -\frac{3}{2^5 \cdot 5^2 \cdot 7} = -.00053\ 57142\ 85714$$

$$A_4 = -\frac{23}{2^7 \cdot 3^2 \cdot 5^3 \cdot 7} = -.00002\ 28174\ 60317$$

$$A_5 = -\frac{947}{2^8 \cdot 3^2 \cdot 5^4 \cdot 7^2 \cdot 11} = -.00000\ 12201\ 09256$$

$$A_6 = -\frac{3293}{2^{11} \cdot 5^3 \cdot 7^2 \cdot 11 \cdot 13} = -.00000\ 00734\ 31033$$

$$A_7 = -\frac{604523}{2^{11} \cdot 3^4 \cdot 5^6 \cdot 7^3 \cdot 11 \cdot 13} = -.00000\ 00047\ 54969$$

$$A_8 = -\frac{11192989}{2^{15} \cdot 3^4 \cdot 5^6 \cdot 7^3 \cdot 11 \cdot 13 \cdot 17} = -.00000\ 00003\ 23677$$

<sup>2</sup> This section was written by G. Blanch and E. L. Lukis of the National Bureau of Standards Institute for Numerical Analysis.

For our present purposes it would have been enough to carry 10 decimals in the value of  $A_n$ , since the series was used for  $\omega^2 < 1$ . The more accurate values are being exhibited for their possible usefulness in other investigations.

For  $U \geq .17$ , 10-place values of  $E$  were obtained by inverse interpolation in the function  $U = E - \sin E$ . The sines were obtained from BAAS, Vol. I [14]. Once  $E$  was known,  $C_e(U)$  and  $S_e(U)$  were computed in turn from (51). The value corresponding to  $U = .17$  was computed by both methods and results were in agreement to within  $2 \times 10^{-10}$ .

Similarly, let

$$U = \sinh F - F, \quad C_h(U) = \cosh F - 1, \quad S_h(U) = \sinh F.$$

Then if  $\omega = (6U)^{1/2}$ ,

$$C_h(U) = \sum_{n=1}^8 B_n \omega^{2n} + R,$$

where  $B_{2n-1} = A_{2n-1}$ ,  $B_{2n} = -A_{2n}$ , and for  $\omega^2 < 1$ ,  $|R| < 10^{-10}$ .

Let  $U = u \cdot 10^{-3n}$ , then  $\omega^2 = (6u)^{1/2} 10^{-2n} = b \cdot 10^{-2n}$ .

Hence

$$C_e(U) = 10^{-2n}(C_1 + C_2), \quad C_h(U) = 10^{-2n}(C_1 - C_2), \quad (53)$$

where

$$\left. \begin{aligned} C_1 &= A_1 b + A_3 b^3 \cdot 10^{-4n} + A_5 b^5 \cdot 10^{-8n} + A_7 b^7 \cdot 10^{-12n} + \dots \\ C_2 &= A_2 b^2 \cdot 10^{-2n} + A_4 b^4 \cdot 10^{-6n} + A_6 b^6 \cdot 10^{-10n} + A_8 b^8 \cdot 10^{-14n} + \dots \end{aligned} \right\} \quad (54)$$

Thus the four terms of  $C_1$  and four terms of  $C_2$  are the same for all  $n$ , except for the position of the decimal point. Since the argument  $u$  is the same for all values of  $n$ , except  $n=0$ , the individual terms of  $C_1$  and  $C_2$  were computed as accurately as they were needed for  $n=0$  or 1. Then by merely shifting the decimal point, the corresponding terms were available for the other values of  $n$ . It is clear that with increasing  $n$ , several terms dropped out. All work involving the series (the greater bulk of the table) was done by means of IBM equipment--the 602 multiplier and 405 tabulator. The values of  $(6u)^{1/2}$  were taken from the NBS Table of Fractional Powers [17] (given to 15D). This table has been extended here to give, alongside every  $x^{1/2}$  and  $x^{3/2}$ , the corresponding values of  $(10x)^{1/2}$ ,  $(100x)^{1/2}$ ,  $(10x)^{3/2}$ , and  $(100x)^{3/2}$ .

For  $U \geq .17$ , the function  $F$  was obtained by inverse interpolation in  $\sinh F - F$ ;  $\sinh F$  was computed with the aid of Van Orstrand's tables [15] of  $e^x$  and  $e^{-x}$ , and Holtappel's table [16]. This part of the work was done by means of calculating machines. All values were differenced.

Consider the eq (53) and (54) for  $n \geq 5$ . Inserting the values of  $A_n$ , with  $U = 10^{-3n}u$ , we have

$$c_e = 10^{2n} C_e(U) = \frac{1}{2}(6u)^{1/2} - \frac{10^{-2n}}{40} (6u)^{3/2} + \dots, \quad (55)$$

$$c_h = 10^{2n} C_h(U) = \frac{1}{2}(6u)^{3/2} + \frac{10^{-2n}}{40} (6u)^{5/2} + \dots \quad (56)$$

It can also be shown that

$$s_e = 10^n S_e(U) = (6u)^{1/2} - \frac{9}{10} 10^{-2n}u + \dots, \quad (57)$$

$$s_h = 10^n S_h(U) = (6u)^{3/2} + \frac{9}{10} 10^{-2n}u + \dots, \quad (58)$$

$$x_e = 10^n X_e(U) = (6u)^{1/2} + \frac{1}{10} 10^{-2n}u + \dots, \quad (59)$$

$$x_h = 10^n X_h(U) = (6u)^{3/2} - \frac{1}{10} 10^{-2n}u + \dots \quad (60)$$

As  $u$  ranges between 0 and 150,  $\frac{1}{60}(6u)^{34}$  ranges between 0 and 218; hence from (55) and (56),  $c_e = c_n = \frac{1}{2}(6u)^{34}$  to within  $2 \cdot 10^{-10}$  for  $n \geq 6$  and to within  $218 \cdot 10^{-10}$  for  $n = 5$ . It follows that in the region where seven decimals are given in the entries ( $u > .34$ ), only an occasional correction in rounding is required for  $n = 5$  if we set  $c_e = c_n = \frac{1}{2}(6u)^{34}$ . It is clear from (57) and (58) that similar rounding corrections for  $s_e$  and  $s_n$ , when these functions are equated to  $(6u)^{34}$ , are even smaller; and from (59) and (60), no correction at all is required if we set  $x_n = x_e = (6u)^{34}$ , to within 1.5 units in the ninth decimal for  $n \geq 5$ . For  $u \leq .34$ , where eight decimals are given in the entries, the term  $\frac{1}{60}(6u)^{34}$  is less than .065; hence no corrections at all are needed in any of the entries. The rounding corrections, where necessary in  $c_e, c_n, s_e, s_n$  for  $n = 5$  (but not for  $n > 5$ ), are indicated alongside the entries by the following symbols:

- a: reduce  $c_e$  only by one unit in last place
- b: increase  $c_n$  only by one unit in last place
- c: reduce  $s_e$  only by one unit in last place
- d: increase  $s_n$  only by one unit in last place.

In the region where six decimals are given in the function  $S_n(U)$ , the results are good to within a unit in the last place; where seven or eight places are given, the error is believed to be less than 0.6 units of the last place.

The final manuscript, which was reproduced by a photo-offset process, was prepared on an IBM card-controlled typewriter. Adequate testing of the manuscript was therefore an important problem. We describe below the procedure that was followed.

After the tested entries were rounded, they were listed, summed in groups of ten, and their first differences taken during the same run through an IBM 405 tabulator. Successive differences were then taken of this first difference, up to order six of the original entries. Since the unrounded entries were differenced and presumed correct, the differences of the rounded entries should have revealed few, if any, errors. Actually, a few errors were found, due to improper corrections. It is clear that the differences of the rounded entries were guaranteed to be those corresponding to the entries which were summed. After the final manuscript was completed, the entries on the manuscript were summed on a Sundstrand adding machine in the same groups of ten, and the sums so obtained were subtracted from the recorded sums for the rounded punched cards. A zero total was accepted as proof that the entries on the manuscript were the same as those on the tested punched cards. In addition, the pages were inspected for continuity and for missing digits (since a missing zero would not be picked up by the test applied). Several errors were discovered, most of them due to digits which failed to print. Some were operators' errors, due apparently to improper card replacements when there was machine trouble. All regions where changes were made, either in the listing of the preliminary rounded entries or in the final manuscript, were redifferenced on a Sundstrand adding machine.

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SAMUEL HERRICK.

## 9. References

### "NEARLY PARABOLIC" ORBITS

- [1] K. F. Gauss, *Theoria Motus*, 33-46 (p. 38-53 of English translation by C. H. Davis, Boston, Little-Brown, 1857).
- [2] A. Marth, *Astronomische Nachrichten*, **43**, 115-134, 1856.
- [3] J. Bauschinger, *Tafeln zur Theoretischen Astronomie* (2d ed., by G. Stracke: Leipzig, Engelmann, 1934). (a) Tables 14a, 14b, p. 12-13, 86-95, (b) p. 14-16, 21, (c) p. 19-20.
- [4] B. Strömberg, Tables giving  $\tan v/2$  and  $\tan^2 v/2$  in parabolic motion with argument  $M = (t-T)q^{-3/2}$ , to facilitate the computation of ephemerides from parabolic elements. *Publikationer fra Kobenhavns Observatorium*, No. 58; *Memoirs of the British Astronomical Association*, **27**, pt. 2, p. 41-57 (1927).
- [5] M. T. Subbotin, Formules et tables pour le calcul des orbites et des ephemerides. *Publications of the Tashkent Astronomical Observatory*, **2**, 119 (1929)
- [6] J. P. Moller, Table giving  $\tan v/2$  in parabolic motion with argument  $M = (t-T)q^{-3/2}$  from  $M = 275$  to  $M = 4515$ . *Publikationer fra Kobenhavns Observatorium*, No. 82 (1932)
- [7] J. P. Moller, The calculation of ephemerides in nearly parabolic orbits. *Monthly Notices of the Royal Astronomical Society*, **93**, 777-788 (October 1933).
- [8] P. Herget, Tables for true anomaly and perihelion passage in nearly parabolic orbits. *Publications of the Cincinnati Observatory*, No. 21, 1936. (Also reproduced as table V in the author's *The Computation of Orbits*, Cincinnati, 1948.)
- [9] S. Herrick, "Nearly parabolic" and "nearly rectilinear" orbits. *Astronomical Journal*, **51**, 123 (1945).

### GENERAL REFERENCES

- [10] J. L. Lagrange, *Memoirs de l'Academie de Berlin*, **24**, 1770, *Oeuvres*, **3**, 25-39.
- [11] E. T. Whittaker and G. N. Watson, *A Course of Modern Analysis*. (Cambridge, University Press, 1902-27; New York, Macmillan, 1913, 1945.) (a) p. 132-133 of 1945 ed.
- [12] R. T. Crawford, *Determination of Orbits of Comets and Asteroids*. (New York, McGraw-Hill, 1930.) (a) p. 31-32.
- [13] F. R. Moulton, *An Introduction to Celestial Mechanics*. (New York, Macmillan, 2d ed. 1914.) (a) p. 169-171.

### TABULAR REFERENCES

- [14] British Association for the Advancement of Science, *Mathematical Tables*, **1**. (Cambridge, University Press, 1946.)
- [15] C. E. Van Orstrand, Tables of the exponential function and of the circular sine and cosine to radian argument. *Memoirs of the National Academy of Sciences*, **14**, fifth memoir. (Washington, Government Printing Office, 1921.)
- [16] H. W. Holtappel, *Tafels van  $e^x$*  (Noordhoff, Groningen, 1938).
- [17] National Bureau of Standards, *Tables of Fractional Powers* (New York, Columbia University Press, 1946).

Schedule A. Ranges of values for various  $n$ 's

	$n$	$U = E - \sin E = 10^{-3n}u$	$C_e(U) = 1 - \cos E = 10^{-2n}c_e$	$S_e(U) = \sin E = 10^{-n}s_e$	$X_e(U) = E = 10^{-n}x_e$
ELLIPSE	*	0.000 000 000 000 000 15	0 000 000 000 046 608 488	0.000 009 654 8938	0.000 009 654 8938
	5	0 000 000 000 000 15	0 000 000 004 660 848 8	0.000 096 548 938	0.000 096 548 938
	4	0 000 000 000 15	0 000 000 466 084 85	0.000 965 489 25	0.000 965 489 40
	3	0 000 000 15	0.000 046 608 270	0.009 654 758 8	0.009 654 908 8
	2	0.000 15	0.004 658 676 0	0.096 413 944	0.096 563 944
	1	0.15	0.443 909 30	0.831 121 61	0.981 121 61
	0	3.141 592 654	2.000 000	0.000 000 0	3.141 592 7
PARABOLA	$n$	$U = \frac{1}{2}D^2 = 10^{-3n}u$	$C_p(U) = \frac{1}{2}D^2 = \frac{1}{2}(6U)^{\frac{2}{3}} = 10^{-2n}c_p$	$S_p(U) = D = (6U)^{\frac{1}{3}} = 10^{-n}s_p$	$X_p(U) = D = (6U)^{\frac{1}{3}} = 10^{-n}x_p$
	*	0.000 000 000 000 000 15	0.000 000 000 046 608 488	0.000 009 654 8938	0.000 009 654 8938
	5	0.000 000 000 000 15	0.000 000 004 660 848 8	0 000 096 548 938	0.000 096 548 938
	4	0.000 000 000 15	0.000 000 466 084 88	0.000 965 489 38	0.000 965 489 38
	3	0 000 000 15	0.000 046 608 488	0.009 654 893 8	0.009 654 893 8
	2	0.000 15	0 004 660 848 8	0.096 548 938	0.096 548 938
	1	0.15	0.466 084 88	0.965 489 38	0.965 489 38
HYPERBOLA	$n$	$U = \sinh F - F = 10^{-3n}u$	$C_h(U) = \cosh F - 1 = 10^{-2n}c_h$	$S_h(U) = \sinh F = 10^{-n}s_h$	$X_h(U) = F = 10^{-n}x_h$
	*	0.000 000 000 000 000 15	0 000 000 000 046 608 488	0.000 009 654 8938	0 000 009 654 8938
	5	0.000 000 000 000 15	0 000 000 004 660 848 8	0 000 096 548 939	0 000 096 518 938
	4	0.000 000 000 15	0 000 000 466 084 90	0 000 965 489 52	0.000 965 489 37
	3	0 000 000 15	0.000 016 608 705	0.009 655 028 8	0.009 654 878 8
	2	0 000 15	0 004 663 020 7	0.096 683 944	0.096 533 944
	1	0.15	0 487 390 87	1.101 059 31	0 951 059 31
0	300.0	305.4	306.4	6 4	

\*For each table move decimal point to left, 3 places in  $U$ , 2 in  $C$ , and 1 in  $S$  and  $X$ , for each unit in  $n > 5$

†For parabola only. move decimal point to right, 3 places in  $U$ , 2 in  $C$ , and 1 in  $S$  and  $X$ , for each unit in  $n < 1$

## Tables

**Ellipse:**  $1 - \cos E$ ,  $\sin E$ ,  $E$  with argument  $E - \sin E$

**Parabola:**  $\frac{1}{2}D^2$  and  $D$  with argument  $\frac{1}{6}D^3$

**Hyperbola:**  $\cosh F - 1$ ,  $\sinh F$ ,  $F$  with argument  $\sinh F - F$



Hyperbola:  $n \geq 5$

$$10^{-n}u = U = \sinh F - F$$

$$10^{-n}c_h = C_h(U) = \cosh F - 1$$

$$10^{-n}s_h = S_h(U) = \sinh F$$

$$10^{-n}x_h = X_h(U) = F$$

Parabola: all values of  $n$

$$10^{-n}u = U = \frac{1}{2}D^2$$

$$10^{-n}c_p = C_p(U) = \frac{1}{2}D^2$$

$$10^{-n}s_p = S_p(U) = D$$

$$10^{-n}x_p = X_p(U) = D$$

Ellipse:  $n \geq 5$

$$10^{-n}u = U = E - \sin E$$

$$10^{-n}c_e = C_e(U) = 1 - \cos E$$

$$10^{-n}s_e = S_e(U) = \sin E$$

$$10^{-n}x_e = X_e(U) = E$$

$u$	$c_h = c_p = c_e$	$\delta$	$\delta^2$	$s_h = s_p = s_e$	$\delta$	$\delta^2$	$x_h = x_p = x_e$
0.150	0.466 08488	10 30074	- 11504	0.965 48938	10 61062	- 23827	0.965 48938
0.155	0.476 38561	10 19055	- 11012	0.976 10001	10 38482	- 22561	0.976 10001
0.160	0.486 57616	10 08493	- 10556	0.986 48483	10 17066	- 21399	0.986 48483
0.165	0.496 66109	9 98355	- 10132	0.996 65549	9 96722	- 20329	0.996 65549
0.170	0.506 64464	9 88614	- 9737	1.006 62271	9 77365	- 19343	1.006 62271
0.175	0.516 53078	9 79242	- 9368	1.016 39636	9 58921	- 18431	1.016 39636
0.180	0.526 32319	9 70215	- 9023	1.025 98557	9 41324	- 17586	1.025 98557
0.185	0.536 02534	9 61512	- 8699	1.035 39881	9 24512	- 16802	1.035 39881
0.190	0.545 64047	9 53114	- 8395	1.044 64393	9 08432	- 16071	1.044 64393
0.195	0.555 17161	9 45001	- 8110	1.053 72824	8 93033	- 15391	1.053 72824
0.200	0.564 62162	9 37158	- 7840	1.062 65857	8 78270	- 14755	1.062 65857
0.205	0.573 99320	9 29569	- 7587	1.071 44127	8 64103	- 14160	1.071 44127
0.210	0.583 28889	9 22220	- 7347	1.080 08230	8 50494	- 13603	1.080 08230
0.215	0.592 51108	9 15098	- 7120	1.088 58723	8 37408	- 13080	1.088 58723
0.220	0.601 66206	9 08191	- 6905	1.096 96131	8 24814	- 12588	1.096 96131
0.225	0.610 74396	9 01487	- 6701	1.105 20945	8 12683	- 12126	1.105 20945
0.230	0.619 75884	8 94978	- 6508	1.113 33628	8 00989	- 11690	1.113 33628
0.235	0.628 70862	8 88652	- 6324	1.121 34617	7 89706	- 11278	1.121 34617
0.240	0.637 59514	8 82502	- 6149	1.129 24323	7 78813	- 10889	1.129 24323
0.245	0.646 42016	8 76519	- 5982	1.137 03137	7 68288	- 10522	1.137 03137
0.250	0.655 18535	8 70694	- 5823	1.144 71424	7 58111	- 10173	1.144 71424
0.255	0.663 89229	8 65021	- 5671	1.152 29535	7 48265	- 9843	1.152 29535
0.260	0.672 54250	8 59494	- 5526	1.159 77800	7 38732	- 9530	1.159 77800
0.265	0.681 13744	8 54105	- 5388	1.167 16532	7 29497	- 9232	1.167 16532
0.270	0.689 67849	8 48848	- 5255	1.174 46029	7 20546	- 8949	1.174 46029
0.275	0.698 16697	8 43719	- 5128	1.181 66575	7 11864	- 8679	1.181 66575
0.280	0.706 60416	8 38712	- 5007	1.188 78439	7 03439	- 8423	1.188 78439
0.285	0.714 99128	8 33821	- 4890	1.195 81878	6 95259	- 8178	1.195 81878
0.290	0.723 32949	8 29042	- 4778	1.202 77137	6 87313	- 7944	1.202 77137
0.295	0.731 61991	8 24371	- 4670	1.209 64450	6 79590	- 7721	1.209 64450
0.300	0.739 86362	8 19804	- 4567	1.216 44040	6 72080	- 7508	1.216 44040
0.305	0.748 06166	8 15336	- 4467	1.223 16120	6 64775	- 7304	1.223 16120
0.310	0.756 21502	8 10964	- 4371	1.229 80895	6 57664	- 7109	1.229 80895
0.315	0.764 32466	8 06684	- 4279	1.236 38559	6 50741	- 6922	1.236 38559
0.320	0.772 39151	8 02494	- 4190	1.242 89300	6 43998	- 6742	1.242 89300
0.325	0.780 41644	7 98389	- 4104	1.249 33298	6 37426	- 6570	1.249 33298
0.330	0.788 40033	7 94366	- 4022	1.255 70724	6 31019	- 6405	1.255 70724
0.335	0.796 34399	7 90424	- 3942	1.262 01743	6 24771	- 6247	1.262 01743
0.340	0.804 24823		- 3865	1.268 26514		- 6094	1.268 26514

Hyperbola:  $n \geq 5$

$$10^{-3n}u = U = \sinh F - F'$$

$$10^{-2n}c_h = C_h(U) = \cosh F - 1$$

$$10^{-n} s_h = S_h(U) = \sinh F$$

$$10^{-n} x_h = X_h(U) = F'$$

Parabola: all values of  $n$

$$10^{-3n}u = U = \frac{1}{2}D^2$$

$$10^{-2n}c_p = C_p(U) = \frac{3}{2}D^2$$

$$10^{-n} s_p = S_p(U) = D$$

$$10^{-n} x_p = X_p(U) = D$$

Ellipse:  $n \geq 5$

$$10^{-3n}u = U = E - \sin E$$

$$10^{-2n}c_e = C_e(U) = 1 - \cos E$$

$$10^{-n} s_e = S_e(U) = \sin E$$

$$10^{-n} x_e = X_e(U) = E$$

$u$	$c_h = c_p = c_e$	$\delta$	$\delta^{2^*}$	$s_h = s_p = s_e$	$\delta$	$\delta^{2^*}$	$x_h = x_p = x_e$
0.34	0.804 24823	15 69326	- 15456	1.268 26514	12 31402	- 24371	1.268 26514
0.35	0.819 94150	15 54449	- 14870	1.280 57916	12 08165	- 23222	1.280 57916
0.36	0.835 48599	15 40120	- 14322	1.292 66081	11 85994	- 22157	1.292 66081
0.37	0.850 88719	15 26306	- 13809	1.304 52075	11 64812	- 21169	1.304 52075
0.38	0.866 15025	15 12974	- 13327	1.316 16887	11 44552	- 20249	1.316 16887
0.39	0.881 27999	15 00096	- 12873	1.327 61439	11 25151	- 19391	1.327 61439
0.40	0.896 28095	14 87646	- 12446	1.338 86590	11 06551	- 18590	1.338 86590
0.41	0.911 15741	14 75599	- 12043	1.349 93141	10 88701	- 17841	1.349 93141
0.42	0.925 91339	14 63933	- 11662	1.360 81842	10 71555	- 17139	1.360 81842
0.43	0.940 55272	14 52627	- 11302	1.371 53397	10 55068	- 16480	1.371 53397
0.44	0.955 07898	14 41663	- 10961	1.382 08465	10 39200	- 15860	1.382 08465
0.45	0.969 49561	14 31022	- 10638	1.392 47665	10 23917	- 15278	1.392 47665
0.46	0.983 80583	14 20689	- 10330	1.402 71582	10 09183	- 14728	1.402 71582
0.47	0.998 01272	14 10648	- 10038	1.412 80764	9 94968	- 14210	1.412 80764
0.48	1.012 11920	14 00885	- 9761	1.422 75732	9 81243	- 13720	1.422 75732
0.49	1.026 12805	13 91387	- 9496	1.432 56975	9 67982	- 13257	1.432 56975
0.50	1.040 04191	13 82141	- 9244	1.442 24957	9 55160	- 12818	1.442 24957
0.51	1.053 86332	13 73136	- 9003	1.451 80117	9 42754	- 12402	1.451 80117
0.52	1.067 59468	13 64361	- 8773	1.461 22871	9 30744	- 12007	1.461 22871
0.53	1.081 23829	13 55807	- 8553	1.470 53616	9 19109	- 11632	1.470 53616
0.54	1.094 79636	13 47463	- 8342	1.479 72724	9 07831	- 11275	1.479 72724
0.55	1.108 27099	13 39321	- 8141	1.488 80555	8 96892	- 10935	1.488 80555
0.56	1.121 66419	13 31372	- 7947	1.497 77448	8 86278	- 10612	1.497 77448
0.57	1.134 97791	13 23608	- 7762	1.506 63725	8 75972	- 10304	1.506 63725
0.58	1.148 21399	13 16022	- 7584	1.515 39697	8 65960	- 10009	1.515 39697
0.59	1.161 37421	13 08608	- 7413	1.524 05657	8 56230	- 9728	1.524 05657
0.60	1.174 46029	13 01358	- 7249	1.532 61886	8 46768	- 9459	1.532 61886
0.61	1.187 47387	13 04265	- 7091	1.541 08654	8 37563	- 9202	1.541 08654
0.62	1.200 41652	12 97325	- 6939	1.549 46218	8 28605	- 8956	1.549 46218
0.63	1.213 28977	12 90532	- 6793	1.557 74823	8 19883	- 8721	1.557 74823
0.64	1.226 09509	12 83879	- 6651	1.565 94706	8 11386	- 8495	1.565 94706
0.65	1.238 83388	12 77363	- 6515	1.574 06092	8 03106	- 8278	1.574 06092
0.66	1.251 50751	12 60978	- 6384	1.582 09198	7 95034	- 8070	1.582 09198
0.67	1.264 11729	12 54720	- 6257	1.590 04232	7 87162	- 7871	1.590 04232
0.68	1.276 66449	12 48584	- 6135	1.597 91395	7 79483	- 7679	1.597 91395
0.69	1.289 15033	12 42567	- 6017	1.605 70877	7 71987	- 7494	1.605 70877
0.70	1.301 57600	12 36663	- 5902	1.613 42865	7 64670	- 7316	1.613 42865
0.71	1.313 94263	12 30871	- 5792	1.621 07534	7 57523	- 7146	1.621 07534
0.72	1.326 25134	12 25185	- 5685	1.628 65057	7 50541	- 6981	1.628 65057
0.73	1.338 50319	12 19603	- 5581	1.636 15598	7 43717	- 6822	1.636 15598
0.74	1.350 69923	12 14123	- 5481	1.643 59315	7 37041	- 6669	1.643 59315

Hyperbola:  $n \geq 5$

$$10^{-n}u = U = \sinh F - F$$

$$10^{-2n}c_h = C_h(U) = \cosh F - 1$$

$$10^{-n}s_h = S_h(U) = \sinh F$$

$$10^{-n}x_h = X_h(U) = F$$

Parabola: all values of  $n$

$$10^{-2n}u = U = \frac{1}{2}D^2$$

$$10^{-2n}c_p = C_p(U) = \frac{1}{2}D^2$$

$$10^{-n}s_p = S_p(U) = D$$

$$10^{-n}x_p = X_p(U) = D$$

Ellipse:  $n \geq 5$

$$10^{-3n}u = U = E - \sin E$$

$$10^{-2n}c_e = C_e(U) = 1 - \cos E$$

$$10^{-n}s_e = S_e(U) = \sin E$$

$$10^{-n}x_e = X_e(U) = E$$

$u$	$c_h = c_p = c_e$	$\delta$	$\delta^2$	$s_h = s_p = s_e$	$\delta$	$\delta^2$	$x_h = x_p = x_e$
0.74	1.350 6992		-2192	1.643 5932		-2667	1.643 5932
0.76	1.374 9278	24 2286	-2115	1.658 2689	14 6757	-2551	1.658 2689
0.78	1.398 9448	24 0170	-2043	1.672 6893	14 4205	-2443	1.672 6893
0.80	1.422 7573	23 8125	-1976	1.686 8653	14 1760	-2342	1.686 8653
0.82	1.446 3722	23 6149	-1912	1.700 8070	13 9417	-2248	1.700 8070
		23 4237			13 7168		
0.84	1.469 7959		-1851	1.714 5238		-2159	1.714 5238
0.86	1.493 0344	23 2385	-1794	1.728 0245	13 5007	-2076	1.728 0245
0.88	1.516 0934	23 0590	-1740	1.741 3175	13 2930	-1998	1.741 3175
0.90	1.538 9784	22 8850	-1689	1.754 4106	13 0931	-1925	1.754 4106
0.92	1.561 6944	22 7161	-1640	1.767 3112	12 9005	-1856	1.767 3112
		22 5520			12 7149		
0.94	1.584 2464		-1594	1.780 0261		-1790	1.780 0261
0.96	1.606 6391	22 3926	-1549	1.792 5619	12 5358	-1729	1.792 5619
0.98	1.628 8767	22 2377	-1507	1.804 9248	12 3629	-1670	1.804 9248
1.00	1.650 9636	22 0869	-1467	1.817 1206	12 1958	-1615	1.817 1206
1.02	1.672 9037	21 9401	-1429	1.829 1549	12 0343	-1563	1.829 1549
		21 7972			11 8780		
1.04	1.694 7009		-1393	1.841 0328		-1513	1.841 0328
1.06	1.716 3588	21 6579	-1358	1.852 7595	11 7266	-1465	1.852 7595
1.08	1.737 8809	21 5221	-1324	1.864 3395	11 5800	-1421	1.864 3395
1.10	1.759 2705	21 3896	-1292	1.875 7775	11 4380	-1378	1.875 7775
1.12	1.780 5309	21 2604	-1262	1.887 0776	11 3001	-1337	1.887 0776
		21 1342			11 1664		
1.14	1.801 6651		-1232	1.898 2440		-1298	1.898 2440
1.16	1.822 6761	21 0110	-1204	1.909 2805	11 0366	-1261	1.909 2805
1.18	1.843 5666	20 8906	-1177	1.920 1910	10 9104	-1226	1.920 1910
1.20	1.864 3395	20 7729	-1151	1.930 9788	10 7878	-1192	1.930 9788
1.22	1.884 9973	20 6578	-1126	1.941 6474	10 6686	-1159	1.941 6474
		20 5452			10 5526		
1.24	1.905 5424		-1102	1.952 2000		-1128	1.952 2000
1.26	1.925 9775	20 4350	-1078	1.962 6398	10 4398	-1099	1.962 6398
1.28	1.946 3046	20 3272	-1056	1.972 9697	10 3299	-1070	1.972 9697
1.30	1.966 5262	20 2216	-1034	1.983 1925	10 2228	-1043	1.983 1925
1.32	1.986 6443	20 1181	-1013	1.993 3110	10 1185	-1017	1.993 3110
		20 0168			10 0168		
1.34	2.006 6611		-993	2.003 3278		-992	2.003 3278
1.36	2.026 5786	19 9174	-974	2.013 2454	9 9176	-967	2.013 2454
1.38	2.046 3986	19 8200	-955	2.023 0663	9 8209	-944	2.023 0663
1.40	2.066 1231	19 7245	-937	2.032 7927	9 7264	-922	2.032 7927
1.42	2.085 7539	19 6308	-919	2.042 4269	9 6342	-900	2.042 4269
		19 5389			9 5442		
1.44	2.105 2928		-902	2.051 9711		-880	2.051 9711
1.46	2.124 7414	19 4486	-886	2.061 4274	9 4562	-860	2.061 4274
1.48	2.144 1014	19 3600	-870	2.070 7976	9 3703	-840	2.070 7976
1.50	2.163 3744	19 2730	-855	2.080 0838	9 2862	-822	2.080 0838

Hyperbola:  $n \geq 5$

$$10^{-3n}u = U = \sinh F - F$$

$$10^{-2n}c_h = C_h(U) = \cosh F - 1$$

$$10^{-n} s_h = S_h(U) = \sinh F$$

$$10^{-n} x_h = X_h(U) = F$$

Parabola: all values of  $n$

$$10^{-3n}u = U = \frac{1}{2}D^2$$

$$10^{-2n}c_p = C_p(U) = \frac{1}{2}D^2$$

$$10^{-n} s_p = S_p(U) = D$$

$$10^{-n} x_p = X_p(U) = D$$

Ellipse:  $n \geq 5$

$$10^{-3n}u = U = E - \sin E$$

$$10^{-2n}c_e = C_e(U) = 1 - \cos E$$

$$10^{-n} s_e = S_e(U) = \sin E$$

$$10^{-n} x_e = X_e(U) = E$$

$u$	$c_h = c_p = c_e$	$\delta$	$\delta^2$	$s_h = s_p = s_e$	$\delta$	$\delta^2$	$x_h = x_p = x_e$
1.50	2.163 3744	47 8118	- 5340	2.080 0838			2.080 0838
1.55	2.211 1861	47 3003	- 5111	2.102 9437	22 8599	- 5133	2.102 9437
1.60	2.258 4865	47 3003	- 4900	2.125 3171	22 3734	- 4861	2.125 3171
1.65	2.305 2966	46 8101	- 4703	2.147 2292	21 9120	- 4380	2.147 2292
1.70	2.351 6361	46 3396	- 4519	2.168 7029	21 4737	- 4167	2.168 7029
		45 8874			21 0567		
1.75	2.397 5235		- 4348	2.189 7596		- 3971	2.189 7596
1.80	2.442 9759	45 4524	- 4188	2.210 4189	20 6593	- 3789	2.210 4189
1.85	2.488 0092	45 0334	- 4038	2.230 6991	20 2802	- 3620	2.230 6991
1.90	2.532 6387	44 6295	- 3897	2.250 6171	19 9180	- 3462	2.250 6171
1.95	2.576 8783	44 2396	- 3764	2.270 1887	19 5716	- 3316	2.270 1887
		43 8631			19 2398		
2.00	2.620 7414		- 3639	2.289 4285		- 3179	2.289 4285
2.05	2.664 2404	43 4990	- 3521	2.308 3502	18 9218	- 3051	2.308 3502
2.10	2.707 3872	43 1468	- 3410	2.326 9668	18 6165	- 2931	2.326 9668
2.15	2.750 1928	42 8056	- 3305	2.345 2901	18 3233	- 2818	2.345 2901
2.20	2.792 6679	42 4751	- 3205	2.363 3315	18 0414	- 2712	2.363 3315
		42 1545			17 7701		
2.25	2.834 8224		- 3110	2.381 1016		- 2612	2.381 1016
2.30	2.876 6657	41 8433	- 3021	2.398 6103	17 5087	- 2518	2.398 6103
2.35	2.918 2069	41 5412	- 2935	2.415 8671	17 2568	- 2430	2.415 8671
2.40	2.959 4545	41 2476	- 2854	2.432 8808	17 0137	- 2346	2.432 8808
2.45	3.000 4166	40 9621	- 2777	2.449 6598	16 7790	- 2267	2.449 6598
		40 6844			16 5523		
2.50	3.041 1010		- 2703	2.466 2121		- 2192	2.466 2121
2.55	3.081 5150	40 4140	- 2632	2.482 5451	16 3330	- 2121	2.482 5451
2.60	3.121 6658	40 1507	- 2565	2.498 6660	16 1209	- 2053	2.498 6660
2.65	3.161 5599	39 8942	- 2501	2.514 5815	15 9155	- 1989	2.514 5815
2.70	3.201 2040	39 6440	- 2439	2.530 2980	15 7165	- 1928	2.530 2980
		39 4001			15 5237		
2.75	3.240 6040		- 2380	2.545 8217		- 1870	2.545 8217
2.80	3.279 7660	39 1620	- 2324	2.561 1583	15 3366	- 1815	2.561 1583
2.85	3.318 6955	38 9295	- 2270	2.576 3135	15 1551	- 1762	2.576 3135
2.90	3.357 3981	38 7025	- 2218	2.591 2924	14 9789	- 1712	2.591 2924
2.95	3.395 8788	38 4807	- 2168	2.606 1001	14 8077	- 1663	2.606 1001
		38 2639			14 6413		
3.00	3.434 1427		- 2120	2.620 7414		- 1618	2.620 7414
3.05	3.472 1947	38 0519	- 2073	2.635 2209	14 4795	- 1574	2.635 2209
3.10	3.510 0392	37 8445	- 2029	2.649 5431	14 3221	- 1532	2.649 5431
3.15	3.547 6808	37 6416	- 1986	2.663 7120	14 1689	- 1491	2.663 7120
3.20	3.585 1238	37 4430	- 1945	2.677 7318	14 0198	- 1453	2.677 7318
		37 2485			13 8745		
3.25	3.622 3723		- 1905	2.691 6063		- 1416	2.691 6063
3.30	3.659 4302	37 0579	- 1867	2.705 3392	13 7329	- 1380	2.705 3392
3.35	3.696 3014	36 8712	- 1830	2.718 9341	13 5949	- 1345	2.718 9341
3.40	3.732 9896	36 6882	- 1794	2.732 3944	13 4603	- 1313	2.732 3944

Hyperbola:  $n \geq 5$

$$10^{-3n}u = U = \sinh F - F$$

$$10^{-2n}c_h = C_h(U) = \cosh F - 1$$

$$10^{-n}s_h = S_h(U) = \sinh F$$

$$10^{-n}x_h = X_h(U) = F$$

Parabola: all values of  $n$

$$10^{-3n}u = U = \frac{1}{2}D^2$$

$$10^{-2n}c_p = C_p(U) = \frac{1}{2}D^2$$

$$10^{-n}s_p = S_p(U) = D$$

$$10^{-n}x_p = X_p(U) = D$$

Ellipse:  $n \geq 5$

$$10^{-3n}u = U = E - \sin E$$

$$10^{-2n}c_e = C_e(U) = 1 - \cos E$$

$$10^{-n}s_e = S_e(U) = \sin E$$

$$10^{-n}x_e = X_e(U) = E$$

$u$	$c_h = c_p = c_e$	$\delta$	$\delta^2$	$s_h = s_p = s_e$	$\delta$	$\delta^2$	$x_h = x_p = x_e$
3.4	3.732 9896		- 7174	2.732 3944		- 5251	2.732 3944
3.5	3.805 8313	72 8417	- 6902	2.758 9242	26 5298	- 5003	2.758 9242
3.6	3.877 9824	72 1511	- 6648	2.784 9533	26 0291	- 4774	2.784 9533
3.7	3.949 4685	71 4861	- 6409	2.810 5048	25 5515	- 4561	2.810 5048
3.8	4.020 3133	70 8448	- 6186	2.835 5999	25 0951	- 4362	2.835 5999
		70 2260			24 6586		
3.9	4.090 5394		- 5975	2.860 2585		- 4178	2.860 2585
4.0	4.160 1676	69 6283	- 5777	2.884 4991	24 2406	- 4005	2.884 4991
4.1	4.229 2180	69 0504	- 5590	2.908 3391	23 8399	- 3844	2.908 3391
4.2	4.297 7093	68 4912	- 5413	2.931 7944	23 4554	- 3692	2.931 7944
4.3	4.365 6590	67 9497	- 5246	2.954 8804	23 0859	- 3550	2.954 8804
		67 4250			22 7307		
4.4	4.433 0839		- 5088	2.977 6111		- 3417	2.977 6111
4.5	4.500 0000	66 9161	- 4938	3.000 0000	22 3889	- 3291	3.000 0000
4.6	4.566 4222	66 4222	- 4795	3.022 0596	22 0596	- 3173	3.022 0596
4.7	4.632 3647	65 9425	- 4659	3.043 8018	21 7422	- 3061	3.043 8018
4.8	4.697 8412	65 4765	- 4530	3.065 2377	21 4359	- 2956	3.065 2377
		65 0233			21 1402		
4.9	4.762 8645		- 4408	3.086 3780		- 2856	3.086 3780
5.0	4.827 4469	64 5824	- 4291	3.107 2325	20 8545	- 2761	3.107 2325
5.1	4.891 6002	64 1533	- 4179	3.127 8108	20 5783	- 2672	3.127 8108
5.2	4.955 3355	63 7353	- 4072	3.148 1218	20 3110	- 2587	3.148 1218
5.3	5.018 6636	63 3280	- 3970	3.168 1741	20 0523	- 2506	3.168 1741
		62 9310			19 8016		
5.4	5.081 5946		- 3872	3.187 9757		- 2429	3.187 9757
5.5	5.144 1382	62 5437	- 3779	3.207 5343	19 5586	- 2356	3.207 5343
5.6	5.206 3040	62 1658	- 3689	3.226 8573	19 3230	- 2286	3.226 8573
5.7	5.268 1008	61 7968	- 3603	3.245 9516	19 0943	- 2220	3.245 9516
5.8	5.329 5372	61 4364	- 3520	3.264 8238	18 8722	- 2156	3.264 8238
		61 0844			18 6565		
5.9	5.390 6216		- 3441	3.283 4803		- 2096	3.283 4803
6.0	5.451 3618	60 7402	- 3365	3.301 9272	18 4469	- 2038	3.301 9272
6.1	5.511 7654	60 4037	- 3291	3.320 1703	18 2431	- 1983	3.320 1703
6.2	5.571 8399	60 0745	- 3221	3.338 2151	18 0448	- 1930	3.338 2151
6.3	5.631 5923	59 7523	- 3153	3.356 0668	17 8518	- 1879	3.356 0668
		59 4370			17 6638		
6.4	5.691 0293		- 3087	3.373 7307		- 1830	3.373 7307
6.5	5.750 1575	59 1282	- 3024	3.391 2114	17 4808	- 1783	3.391 2114
6.6	5.808 9833	58 8258	- 2963	3.408 5138	17 3024	- 1739	3.408 5138
6.7	5.867 5127	58 5294	- 2904	3.425 6423	17 1285	- 1696	3.425 6423
6.8	5.925 7517	58 2389	- 2848	3.442 6012	16 9589	- 1654	3.442 6012
		57 9541			16 7934		
6.9	5.983 7058		- 2793	3.459 3947		- 1615	3.459 3947
7.0	6.041 3806	57 6748	- 2740	3.476 0266	16 6320	- 1576	3.476 0266
7.1	6.098 7814	57 4008	- 2688	3.492 5010	16 4743	- 1539	3.492 5010
7.2	6.155 9134	57 1320	- 2639	3.508 8213	16 3203	- 1504	3.508 8213
7.3	6.212 7815	56 8681	- 2591	3.524 9912	16 1699	- 1470	3.524 9912
		56 6090			16 0229		
7.4	6.269 3904		- 2544	3.541 0141		- 1437	3.541 0141

Hyperbola:  $n \geq 5$   
 $10^{-2n}u = U = \sinh F - F'$   
 $10^{-2n}c_h = C_h(U) = \cosh F - 1$   
 $10^{-n} s_h = S_h(U) = \sinh F$   
 $10^{-n} x_h = X_h(U) = F'$

Parabola: all values of  $n$   
 $10^{-2n}u = U = \frac{1}{2}D^2$   
 $10^{-2n}c_p = C_p(U) = \frac{1}{2}D^2$   
 $10^{-n} s_p = S_p(U) = D$   
 $10^{-n} x_p = X_p(U) = D$

Ellipse:  $n \geq 5$   
 $10^{-2n}u = U = E - \sin E$   
 $10^{-2n}c_e = C_e(U) = 1 - \cos E$   
 $10^{-n} s_e = S_e(U) = \sin E$   
 $10^{-n} x_e = X_e(U) = E$

$u$	$c_h = c_p = c_e$	$\delta$	$\delta^2$	$s_h = s_p = s_e$	$\delta$	$\delta^2$	$x_h = x_p = x_e$
7.4	6.269 3904	112 4592	-1 0174	3.541 0141	31 6179	- 5746	3.541 0141
7.6	6.381 8496	111 4769	- 9819	3.572 6320	31 0679	- 5496	3.572 6320
7.8	6.493 3265	- 9485	- 9485	3.603 6999	30 5413	- 5264	3.603 6999
8.0	6.603 8545	109 6107	- 9170	3.634 2412	30 0364	- 5046	3.634 2412
8.2	6.713 4652	108 7230	- 8873	3.664 2776	29 5519	- 4843	3.664 2776
8.4	6.822 1882	107 8635	- 8593	3.693 8295	29 0865	- 4652	3.693 8295
8.6	6.930 0517	107 0305	- 8327	3.722 9160	28 6389	- 4473	3.722 9160
8.8	7.037 0821	106 2226	- 8076	3.751 5549	28 2082	- 4305	3.751 5549
9.0	7.143 3047	105 4386	- 7838	3.779 7631	27 7934	- 4147	3.779 7631
9.2	7.248 7433	104 6773	- 7611	3.807 5565	27 3934	- 3998	3.807 5565
9.4	7.353 4206	103 9374	- 7396	3.834 9500	27 0076	- 3857	3.834 9500
9.6	7.457 3580	103 2181	- 7192	3.861 9575	26 6350	- 3724	3.861 9575
9.8	7.560 5761	102 5182	- 6997	3.888 5926	26 2751	- 3598	3.888 5926
10.0	7.663 0943	101 8370	- 6811	3.914 8676	25 9270	- 3479	3.914 8676
10.2	7.764 9313	101 1735	- 6633	3.940 7947	25 5903	- 3366	3.940 7947
10.4	7.866 1048	100 5270	- 6464	3.966 3850	25 2643	- 3259	3.966 3850
10.6	7.966 6318	99 8967	- 6302	3.991 6492	24 9485	- 3157	3.991 6492
10.8	8.066 5285	99 2819	- 6147	4.016 5977	24 6423	- 3060	4.016 5977
11.0	8.165 8105	98 6820	- 5998	4.041 2400	24 3454	- 2968	4.041 2400
11.2	8.264 4924	98 0963	- 5856	4.065 5854	24 0573	- 2881	4.065 5854
11.4	8.362 5887	97 5243	- 5719	4.089 6427	23 7775	- 2797	4.089 6427
11.6	8.460 1130	96 9654	- 5588	4.113 4202	23 5058	- 2717	4.113 4202
11.8	8.557 0784	96 4191	- 5462	4.136 9260	23 2416	- 2641	4.136 9260
12.0	8.653 4974	95 8848	- 5341	4.160 1676	22 9848	- 2568	4.160 1676
12.2	8.749 3823	95 3623	- 5225	4.183 1525	22 7350	- 2498	4.183 1525
12.4	8.844 7446	94 8509	- 5113	4.205 8874	22 4918	- 2431	4.205 8874
12.6	8.939 5955	94 3504	- 5005	4.228 3792	22 2550	- 2367	4.228 3792
12.8	9.033 9459	93 8602	- 4901	4.250 6343	22 0244	- 2306	4.250 6343
13.0	9.127 8061	93 3801	- 4801	4.272 6587	21 7997	- 2247	4.272 6587
13.2	9.221 1862	92 9097	- 4704	4.294 4583	21 5806	- 2191	4.294 4583
13.4	9.314 0959	92 4485	- 4611	4.316 0389	21 3669	- 2136	4.316 0389
13.6	9.406 5444	91 9965	- 4520	4.337 4058	21 1584	- 2084	4.337 4058
13.8	9.498 5409	91 5531	- 4433	4.358 5642	20 9550	- 2034	4.358 5642
14.0	9.590 0939	91 1181	- 4349	4.379 5191	20 7563	- 1986	4.379 5191
14.2	9.681 2121	90 6913	- 4268	4.400 2755	20 5623	- 1940	4.400 2755
14.4	9.771 9034	90 2724	- 4189	4.420 8378	20 3728	- 1895	4.420 8378
14.6	9.862 1758	89 8611	- 4112	4.441 2106	20 1876	- 1852	4.441 2106
14.8	9.952 0370	89 4573	- 4038	4.461 3982	20 0065	- 1810	4.461 3982
15.0	10.041 4943		- 3967	4.481 4047		- 1770	4.481 4047

d: For  $n = 5$  increase  $s_h$  by 0.000 0001

Hyperbola:  $n \geq 5$   
 $10^{-n} u = U - \sinh F - F$   
 $10^{-n} c_h = C_h(F) - \cosh F - 1$   
 $10^{-n} s_h = S_h(F) - \sinh F$   
 $10^{-n} x_h = X_h(F) - F$

Parabola: all values of  $n$   
 $10^{-n} u = U - \frac{1}{2} D^2$   
 $10^{-n} c_p = C_p(U) - \frac{1}{2} D^2$   
 $10^{-n} s_p = S_p(U) - D$   
 $10^{-n} x_p = X_p(U) - D$

Ellipse:  $n \geq 5$   
 $10^{-n} u = U - E - \sin E$   
 $10^{-n} c_e = C_e(E) - 1 - \cos E$   
 $10^{-n} s_e = S_e(E) - \sin E$   
 $10^{-n} x_e = X_e(E) - E$

$u$	$c_h = c_p = c_e$	$\delta$	$\delta^2$	$s_h = s_p = s_e$	$\delta$	$\delta^2$	$x_h = x_p = x_e$
15.0	10.041 4943		-2 4785	4.481 4047		-1 1060	4.481 4047
15.5	10.263 4169	221 9226	-2 3725	4.530 6549	49 2501	-1 0472	4.530 6549
16.0	10.482 9656	219 5487	-2 2743	4.578 8570	48 2021	-9932	4.578 8570
16.5	10.700 2387	217 2732	-2 1829	4.626 0650	47 2080	-9436	4.626 0650
17.0	10.915 3279	215 0891	-2 0977	4.672 3287	46 2637	-8978	4.672 3287
		212 9904			45 3653		
17.5	11.128 3182		-2 0182	4.717 6940		-8555	4.717 6940
18.0	11.339 2894 b	210 9712	-1 9439	4.762 2032	44 5092	-8163	4.762 2032
18.5	11.548 3159	209 0265	-1 8741	4.805 8955	43 6924	-7799	4.805 8955
19.0	11.755 4675	207 1516	-1 8087	4.848 8076	42 9121	-7460	4.848 8076
19.5	11.960 8096 b	205 3421	-1 7471	4.890 9732	42 1657	-7144	4.890 9732
		203 5943			41 4509		
20.0	12.164 4040		-1 6892	4.932 4241 d		-6849	4.932 4241
20.5	12.366 3086	201 9046	-1 6345	4.973 1898	40 7657	-6573	4.973 1898
21.0	12.566 5781	200 2695	-1 5828	5.013 2979	40 1081	-6314	5.013 2979
21.5	12.765 2643	198 6862	-1 5339	5.052 7743	39 4764	-6071	5.052 7743
22.0	12.962 4161	197 1518	-1 4876	5.091 6434	38 8690	-5843	5.091 6434
		195 6637			38 2845		
22.5	13.158 0798		-1 4437	5.129 9278		-5628	5.129 9278
23.0	13.352 2994	194 2196	-1 4020	5.167 6493	37 7214	-5426	5.167 6493
23.5	13.545 1165	192 8171	-1 3624	5.204 8279	37 1786	-5235	5.204 8279
24.0	13.736 5709	191 4544	-1 3247	5.241 4828	36 6549	-5054	5.241 4828
24.5	13.926 7002	190 1293	-1 2888	5.277 6321	36 1493	-4884	5.277 6321
		188 8402			35 6608		
25.0	14.115 5404		-1 2546	5.313 2928		-4722	5.313 2928
25.5	14.303 1258	187 5854	-1 2219	5.348 4812	35 1884	-4569	5.348 4812
26.0	14.489 4890	186 3632	-1 1906	5.383 2126	34 7314	-4423	5.383 2126
26.5	14.674 6613	185 1723	-1 1608	5.417 5015	34 2889	-4285	5.417 5015
27.0	14.858 6726	184 0113	-1 1322	5.451 3618	33 8603	-4154	5.451 3618
		182 8788			33 4448		
27.5	15.041 5515		-1 1049	5.484 8066 c		-4029	5.484 8066
28.0	15.223 3252	181 7738	-1 0786	5.517 8484	33 0418	-3909	5.517 8484
28.5	15.404 0201	180 6949	-1 0535	5.550 4991	32 6508	-3796	5.550 4991
29.0	15.583 6614	179 6412	-1 0293	5.582 7702	32 2711	-3687	5.582 7702
29.5	15.762 2731	178 6117	-1 0062	5.614 6724	31 9022	-3584	5.614 6724
		177 6054			31 5438		
30.0	15.939 8785		-9839	5.646 2162		-3485	5.646 2162
30.5	16.116 4999	176 6214	-9624	5.677 4114	31 1952	-3390	5.677 4114
31.0	16.292 1588	175 6588	-9418	5.708 2675	30 8561	-3300	5.708 2675
31.5	16.466 8757	174 7169	-9219	5.738 7935 d	30 5261	-3213	5.738 7935
32.0	16.640 6706	173 7949	-9027	5.768 9983	30 2047	-3130	5.768 9983
		172 8920			29 8917		
32.5	16.813 5626		-8843	5.798 8900		-3050	5.798 8900
33.0	16.985 5702	172 0076	-8665	5.828 4767	29 5867	-2973	5.828 4767
33.5	17.156 7113	171 1410	-8493	5.857 7660	29 2893	-2900	5.857 7660
34.0	17.327 0029 b	170 2917	-8327	5.886 7653	28 9993	-2829	5.886 7653

b: For  $n = 5$  increase  $c_h$  by 0.000 0001; c: For  $n = 5$  decrease  $s_e$  by 0.000 0001;  
d: For  $n = 5$  increase  $s_h$  by 0.000 0001

Hyperbola:  $n \geq 5$

$$10^{-3n}u = U = \sinh F - F$$

$$10^{-2n}c_h = C_h(U) = \cosh F - 1$$

$$10^{-n}s_h = S_h(U) = \sinh F$$

$$10^{-n}x_h = X_h(U) = F$$

Parabola: all values of  $n$

$$10^{-3n}u = U = \frac{1}{2}D^2$$

$$10^{-2n}c_p = C_p(U) = \frac{1}{2}D^2$$

$$10^{-n}s_p = S_p(U) = D$$

$$10^{-n}x_p = X_p(U) = D$$

Ellipse:  $n \geq 5$

$$10^{-3n}u = U = E - \sin E$$

$$10^{-2n}c_e = C_e(U) = 1 - \cos E$$

$$10^{-n}s_e = S_e(U) = \sin E$$

$$10^{-n}x_e = X_e(U) = E$$

$u$	$c_h = c_p = c_e$	$\delta$	$\delta^2$	$s_h = s_p = s_e$	$\delta$	$\delta^2$	$x_h = x_p = x_e$
34	17.327 0029 b		-3 3299	5.886 7653		-1 1312	5.886 7653
35	17.665 1041	338 1011	-3 2037	5.943 9220 c	57 1566	-1 0779	5.943 9220
36	18.000 0000	334 8959	-3 0857	6.000 0000	56 0780	-1 0284	6.000 0000
37	18.331 8089	331 8089	-2 9750	6.055 0489	55 0489	-9 826	6.055 0489
38	18.660 6415	328 8326 325 9603	-2 8711	6.109 1147	54 0658 53 1254	-9 399	6.109 1147
39	18.986 6018		-2 7734	6.162 2401 d		-9001	6.162 2401
40	19.309 7877	323 1859	-2 6814	6.214 4650	52 2249	-8629	6.214 4650
41	19.630 2912	320 5035	-2 5946	6.265 8266	51 3615	-8281	6.265 8266
42	19.948 1993	317 9081	-2 5126	6.316 3596	50 5330	-7955	6.316 3596
43	20.263 5940	315 3947 312 9590	-2 4350	6.366 0968	49 7372 48 9719	-7649	6.366 0968
44	20.576 5530		-2 3615	6.415 0687		-7362	6.415 0687
45	20.887 1498 a	310 5968	-2 2918	6.463 3041	48 2354	-7091	6.463 3041
46	21.195 4541	308 3044	-2 2256	6.510 8301	47 5260	-6836	6.510 8301
47	21.501 5323 a	306 0781	-2 1627	6.557 6722	46 8421	-6596	6.557 6722
48	21.805 4471	303 9149 301 8115	-2 1029	6.603 8545	46 1823 45 5453	-6368	6.603 8545
49	22.107 2586		-2 0458	6.649 3998		-6153	6.649 3998
50	22.407 0237	299 7651	-1 9915	6.694 3295	44 9297	-5949	6.694 3295
51	22.704 7969	297 7732	-1 9396	6.738 6641	44 3346	-5756	6.738 6641
52	23.000 6301	295 8332	-1 8900	6.782 4229	43 7588	-5573	6.782 4229
53	23.294 5728	293 9427 292 0997	-1 8426	6.825 6242	43 2013 42 6613	-5399	6.825 6242
54	23.586 6725 b		-1 7973	6.868 2855		-5233	6.868 2855
55	23.876 9746	290 3021	-1 7539	6.910 4232	42 1378	-5076	6.910 4232
56	24.165 5225	288 5479	-1 7122	6.952 0533	41 6301	-4926	6.952 0533
57	24.452 3578	286 8353	-1 6723	6.993 1907	41 1374	-4782	6.993 1907
58	24.737 5205	285 1627 283 5284	-1 6340	7.033 8497	40 6590 40 1943	-4646	7.033 8497
59	25.021 0489		-1 5972	7.074 0440 c		-4515	7.074 0440
60	25.302 9800	281 9310	-1 5618	7.113 7866	39 7427	-4391	7.113 7866
61	25.583 3490 a	280 3690	-1 5277	7.153 0901	39 3035	-4271	7.153 0901
62	25.862 1900	278 8410	-1 4950	7.191 9663 d	38 8763	-4157	7.191 9663
63	26.139 5358	277 3458 275 8822	-1 4634	7.230 4268	38 4604 38 0556	-4048	7.230 4268
64	26.415 4180		-1 4330	7.268 4824		-3943	7.268 4824
65	26.689 8670	274 4490	-1 4037	7.306 1436	37 6612	-3842	7.306 1436
66	26.962 9120	273 0451	-1 3754	7.343 4205	37 2769	-3746	7.343 4205
67	27.234 5815	271 6695	-1 3481	7.380 3227	36 9022	-3653	7.380 3227
68	27.504 9027	270 3212 268 9993	-1 3218	7.416 8595	36 5368 36 1804	-3564	7.416 8595
69	27.773 9020		-1 2963	7.453 0399		-3478	7.453 0399
70	28.041 6048	267 7028	-1 2716	7.488 8724	35 8325	-3396	7.488 8724
71	28.308 0359	266 4310	-1 2478	7.524 3652	35 4928	-3317	7.524 3652
72	28.573 2189	265 1831	-1 2248	7.559 5263	35 1611	-3240	7.559 5263
73	28.837 1771	263 9582 262 7556	-1 2025	7.594 3633	34 8370 34 5203	-3167	7.594 3633
74	29.099 9327		-1 1808	7.628 8836		-3096	7.628 8836

a : For  $n = 5$  decrease  $c_e$  by 0.000 0001; b : For  $n = 5$  increase  $c_h$  by 0.000 0001  
 c : For  $n = 5$  decrease  $s_e$  by 0.000 0001; d : For  $n = 5$  increase  $s_h$  by 0.000 0001

Hyperbola:  $n \geq 5$

$$10^{-3n}u = U = \sinh F - F$$

$$10^{-2n}c_h = C_h(U) = \cosh F - 1$$

$$10^{-n} s_h = S_h(U) = \sinh F$$

$$10^{-n} x_h = X_h(U) = F$$

Parabola: all values of  $n$

$$10^{-3n}u = U = \frac{1}{2}D^2$$

$$10^{-2n}c_p = C_p(U) = \frac{1}{2}D^2$$

$$10^{-n} s_p = S_p(U) = D$$

$$10^{-n} x_p = X_p(U) = D$$

Ellipse:  $n \geq 5$

$$10^{-3n}u = U = E - \sin E$$

$$10^{-2n}c_e = C_e(U) = 1 - \cos E$$

$$10^{-n} s_e = S_e(U) = \sin E$$

$$10^{-n} x_e = X_e(U) = E$$

$u$	$c_h = c_p = c_e$	$\delta$	$\delta^2$	$s_h = s_p = s_e$	$\delta$	$\delta^2$	$x_h = x_p = x_e$
74	29.099 9327		-4 7226	7.628 8836		-1 2380	7.628 8836
76	29.621 9219	521 9892	-4 5576	7.697 0023	68 1186	-1 1842	7.697 0023
78	30.139 3517	517 4298	-4 4025	7.763 9361	66 9338	-1 1340	7.763 9361
80	30.652 3773	513 0256	-4 2564	7.829 7353	65 7992	-1 0872	7.829 7353
82	31.161 1449	508 7676	-4 1186	7.894 4468	64 7115	-1 0433	7.894 4468
		504 6476			63 6676		
84	31.665 7925		-3 9884	7.958 1144		-1 0023	7.958 1144
86	32.166 4504	500 6579	-3 8653	8.020 7793	62 6649	- 9637	8.020 7793
88	32.663 2418	496 7914	-3 7486	8.082 4800	61 7007	- 9275	8.082 4800
90	33.156 2835	493 0417	-3 6380	8.143 2528 d	60 7728	- 8934	8.143 2528
92	33.645 6862 a	489 4027	-3 5329	8.203 1319	59 8790	- 8613	8.203 1319
		485 8688			59 0174		
94	34.131 5549		-3 4331	8.262 1492		- 8310	8.262 1492
96	34.613 9897	482 4348	-3 3381	8.320 3353	58 1861	- 8023	8.320 3353
98	35.093 0855 b	479 0959	-3 2476	8.377 7187	57 3834	- 7752	8.377 7187
100	35.568 9330 b	475 8475	-3 1613	8.434 3267 c	56 6079	- 7496	8.434 3267
102	36.041 6185	472 6855	-3 0789	8.490 1847 d	55 8581	- 7253	8.490 1847
		469 6059			55 1326		
104	36.511 2244		-3 0002	8.545 3174		- 7022	8.545 3174
106	36.977 8294	466 6050	-2 9250	8.599 7476	54 4302	- 6802	8.599 7476
108	37.441 5088	463 6794	-2 8530	8.653 4974	53 7498	- 6594	8.653 4974
110	37.902 3346	460 8258	-2 7841	8.706 5877	53 0903	- 6395	8.706 5877
112	38.360 3758	458 0412	-2 7180	8.759 0383	52 4506	- 6206	8.759 0383
		455 3227			51 8298		
114	38.815 6985		-2 6546	8.810 8681		- 6026	8.810 8681
116	39.268 3661 a	452 6676	-2 5938	8.862 0952 d	51 2271	- 5853	8.862 0952
118	39.718 4394	450 0734	-2 5353	8.912 7369	50 6416	- 5689	8.912 7369
120	40.165 9770	447 5376	-2 4792	8.962 8095	50 0726	- 5532	8.962 8095
122	40.611 0350 b	445 0580	-2 4251	9.012 3288	49 5193	- 5382	9.012 3288
		442 6325			48 9810		
124	41.053 6676		-2 3731	9.061 3098		- 5238	9.061 3098
126	41.493 9266	440 2591	-2 3230	9.109 7669	48 4571	- 5100	9.109 7669
128	41.931 8623	437 9357	-2 2748	9.157 7139 d	47 9470	- 4968	9.157 7139
130	42.367 5229	435 6606	-2 2282	9.205 1641	47 4501	- 4841	9.205 1641
132	42.800 9549 b	433 4320	-2 1833	9.252 1300	46 9659	- 4720	9.252 1300
		431 2484			46 4939		
134	43.232 2034 a		-2 1400	9.298 6239		- 4603	9.298 6239
136	43.661 3115	429 1081	-2 0982	9.344 6575 c	46 0335	- 4490	9.344 6575
138	44.088 3212	427 0097	-2 0577	9.390 2419	45 5844	- 4383	9.390 2419
140	44.513 2730	424 9518	-2 0186	9.435 3880 c	45 1461	- 4279	9.435 3880
142	44.936 2059	422 9329	-1 9808	9.480 1061	44 7181	- 4179	9.480 1061
		420 9519			44 3002		
144	45.357 1578		-1 9442	9.524 4063		- 4082	9.524 4063
146	45.776 1653	419 0075	-1 9088	9.568 2982	43 8919	- 3990	9.568 2982
148	46.193 2638 a	417 0985	-1 8745	9.611 7911	43 4929	- 3900	9.611 7911
150	46.608 4876	415 2238	-1 8412	9.654 8938 d	43 1028	- 3814	9.654 8938

a : For  $n = 5$  decrease  $c_e$  by 0.000 0001;    b : For  $n = 5$  increase  $c_h$  by 0.000 0001  
 c : For  $n = 5$  decrease  $s_e$  by 0.000 0001;    d : For  $n = 5$  increase  $s_h$  by 0.000 0001

Ellipse:  $n=4$

$$10^{-3n}u = U - E - \sin E$$

$$10^{-2n}c_e = C_e(U) = 1 - \cos E$$

$$10^{-n}s_e = S_e(U) = \sin E$$

$$10^{-n}x_e = X_e(U) = E$$

$u$	$c_e$	$\delta$	$\delta^2$	$s_e$	$\delta$	$\delta^2$	$x_e$
0.150	0.466 08488	10 30074	- 11504	0.965 48938	10 61062	- 23827	0.965 48938
0.155	0.476 38561	10 19055	- 11012	0.976 10001	10 38482	- 22561	0.976 10001
0.160	0.486 57616	10 08493	- 10556	0.986 48483	10 17066	- 21399	0.986 48483
0.165	0.496 66109	9 98355	- 10132	0.996 65549	9 96722	- 20329	0.996 65549
0.170	0.506 64464	9 88614	- 9737	1.006 62271	9 77365	- 19343	1.006 62271
0.175	0.516 53078	9 79242	- 9368	1.016 39636	9 58921	- 18431	1.016 39636
0.180	0.526 32319	9 70215	- 9023	1.025 98557	9 41324	- 17586	1.025 98557
0.185	0.536 02534	9 61512	- 8699	1.035 39880	9 24512	- 16802	1.035 39881
0.190	0.545 64047	9 53114	- 8395	1.044 64393	9 08432	- 16071	1.044 64393
0.195	0.555 17160	9 45001	- 8110	1.053 72824	8 93033	- 15391	1.053 72824
0.200	0.564 62162	9 37158	- 7840	1.062 65857	8 78270	- 14755	1.062 65857
0.205	0.573 99320	9 29569	- 7587	1.071 44127	8 64103	- 14160	1.071 44127
0.210	0.583 28889	9 22220	- 7347	1.080 08230	8 50494	- 13603	1.080 08230
0.215	0.592 51108	9 15098	- 7120	1.088 58723	8 37408	- 13080	1.088 58723
0.220	0.601 66206	9 08191	- 6905	1.096 96131	8 24814	- 12588	1.096 96131
0.225	0.610 74396	9 01487	- 6701	1.105 20945	8 12683	- 12126	1.105 20945
0.230	0.619 75884	8 94978	- 6508	1.113 33628	8 00989	- 11690	1.113 33628
0.235	0.628 70862	8 88652	- 6324	1.121 34617	7 89706	- 11278	1.121 34617
0.240	0.637 59514	8 82502	- 6149	1.129 24323	7 78813	- 10889	1.129 24323
0.245	0.646 42016	8 76519	- 5982	1.137 03136	7 68288	- 10522	1.137 03137
0.250	0.655 18535	8 70694	- 5823	1.144 71424	7 58111	- 10173	1.144 71424
0.255	0.663 89229	8 65021	- 5671	1.152 29535	7 48265	- 9843	1.152 29535
0.260	0.672 54250	8 59494	- 5526	1.159 77800	7 38732	- 9530	1.159 77800
0.265	0.681 13744	8 54105	- 5388	1.167 16532	7 29497	- 9232	1.167 16532
0.270	0.689 67849	8 48848	- 5255	1.174 46029	7 20546	- 8949	1.174 46029
0.275	0.698 16697	8 43719	- 5128	1.181 66575	7 11864	- 8679	1.181 66575
0.280	0.706 60416	8 38712	- 5007	1.188 78439	7 03439	- 8423	1.188 78439
0.285	0.714 99128	8 33821	- 4890	1.195 81878	6 95259	- 8178	1.195 81878
0.290	0.723 32949	8 29042	- 4778	1.202 77137	6 87313	- 7944	1.202 77137
0.295	0.731 61991	8 24371	- 4670	1.209 64450	6 79590	- 7721	1.209 64450
0.300	0.739 86362	8 19804	- 4567	1.216 44040	6 72080	- 7508	1.216 44040
0.305	0.748 06166	8 15336	- 4467	1.223 16120	6 64775	- 7304	1.223 16120
0.310	0.756 21502	8 10964	- 4371	1.229 80894	6 57664	- 7109	1.229 80895
0.315	0.764 32466	8 06684	- 4279	1.236 38559	6 50741	- 6922	1.236 38559
0.320	0.772 39151	8 02494	- 4190	1.242 89300	6 43998	- 6742	1.242 89300
0.325	0.780 41644	7 98389	- 4104	1.249 33297	6 37426	- 6570	1.249 33298
0.330	0.788 40033	7 94366	- 4022	1.255 70723	6 31019	- 6405	1.255 70724
0.335	0.796 34399	7 90424	- 3942	1.262 01743	6 24771	- 6247	1.262 01743
0.340	0.804 24823		- 3865	1.268 26514		- 6095	1.268 26514

Hyperbola:  $n=4$

$$10^{-3n}u \quad U \quad \sinh F - F$$

$$10^{-2n}c_h = C_h(U) = \cosh F - 1$$

$$10^{-n}s_h = S_h(U) = \sinh F$$

$$10^{-n}x_h = X_h(U) = F$$

$u$	$c_h$	$\delta$	$\delta''$	$s_h$	$\delta$	$\delta''$	$x_h$
0.150	0.466 08488	10 30074	- 11504	0.965 48939	10 61062	- 23828	0.965 48938
0.155	0.476 38561	10 19055	- 11012	0.976 10001	10 38482	- 22561	0.976 10001
0.160	0.486 57616	10 08493	- 10556	0.986 48483	10 17066	- 21399	0.986 48483
0.165	0.496 66109	9 98355	- 10132	0.996 65549	9 96722	- 20329	0.996 65549
0.170	0.506 64464	9 88614	- 9737	1.006 62271	9 77365	- 19343	1.006 62271
0.175	0.516 53078	9 79242	- 9368	1.016 39636	9 58921	- 18431	1.016 39636
0.180	0.526 32319	9 70215	- 9023	1.025 98557	9 41324	- 17586	1.025 98557
0.185	0.536 02534	9 61512	- 8699	1.035 39881	9 24512	- 16802	1.035 39881
0.190	0.545 64047	9 53114	- 8395	1.044 64393	9 08432	- 16071	1.044 64393
0.195	0.555 17161	9 45001	- 8110	1.053 72824	8 93033	- 15391	1.053 72824
0.200	0.564 62162	9 37158	- 7840	1.062 65857	8 78270	- 14755	1.062 65857
0.205	0.573 99320	9 29569	- 7587	1.071 44127	8 64103	- 14160	1.071 44127
0.210	0.583 28889	9 22220	- 7347	1.080 08230	8 50494	- 13603	1.080 08230
0.215	0.592 51108	9 15098	- 7120	1.088 58724	8 37408	- 13080	1.088 58723
0.220	0.601 66206	9 08191	- 6905	1.096 96131	8 24814	- 12588	1.096 96131
0.225	0.610 74396	9 01487	- 6701	1.105 20945	8 12683	- 12126	1.105 20945
0.230	0.619 75884	8 94978	- 6508	1.113 33628	8 00989	- 11690	1.113 33628
0.235	0.628 70862	8 88652	- 6324	1.121 34617	7 89706	- 11278	1.121 34617
0.240	0.637 59514	8 82502	- 6149	1.129 24324	7 78813	- 10889	1.129 24323
0.245	0.646 42016	8 76519	- 5982	1.137 03137	7 68288	- 10522	1.137 03136
0.250	0.655 18535	8 70694	- 5823	1.144 71424	7 58111	- 10173	1.144 71424
0.255	0.663 89229	8 65021	- 5671	1.152 29535	7 48265	- 9843	1.152 29535
0.260	0.672 54250	8 59494	- 5526	1.159 77800	7 38732	- 9530	1.159 77800
0.265	0.681 13744	8 54105	- 5388	1.167 16532	7 29497	- 9232	1.167 16532
0.270	0.689 67849	8 48848	- 5255	1.174 46029	7 20546	- 8949	1.174 46029
0.275	0.698 16697	8 43719	- 5128	1.181 66575	7 11864	- 8679	1.181 66575
0.280	0.706 60416	8 38712	- 5007	1.188 78439	7 03439	- 8423	1.188 78439
0.285	0.714 99128	8 33821	- 4890	1.195 81878	6 95259	- 8178	1.195 81878
0.290	0.723 32949	8 29042	- 4778	1.202 77138	6 87313	- 7944	1.202 77137
0.295	0.731 61991	8 24371	- 4670	1.209 64450	6 79590	- 7721	1.209 64450
0.300	0.739 86362	8 19804	- 4567	1.216 44040	6 72080	- 7508	1.216 44040
0.305	0.748 06166	8 15336	- 4467	1.223 16120	6 64775	- 7304	1.223 16120
0.310	0.756 21502	8 10964	- 4371	1.229 80895	6 57664	- 7109	1.229 80895
0.315	0.764 32466	8 06684	- 4279	1.236 38559	6 50741	- 6922	1.236 38559
0.320	0.772 39151	8 02494	- 4190	1.242 89301	6 43998	- 6742	1.242 89300
0.325	0.780 41644	7 98389	- 4104	1.249 33298	6 37426	- 6570	1.249 33298
0.330	0.788 40033	7 94366	- 4022	1.255 70724	6 31019	- 6405	1.255 70724
0.335	0.796 34400	7 90424	- 3942	1.262 01743	6 24771	- 6247	1.262 01743
0.340	0.804 24823		- 3865	1.268 26514		- 6094	1.268 26514

Ellipse:  $n=4$

$$10^{-3n}u = U - E - \sin E$$

$$10^{-2n}e_e = C_e(U) = 1 - \cos E$$

$$10^{-n}e_s = S_e(U) - \sin E$$

$$10^{-n}x_e = X_e(U) - E$$

$u$	$e_e$	$\delta$	$\delta^{**}$	$s_e$	$\delta$	$\delta^{**}$	$x_e$
0.34	0.804 24823		- 15456	1.268 26514		- 24371	1.268 26514
0.35	0.819 94150	15 69326	- 14870	1.280 57916	12 31402	- 23222	1.280 57917
0.36	0.835 48599	15 54449	- 14322	1.292 66081	12 08165	- 22157	1.292 66081
0.37	0.850 88719	15 40120	- 13809	1.304 52075	11 85994	- 21169	1.304 52075
0.38	0.866 15025	15 26306	- 13327	1.316 16887	11 64812	- 20249	1.316 16887
		15 12974			11 44552		
0.39	0.881 27999		- 12873	1.327 61439		- 19391	1.327 61439
0.40	0.896 28095	15 00096	- 12446	1.338 86590	11 25151	- 18590	1.338 86590
0.41	0.911 15740	14 87646	- 12043	1.349 93141	11 06551	- 17841	1.349 93141
0.42	0.925 91339	14 75599	- 11662	1.360 81842	10 88701	- 17139	1.360 81842
0.43	0.940 55271	14 63933	- 11302	1.371 53397	10 71555	- 16480	1.371 53397
		14 52627			10 55068		
0.44	0.955 07898		- 10961	1.382 08464		- 15860	1.382 08465
0.45	0.969 49561	14 41663	- 10638	1.392 47665	10 39200	- 15278	1.392 47665
0.46	0.983 80583	14 31022	- 10330	1.402 71581	10 23917	- 14728	1.402 71582
0.47	0.998 01272	14 20689	- 10038	1.412 80764	10 09183	- 14210	1.412 80764
0.48	1.012 11920	14 10648	- 9761	1.422 75732	9 94968	- 13720	1.422 75732
		14 00885			9 81243		
0.49	1.026 12805		- 9496	1.432 56975		- 13257	1.432 56975
0.50	1.040 04191	13 91387	- 9244	1.442 24957	9 67982	- 12818	1.442 24957
0.51	1.053 86332	13 82141	- 9003	1.451 80117	9 55160	- 12402	1.451 80117
0.52	1.067 59468	13 73136	- 8773	1.461 22871	9 42754	- 12007	1.461 22872
0.53	1.081 23829	13 64361	- 8553	1.470 53615	9 30744	- 11632	1.470 53616
		13 55807			9 19109		
0.54	1.094 79636		- 8342	1.479 72724		- 11275	1.479 72725
0.55	1.108 27099	13 47463	- 8141	1.488 80555	9 07831	- 10935	1.488 80555
0.56	1.121 66419	13 39321	- 7947	1.497 77447	8 96892	- 10612	1.497 77448
0.57	1.134 97791	13 31372	- 7762	1.506 63725	8 86278	- 10304	1.506 63726
0.58	1.148 21399	13 23608	- 7584	1.515 39697	8 75972	- 10009	1.515 39697
		13 16022			8 65960		
0.59	1.161 37421		- 7413	1.524 05656		- 9728	1.524 05657
0.60	1.174 46029	13 08608	- 7249	1.532 61886	8 56230	- 9459	1.532 61887
0.61	1.187 47387	13 01358	- 7091	1.541 08654	8 46768	- 9202	1.541 08654
0.62	1.200 41652	12 94265	- 6939	1.549 46217	8 37563	- 8956	1.549 46218
0.63	1.213 28977	12 87325	- 6793	1.557 74822	8 28605	- 8721	1.557 74823
		12 80532			8 19883		
0.64	1.226 09509		- 6651	1.565 94705		- 8495	1.565 94706
0.65	1.238 83388	12 73879	- 6515	1.574 06091	8 11386	- 8278	1.574 06092
0.66	1.251 50751	12 67363	- 6384	1.582 09197	8 03106	- 8070	1.582 09198
0.67	1.264 11729	12 60978	- 6257	1.590 04232	7 95034	- 7871	1.590 04232
0.68	1.276 66449	12 54720	- 6135	1.597 91394	7 87162	- 7679	1.597 91395
		12 48584			7 79483		
0.69	1.289 15033		- 6017	1.605 70877		- 7494	1.605 70877
0.70	1.301 57600	12 42567	- 5902	1.613 42864	7 71987	- 7316	1.613 42865
0.71	1.313 94263	12 36663	- 5792	1.621 07534	7 64670	- 7146	1.621 07534
0.72	1.326 25134	12 30871	- 5685	1.628 65056	7 57523	- 6981	1.628 65057
0.73	1.338 50319	12 25185	- 5581	1.636 15597	7 50541	- 6822	1.636 15598
		12 19603			7 43717		
0.74	1.350 69922		- 5481	1.643 59315		- 6669	1.643 59315

Hyperbola:  $n=4$

$$10^{-3u} = U = \operatorname{smh} F \cdot F$$

$$10^{-2c_k} = C_k(U) = \cosh F - 1$$

$$10^{-n s_k} = S_k(U) = \operatorname{smh} F$$

$$10^{-n x_k} = X_k(U) = F$$

$u$	$c_k$	$\delta$	$\delta^{2^*}$	$s_k$	$\delta$	$\delta^{2^*}$	$x_k$
0.34	0.804 24823		- 15456	1.268 26514		- 24371	1.268 26514
0.35	0.819 94150	15 69326	- 14870	1.280 57917	12 31402	- 23222	1.280 57916
0.36	0.835 48599	15 54449	- 14322	1.292 66082	12 08165	- 22157	1.292 66081
0.37	0.850 88719	15 40120	- 13809	1.304 52075	11 85994	- 21169	1.304 52075
0.38	0.866 15025	15 26306	- 13327	1.316 16888	11 64812	- 20249	1.316 16887
		15 12974			11 44552		
0.39	0.881 27999		- 12873	1.327 61440		- 19391	1.327 61439
0.40	0.896 28095	15 00096	- 12446	1.338 86590	11 25151	- 18590	1.338 86590
0.41	0.911 15741	14 87646	- 12043	1.349 93141	11 06551	- 17841	1.349 93141
0.42	0.925 91339	14 75599	- 11662	1.360 81843	10 88701	- 17139	1.360 81842
0.43	0.940 55272	14 63933	- 11302	1.371 53397	10 71555	- 16480	1.371 53397
		14 52627			10 55068		
0.44	0.955 07899		- 10961	1.382 08465		- 15860	1.382 08465
0.45	0.969 49561	14 41663	- 10638	1.392 47665	10 39200	- 15278	1.392 47665
0.46	0.983 80583	14 31022	- 10330	1.402 71582	10 23917	- 14728	1.402 71582
0.47	0.998 01272	14 20689	- 10038	1.412 80765	10 09183	- 14210	1.412 80764
0.48	1.012 11920	14 10648	- 9761	1.422 75733	9 94968	- 13720	1.422 75732
		14 00885			9 81243		
0.49	1.026 12805		- 9496	1.432 56976		- 13257	1.432 56975
0.50	1.040 04191	13 91387	- 9244	1.442 24957	9 67982	- 12818	1.442 24957
0.51	1.053 86332	13 82141	- 9003	1.451 80117	9 55160	- 12402	1.451 80117
0.52	1.067 59468	13 73136	- 8773	1.461 22872	9 42754	- 12007	1.461 22871
0.53	1.081 23829	13 64361	- 8553	1.470 53616	9 30744	- 11632	1.470 53615
		13 55807			9 19109		
0.54	1.094 79636		- 8342	1.479 72725		- 11275	1.479 72724
0.55	1.108 27099	13 47463	- 8141	1.488 80556	9 07831	- 10935	1.488 80555
0.56	1.121 66419	13 39321	- 7947	1.497 77448	8 96892	- 10612	1.497 77448
0.57	1.134 97791	13 31372	- 7762	1.506 63726	8 86278	- 10303	1.506 63725
0.58	1.148 21399	13 23608	- 7584	1.515 39698	8 75972	- 10009	1.515 39697
		13 16022			8 65960		
0.59	1.161 37421		- 7413	1.524 05657		- 9728	1.524 05657
0.60	1.174 46029	13 08608	- 7249	1.532 61887	8 56230	- 9459	1.532 61886
0.61	1.187 47387	13 01358	- 7091	1.541 08655	8 46768	- 9202	1.541 08654
0.62	1.200 41652	12 94265	- 6939	1.549 46218	8 37563	- 8956	1.549 46218
0.63	1.213 28978	12 87325	- 6793	1.557 74824	8 28605	- 8721	1.557 74823
		12 80532			8 19883		
0.64	1.226 09509		- 6651	1.565 94706		- 8495	1.565 94706
0.65	1.238 83389	12 73879	- 6515	1.574 06092	8 11386	- 8278	1.574 06092
0.66	1.251 50752	12 67363	- 6384	1.582 09198	8 03106	- 8070	1.582 09198
0.67	1.264 11730	12 60978	- 6257	1.590 04233	7 95034	- 7871	1.590 04232
0.68	1.276 66449	12 54720	- 6135	1.597 91395	7 87163	- 7679	1.597 91395
		12 48584			7 79483		
0.69	1.289 15033		- 6017	1.605 70878		- 7494	1.605 70877
0.70	1.301 57600	12 42567	- 5902	1.613 42865	7 71987	- 7316	1.613 42865
0.71	1.313 94263	12 36663	- 5792	1.621 07535	7 64670	- 7146	1.621 07534
0.72	1.326 25134	12 30871	- 5685	1.628 65058	7 57523	- 6981	1.628 65057
0.73	1.338 50319	12 25185	- 5581	1.636 15598	7 50541	- 6822	1.636 15598
		12 19603			7 43718		
0.74	1.350 69923		- 5481	1.643 59316		- 6669	1.643 59315

Ellipse:  $n=4$

$$10^{-4}u = U - E - \sin E$$

$$10^{-4}c_e = C_e(U) = 1 - \cos E$$

$$10^{-4}x_e = X_e(U) - \sin E$$

$$10^{-4}x_e = X_e(U) - E$$

$u$	$c_e$	$\delta$	$\delta^2$	$s_e$	$\delta$	$\delta^2$	$x_e$
0.74	1.350 6992	24 2286	- 2192	1.643 5931	14 6757	- 2667	1.643 5931
0.76	1.374 9278	24 0170	- 2115	1.658 2689	14 4205	- 2551	1.658 2689
0.78	1.398 9448	23 8125	- 2043	1.672 6893	14 1760	- 2443	1.672 6893
0.80	1.422 7573	23 6149	- 1976	1.686 8653	13 9417	- 2342	1.686 8653
0.82	1.446 3722	23 4237	- 1912	1.700 8070	13 7168	- 2248	1.700 8070
0.84	1.469 7959	23 2385	- 1851	1.714 5238	13 5007	- 2159	1.714 5238
0.86	1.493 0344	23 0590	- 1794	1.728 0245	13 2930	- 2076	1.728 0245
0.88	1.516 0934	22 8850	- 1740	1.741 3175	13 0931	- 1998	1.741 3175
0.90	1.538 9783	22 7161	- 1689	1.754 4106	12 9005	- 1925	1.754 4106
0.92	1.561 6944	22 5520	- 1640	1.767 3112	12 7149	- 1856	1.767 3112
0.94	1.584 2464	22 3926	- 1594	1.780 0261	12 5358	- 1790	1.780 0261
0.96	1.606 6391	22 2377	- 1549	1.792 5619	12 3629	- 1729	1.792 5619
0.98	1.628 8767	22 0869	- 1507	1.804 9248	12 1958	- 1670	1.804 9248
1.00	1.650 9636	21 9401	- 1467	1.817 1206	12 0343	- 1615	1.817 1206
1.02	1.672 9037	21 7972	- 1429	1.829 1548	11 8780	- 1563	1.829 1548
1.04	1.694 7009	21 6579	- 1393	1.841 0328	11 7266	- 1513	1.841 0328
1.06	1.716 3588	21 5221	- 1358	1.852 7594	11 5800	- 1466	1.852 7595
1.08	1.737 8809	21 3896	- 1324	1.864 3395	11 4380	- 1421	1.864 3395
1.10	1.759 2705	21 2604	- 1292	1.875 7774	11 3001	- 1378	1.875 7775
1.12	1.780 5309	21 1342	- 1262	1.887 0776	11 1664	- 1337	1.887 0776
1.14	1.801 6651	21 0110	- 1232	1.898 2440	11 0366	- 1298	1.898 2440
1.16	1.822 6761	20 8906	- 1204	1.909 2805	10 9104	- 1261	1.909 2805
1.18	1.843 5666	20 7729	- 1177	1.920 1909	10 7878	- 1226	1.920 1910
1.20	1.864 3395	20 6578	- 1151	1.930 9788	10 6686	- 1192	1.930 9788
1.22	1.884 9973	20 5452	- 1126	1.941 6474	10 5526	- 1159	1.941 6474
1.24	1.905 5424	20 4350	- 1102	1.952 2000	10 4398	- 1128	1.952 2000
1.26	1.925 9775	20 3272	- 1078	1.962 6398	10 3299	- 1099	1.962 6398
1.28	1.946 3046	20 2216	- 1056	1.972 9696	10 2228	- 1070	1.972 9697
1.30	1.966 5262	20 1181	- 1034	1.983 1925	10 1185	- 1043	1.983 1925
1.32	1.986 6443	20 0168	- 1013	1.993 3110	10 0168	- 1017	1.993 3110
1.34	2.006 6611	19 9174	- 993	2.003 3278	9 9176	- 992	2.003 3278
1.36	2.026 5786	19 8200	- 974	2.013 2454	9 8209	- 967	2.013 2454
1.38	2.046 3986	19 7245	- 955	2.023 0663	9 7264	- 944	2.023 0663
1.40	2.066 1231	19 6308	- 937	2.032 7927	9 6342	- 922	2.032 7927
1.42	2.085 7539	19 5389	- 919	2.042 4269	9 5442	- 900	2.042 4269
1.44	2.105 2928	19 4486	- 902	2.051 9711	9 4562	- 880	2.051 9711
1.46	2.124 7414	19 3600	- 886	2.061 4273	9 3703	- 860	2.061 4274
1.48	2.144 1014	19 2730	- 870	2.070 7976	9 2862	- 840	2.070 7976
1.50	2.163 3744		- 855	2.080 0838		- 822	2.080 0838

Hyperbola:  $n = 4$

$$10^{-4} u = U = \operatorname{snh} U' - 1$$

$$10^{-20} c_{\lambda} = C_{\lambda}(U) = \cosh U' - 1$$

$$10^{-20} s_{\lambda} = S_{\lambda}(U) = \operatorname{snh} U'$$

$$10^{-20} \chi_{\lambda} = \chi_{\lambda}(U) = U$$

$u$	$c_{\lambda}$	$\delta$	$\delta^{20}$	$s_{\lambda}$	$\delta$	$\delta^{20}$	$\chi_{\lambda}$
0.74	1.350 6992	24 2286	- 2192	1.643 5932	14 6757	- 2667	1.643 5932
0.76	1.374 9278	24 0170	- 2115	1.658 2689	14 4205	- 2551	1.658 2689
0.78	1.398 9448	23 8125	- 2043	1.672 6893	14 1760	- 2443	1.672 6893
0.80	1.422 7573	23 6149	- 1976	1.686 8653	13 9417	- 2342	1.686 8653
0.82	1.446 3722	23 4237	- 1912	1.700 8070	13 7168	- 2248	1.700 8070
0.84	1.469 7959	23 2395	- 1851	1.714 5238	13 5007	- 2159	1.714 5238
0.86	1.493 0344	23 0590	- 1794	1.728 0245	13 2930	- 2076	1.728 0245
0.88	1.516 0934	22 8850	- 1740	1.741 3175	13 0931	- 1998	1.741 3175
0.90	1.538 9784	22 7161	- 1699	1.754 4107	12 9005	- 1925	1.754 4106
0.92	1.561 6944	22 5520	- 1640	1.767 3112	12 7149	- 1856	1.767 3112
0.94	1.584 2464	22 3926	- 1594	1.780 0261	12 5358	- 1790	1.780 0261
0.96	1.606 6391	22 2377	- 1549	1.792 5619	12 3629	- 1729	1.792 5619
0.98	1.628 8767	22 0869	- 1507	1.804 9248	12 1958	- 1670	1.804 9248
1.00	1.650 9636	21 9401	- 1467	1.817 1206	12 0343	- 1615	1.817 1206
1.02	1.672 9037	21 7972	- 1429	1.829 1549	11 8780	- 1563	1.829 1549
1.04	1.694 7009	21 6579	- 1393	1.841 0328	11 7266	- 1513	1.841 0328
1.06	1.716 3588	21 5221	- 1358	1.852 7595	11 5800	- 1465	1.852 7595
1.08	1.737 8809	21 3896	- 1324	1.864 3395	11 4380	- 1421	1.864 3395
1.10	1.759 2705	21 2604	- 1292	1.875 7775	11 3001	- 1378	1.875 7775
1.12	1.780 5309	21 1342	- 1262	1.887 0776	11 1664	- 1337	1.887 0776
1.14	1.801 6651	21 0110	- 1232	1.898 2440	11 0366	- 1298	1.898 2440
1.16	1.822 6761	20 8906	- 1204	1.909 2806	10 9104	- 1261	1.909 2805
1.18	1.843 5667	20 7727	- 1177	1.920 1910	10 7878	- 1226	1.920 1910
1.20	1.864 3395	20 6578	- 1151	1.930 9788	10 6686	- 1192	1.930 9788
1.22	1.884 9973	20 5452	- 1126	1.941 6474	10 5526	- 1159	1.941 6474
1.24	1.905 5425	20 4350	- 1102	1.952 2000	10 4398	- 1128	1.952 2000
1.26	1.925 9775	20 3272	- 1078	1.962 6398	10 3299	- 1099	1.962 6398
1.28	1.946 3046	20 2216	- 1056	1.972 9697	10 2228	- 1070	1.972 9697
1.30	1.966 5262	20 1181	- 1034	1.983 1925	10 1185	- 1043	1.983 1925
1.32	1.986 6443	20 0168	- 1013	1.993 3110	10 0168	- 1017	1.993 3110
1.34	2.006 6611	19 9174	- 993	2.003 3278	9 9176	- 992	2.003 3278
1.36	2.026 5786	19 8200	- 974	2.013 2454	9 8209	- 967	2.013 2454
1.38	2.046 3986	19 7245	- 955	2.023 0663	9 7264	- 944	2.023 0663
1.40	2.066 1231	19 6308	- 937	2.032 7927	9 6342	- 922	2.032 7927
1.42	2.085 7539	19 5389	- 919	2.042 4270	9 5442	- 900	2.042 4269
1.44	2.105 2928	19 4486	- 902	2.051 9711	9 4562	- 880	2.051 9711
1.46	2.124 7414	19 3600	- 886	2.061 4274	9 3703	- 860	2.061 4274
1.48	2.144 1014	19 2730	- 870	2.070 7976	9 2862	- 840	2.070 7976
1.50	2.163 3744	19 1875	- 855	2.080 0838	9 2038	- 822	2.080 0838

Ellipse:  $n=4$

$$10^{-n} u = U - E \sin E$$

$$10^{-2n} e_e = C_e(U) - 1 - \cos E$$

$$10^{-n} v_r = S_r(U) \sin E$$

$$10^{-n} x_r = X_r(U) E$$

$u$	$e_e$	$\delta$	$\delta^2$	$v_r$	$\delta$	$\delta^2$	$x_r$
1.50	2.163 3744		- 5340	2.080 0838			2.080 0838
1.55	2.211 1861	47 8118	- 5111	2.102 9437	22 8599	- 5133	2.102 9437
1.60	2.258 4865	47 3003	- 4900	2.125 3171	22 3734	- 4861	2.125 3171
1.65	2.305 2965	46 8101	- 4703	2.147 2292	21 9120	- 4380	2.147 2292
1.70	2.351 6361	46 3396	- 4519	2.168 7029	21 4737	- 4167	2.168 7029
		45 8874			21 0567		
1.75	2.397 5235		- 4348	2.189 7596		- 3971	2.189 7596
1.80	2.442 9758	45 4524	- 4188	2.210 4189	20 6593	- 3789	2.210 4189
1.85	2.488 0092	45 0334	- 4038	2.230 6991	20 2802	- 3620	2.230 6991
1.90	2.532 6387	44 6295	- 3897	2.250 6171	19 9180	- 3462	2.250 6171
1.95	2.576 8783	44 2396	- 3764	2.270 1887	19 5716	- 3316	2.270 1887
		43 8631			19 2398		
2.00	2.620 7414		- 3639	2.289 4285		- 3179	2.289 4285
2.05	2.664 2404	43 4990	- 3521	2.308 3502	18 9218	- 3051	2.308 3502
2.10	2.707 3872	43 1468	- 3410	2.326 9668	18 6165	- 2931	2.326 9668
2.15	2.750 1928	42 8056	- 3305	2.345 2901	18 3233	- 2818	2.345 2901
2.20	2.792 6679	42 4751	- 3205	2.363 3315	18 0414	- 2712	2.363 3315
		42 1545			17 7701		
2.25	2.834 8224		- 3110	2.381 1016		- 2612	2.381 1016
2.30	2.876 6657	41 8433	- 3021	2.398 6103	17 5087	- 2518	2.398 6103
2.35	2.918 2069	41 5412	- 2935	2.415 8671	17 2568	- 2430	2.415 8671
2.40	2.959 4545	41 2476	- 2854	2.432 8808	17 0137	- 2346	2.432 8808
2.45	3.000 4166	40 9621	- 2777	2.449 6598	16 7790	- 2267	2.449 6598
		40 6844			16 5523		
2.50	3.041 1010		- 2703	2.466 2121		- 2192	2.466 2121
2.55	3.081 5150	40 4140	- 2632	2.482 5451	16 3330	- 2121	2.482 5451
2.60	3.121 6658	40 1507	- 2565	2.498 6659	16 1209	- 2053	2.498 6660
2.65	3.161 5599	39 8942	- 2501	2.514 5814	15 9155	- 1989	2.514 5815
2.70	3.201 2040	39 6440	- 2439	2.530 2980	15 7165	- 1928	2.530 2980
		39 4001			15 5237		
2.75	3.240 6040		- 2380	2.545 8217		- 1870	2.545 8217
2.80	3.279 7660	39 1620	- 2324	2.561 1583	15 3366	- 1815	2.561 1583
2.85	3.318 6955	38 9295	- 2270	2.576 3134	15 1551	- 1762	2.576 3135
2.90	3.357 3981	38 7025	- 2218	2.591 2923	14 9789	- 1712	2.591 2924
2.95	3.395 8788	38 4807	- 2169	2.606 1000	14 8077	- 1663	2.606 1001
		38 2639			14 6413		
3.00	3.434 1427		- 2120	2.620 7414		- 1618	2.620 7414
3.05	3.472 1946	38 0519	- 2073	2.635 2209	14 4795	- 1574	2.635 2209
3.10	3.510 0392	37 8445	- 2029	2.649 5430	14 3221	- 1532	2.649 5431
3.15	3.547 6808	37 6416	- 1986	2.663 7120	14 1689	- 1491	2.663 7120
3.20	3.585 1238	37 4430	- 1945	2.677 7318	14 0198	- 1453	2.677 7318
		37 2485			13 8745		
3.25	3.622 3722		- 1905	2.691 6063		- 1416	2.691 6063
3.30	3.659 4302	37 0579	- 1867	2.705 3392	13 7329	- 1380	2.705 3392
3.35	3.696 3014	36 8712	- 1830	2.718 9341	13 5949	- 1346	2.718 9341
3.40	3.732 9896	36 6882	- 1794	2.732 3944	13 4603	- 1313	2.732 3944

Hyperbola:  $n=4$

$$10^{-3}u = U - \sinh F - F$$

$$10^{-2}c_h = C_h(U) - \cosh F - 1$$

$$10^{-1}s_h = S_h(U) - \sinh F$$

$$10^{-1}\lambda_h = X_h(F) - F$$

$u$	$c_h$	$\delta$	$\delta^2$	$s_h$	$\delta$	$\delta^2$	$\lambda_h$
1.50	2.163 3744	47 8118	- 5340	2.080 0838	22 8599	- 5133	2.080 0838
1.55	2.211 1861	47 3003	- 5111	2.102 9437	22 3734	- 4861	2.102 9437
1.60	2.258 4865	46 8101	- 4900	2.125 3172	21 9120	- 4610	2.125 3171
1.65	2.305 2966	46 3396	- 4703	2.147 2292	21 4737	- 4380	2.147 2292
1.70	2.351 6361	45 8874	- 4519	2.168 7029	21 0567	- 4167	2.168 7029
1.75	2.397 5235	45 4524	- 4348	2.189 7596	20 6593	- 3971	2.189 7596
1.80	2.442 9759	45 0334	- 4188	2.210 4189	20 2802	- 3789	2.210 4189
1.85	2.488 0093	44 6295	- 4038	2.230 6991	19 9180	- 3620	2.230 6991
1.90	2.532 6387	44 2396	- 3897	2.250 6171	19 5716	- 3462	2.250 6171
1.95	2.576 8783	43 8631	- 3764	2.270 1887	19 2398	- 3316	2.270 1887
2.00	2.620 7414	43 4990	- 3639	2.289 4285	18 9218	- 3179	2.289 4285
2.05	2.664 2404	43 1468	- 3521	2.308 3503	18 6165	- 3051	2.308 3502
2.10	2.707 3872	42 8056	- 3410	2.326 9668	18 3233	- 2931	2.326 9668
2.15	2.750 1928	42 4751	- 3305	2.345 2901	18 0414	- 2818	2.345 2901
2.20	2.792 6679	42 1545	- 3205	2.363 3315	17 7701	- 2712	2.363 3315
2.25	2.834 8224	41 8433	- 3110	2.381 1016	17 5087	- 2612	2.381 1016
2.30	2.876 6657	41 5412	- 3021	2.398 6103	17 2568	- 2518	2.398 6103
2.35	2.918 2069	41 2476	- 2935	2.415 8671	17 0137	- 2430	2.415 8671
2.40	2.959 4545	40 9621	- 2854	2.432 8808	16 7790	- 2346	2.432 8808
2.45	3.000 4166	40 6844	- 2777	2.449 6598	16 5523	- 2267	2.449 6598
2.50	3.041 1010	40 4140	- 2703	2.466 2121	16 3330	- 2192	2.466 2121
2.55	3.081 5150	40 1507	- 2632	2.482 5451	16 1209	- 2121	2.482 5451
2.60	3.121 6658	39 8942	- 2565	2.498 6660	15 9155	- 2053	2.498 6660
2.65	3.161 5600	39 6440	- 2501	2.514 5815	15 7165	- 1989	2.514 5815
2.70	3.201 2040	39 4001	- 2439	2.530 2980	15 5237	- 1928	2.530 2980
2.75	3.240 6040	39 1620	- 2380	2.545 8217	15 3366	- 1870	2.545 8217
2.80	3.279 7660	38 9295	- 2324	2.561 1584	15 1551	- 1815	2.561 1583
2.85	3.318 6955	38 7025	- 2270	2.576 3135	14 9789	- 1762	2.576 3135
2.90	3.357 3981	38 4807	- 2218	2.591 2924	14 8077	- 1712	2.591 2924
2.95	3.395 8788	38 2639	- 2168	2.606 1001	14 6413	- 1663	2.606 1001
3.00	3.434 1427	38 0519	- 2120	2.620 7414	14 4795	- 1618	2.620 7414
3.05	3.472 1947	37 8445	- 2073	2.635 2209	14 3221	- 1574	2.635 2209
3.10	3.510 0392	37 6416	- 2029	2.649 5431	14 1689	- 1532	2.649 5431
3.15	3.547 6808	37 4430	- 1986	2.663 7120	14 0198	- 1491	2.663 7120
3.20	3.585 1238	37 2485	- 1945	2.677 7318	13 8745	- 1453	2.677 7318
3.25	3.622 3723	37 0579	- 1905	2.691 6063	13 7329	- 1416	2.691 6063
3.30	3.659 4302	36 8712	- 1867	2.705 3393	13 5949	- 1380	2.705 3392
3.35	3.696 3014	36 6882	- 1830	2.718 9342	13 4603	- 1346	2.718 9341
3.40	3.732 9896		- 1794	2.732 3944		- 1313	2.732 3944

Ellipse:  $n=4$

$$10^{-3n}u = U - E - \sin E$$

$$10^{-2n}c_e = C_e(U) = 1 - \cos E$$

$$10^{-n}s_e = S_e(U) - \sin E$$

$$10^{-n}x_e = X_e(U) - E$$

$u$	$c_e$	$\delta$	$\delta^{2''}$	$s_e$	$\delta$	$\delta^{2''}$	$x_e$
3.4	3.732 9896		- 7174	2.732 3944		- 5251	2.732 3944
3.5	3.805 8313	72 8417	- 6902	2.758 9241	26 5298	- 5003	2.758 9242
3.6	3.877 9824	72 1511	- 6648	2.784 9533	26 0291	- 4774	2.784 9533
3.7	3.949 4685	71 4861	- 6409	2.810 5047	25 5515	- 4561	2.810 5048
3.8	4.020 3133	70 8448	- 6186	2.835 5998	25 0951	- 4362	2.835 5999
		70 2260			24 6586		
3.9	4.090 5393		- 5975	2.860 2585		- 4178	2.860 2585
4.0	4.160 1676	69 6283	- 5777	2.884 4991	24 2406	- 4005	2.884 4991
4.1	4.229 2180	69 0504	- 5590	2.908 3390	23 8399	- 3844	2.908 3391
4.2	4.297 7092	68 4912	- 5413	2.931 7944	23 4554	- 3692	2.931 7944
4.3	4.365 6590	67 9497	- 5246	2.954 8803	23 0859	- 3550	2.954 8804
		67 4250			22 7307		
4.4	4.433 0839		- 5088	2.977 6111		- 3417	2.977 6111
4.5	4.500 0000	66 9161	- 4938	3.000 0000	22 3889	- 3291	3.000 0000
4.6	4.566 4221	66 4222	- 4795	3.022 0596	22 0596	- 3173	3.022 0596
4.7	4.632 3647	65 9425	- 4659	3.043 8018	21 7422	- 3061	3.043 8018
4.8	4.697 8411	65 4765	- 4530	3.065 2377	21 4359	- 2956	3.065 2377
		65 0233			21 1402		
4.9	4.762 8645		- 4408	3.086 3779		- 2856	3.086 3780
5.0	4.827 4469	64 5824	- 4291	3.107 2325	20 8545	- 2761	3.107 2325
5.1	4.891 6002	64 1533	- 4179	3.127 8108	20 5783	- 2672	3.127 8108
5.2	4.955 3355	63 7353	- 4072	3.148 1218	20 3110	- 2587	3.148 1218
5.3	5.018 6636	63 3280	- 3970	3.168 1741	20 0523	- 2506	3.168 1741
		62 9310			19 8016		
5.4	5.081 5945		- 3872	3.187 9757		- 2429	3.187 9757
5.5	5.144 1382	62 5437	- 3779	3.207 5343	19 5586	- 2356	3.207 5343
5.6	5.206 3040	62 1658	- 3689	3.226 8572	19 3230	- 2286	3.226 8573
5.7	5.268 1008	61 7968	- 3603	3.245 9515	19 0943	- 2220	3.245 9516
5.8	5.329 5372	61 4364	- 3520	3.264 8237	18 8722	- 2156	3.264 8238
		61 0844			18 6565		
5.9	5.390 6216		- 3441	3.283 4803		- 2096	3.283 4803
6.0	5.451 3617	60 7402	- 3365	3.301 9272	18 4469	- 2038	3.301 9273
6.1	5.511 7654	60 4037	- 3291	3.320 1703	18 2431	- 1983	3.320 1703
6.2	5.571 8399	60 0745	- 3221	3.338 2150	18 0448	- 1930	3.338 2151
6.3	5.631 5922	59 7523	- 3153	3.356 0668	17 8518	- 1879	3.356 0668
		59 4370			17 6638		
6.4	5.691 0293		- 3087	3.373 7306		- 1830	3.373 7307
6.5	5.750 1575	59 1282	- 3024	3.391 2114	17 4808	- 1783	3.391 2114
6.6	5.808 9833	58 8258	- 2963	3.408 5138	17 3024	- 1739	3.408 5138
6.7	5.867 5127	58 5294	- 2904	3.425 6423	17 1285	- 1696	3.425 6423
6.8	5.925 7516	58 2389	- 2848	3.442 6012	16 9589	- 1654	3.442 6012
		57 9541			16 7934		
6.9	5.983 7058		- 2793	3.459 3946		- 1615	3.459 3947
7.0	6.041 3806	57 6748	- 2740	3.476 0266	16 6320	- 1576	3.476 0267
7.1	6.098 7814	57 4008	- 2688	3.492 5009	16 4743	- 1539	3.492 5010
7.2	6.155 9134	57 1320	- 2639	3.508 8212	16 3203	- 1504	3.508 8213
7.3	6.212 7814	56 8681	- 2591	3.524 9911	16 1699	- 1470	3.524 9912
		56 6090			16 0229		
7.4	6.269 3904		- 2544	3.541 0140		- 1437	3.541 0141

Hyperbola:  $n=4$

$$10^{-2n}u = U = \sinh F - F$$

$$10^{-2n}c_h = C_h(U) = \cosh F - 1$$

$$10^{-n}s_h = S_h(U) = \sinh F$$

$$10^{-n}x_h = X_h(U) = F$$

$u$	$c_h$	$\delta$	$\delta^{2^*}$	$s_h$	$\delta$	$\delta^{2^*}$	$x_h$
3.4	3.732 9896		- 7174	2.732 3944		- 5251	2.732 3944
3.5	3.805 8313	72 8417	- 6902	2.758 9242	26 5298	- 5003	2.758 9242
3.6	3.877 9825	72 1511	- 6648	2.784 9533	26 0291	- 4774	2.784 9533
3.7	3.949 4685	71 4861	- 6409	2.810 5048	25 5515	- 4561	2.810 5048
3.8	4.020 3134	70 8448	- 6187	2.835 5999	25 0951	- 4362	2.835 5999
		70 2260			24 6586		
3.9	4.090 5394		- 5975	2.860 2585		- 4178	2.860 2585
4.0	4.160 1677	69 6283	- 5777	2.884 4992	24 2406	- 4005	2.884 4991
4.1	4.229 2181	69 0504	- 5590	2.908 3391	23 8399	- 3844	2.908 3391
4.2	4.297 7093	68 4912	- 5413	2.931 7945	23 4554	- 3692	2.931 7944
4.3	4.365 6590	67 9497	- 5246	2.954 8804	23 0859	- 3550	2.954 8804
		67 4250			22 7307		
4.4	4.433 0840		- 5088	2.977 6111		- 3417	2.977 6111
4.5	4.500 0000	66 9161	- 4938	3.000 0000	22 3889	- 3291	3.000 0000
4.6	4.566 4222	66 4222	- 4795	3.022 0597	22 0596	- 3173	3.022 0596
4.7	4.632 3647	65 9425	- 4659	3.043 8018	21 7422	- 3061	3.043 8018
4.8	4.697 8412	65 4765	- 4530	3.065 2378	21 4359	- 2956	3.065 2377
		65 0233			21 1402		
4.9	4.762 8645		- 4408	3.086 3780		- 2856	3.086 3780
5.0	4.827 4469	64 5824	- 4291	3.107 2326	20 8545	- 2761	3.107 2325
5.1	4.891 6002	64 1533	- 4179	3.127 8109	20 5783	- 2672	3.127 8108
5.2	4.955 3356	63 7353	- 4072	3.148 1219	20 3110	- 2587	3.148 1218
5.3	5.018 6636	63 3280	- 3970	3.168 1742	20 0523	- 2506	3.168 1741
		62 9310			19 8016		
5.4	5.081 5946		- 3872	3.187 9758		- 2429	3.187 9757
5.5	5.144 1383	62 5437	- 3779	3.207 5344	19 5586	- 2356	3.207 5343
5.6	5.206 3040	62 1658	- 3689	3.226 8573	19 3230	- 2286	3.226 8573
5.7	5.268 1008	61 7968	- 3603	3.245 9516	19 0943	- 2220	3.245 9516
5.8	5.329 5373	61 4364	- 3520	3.264 8239	18 8722	- 2156	3.264 8238
		61 0844			18 6565		
5.9	5.390 6216		- 3441	3.283 4804		- 2096	3.283 4803
6.0	5.451 3618	60 7402	- 3365	3.301 9273	18 4469	- 2038	3.301 9272
6.1	5.511 7655	60 4037	- 3291	3.320 1704	18 2431	- 1983	3.320 1703
6.2	5.571 8400	60 0745	- 3221	3.338 2151	18 0448	- 1930	3.338 2151
6.3	5.631 5923	59 7523	- 3153	3.356 0669	17 8518	- 1879	3.356 0668
		59 4370			17 6638		
6.4	5.691 0293		- 3087	3.373 7307		- 1830	3.373 7307
6.5	5.750 1576	59 1282	- 3024	3.391 2115	17 4808	- 1783	3.391 2114
6.6	5.808 9833	58 8258	- 2963	3.408 5139	17 3024	- 1739	3.408 5138
6.7	5.867 5128	58 5294	- 2904	3.425 6424	17 1285	- 1696	3.425 6423
6.8	5.925 7517	58 2389	- 2848	3.442 6013	16 9589	- 1654	3.442 6012
		57 9541			16 7934		
6.9	5.983 7058		- 2793	3.459 3947		- 1615	3.459 3947
7.0	6.041 3807	57 6748	- 2740	3.476 0267	16 6320	- 1576	3.476 0266
7.1	6.098 7815	57 4008	- 2688	3.492 5010	16 4743	- 1539	3.492 5009
7.2	6.155 9134	57 1320	- 2639	3.508 8214	16 3203	- 1504	3.508 8213
7.3	6.212 7815	56 8681	- 2591	3.524 9913	16 1699	- 1470	3.524 9912
		56 6090			16 0229		
7.4	6.269 3905		- 2544	3.541 0142		- 1437	3.541 0141

Ellipse:  $n=4$

$$10^{-2n}u = U - E - \sin E$$

$$10^{-2n}c_e - C_e(U) = 1 - \cos E$$

$$10^{-n}s_e - S_e(U) = \sin E$$

$$10^{-n}x_e = X_e(U) - E$$

$u$	$c_e$	$\delta$	$\delta^{2''}$	$s_e$	$\delta$	$\delta^{2''}$	$x_e$
7.4	6.269 3904		-1 0174	3.541 0140		-5746	3.541 0141
7.6	6.381 8496	112 4592	- 9819	3.572 6319	31 6179	- 5496	3.572 6320
7.8	6.493 3264	111 4769	- 9485	3.603 6998	31 0679	- 5264	3.603 6999
8.0	6.603 8545	110 5280	- 9170	3.634 2411	30 5413	- 5046	3.634 2412
8.2	6.713 4651	109 6107	- 8873	3.664 2775	30 0364	- 4843	3.664 2776
		108 7230			29 5519		
8.4	6.822 1881		- 8593	3.693 8294		- 4652	3.693 8295
8.6	6.930 0516	107 8635	- 8327	3.722 9159	29 0865	- 4473	3.722 9160
8.8	7.037 0821	107 0305	- 8076	3.751 5548	28 6389	- 4305	3.751 5549
9.0	7.143 3047	106 2226	- 7838	3.779 7631	28 2082	- 4147	3.779 7632
9.2	7.248 7433	105 4386	- 7611	3.807 5564	27 7934	- 3998	3.807 5565
		104 6773			27 3934		
9.4	7.353 4205		- 7396	3.834 9499		- 3857	3.834 9500
9.6	7.457 3580	103 9374	- 7192	3.861 9575	27 0076	- 3724	3.861 9575
9.8	7.560 5760	103 2181	- 6997	3.888 5925	26 6350	- 3598	3.888 5926
10.0	7.663 0943	102 5182	- 6811	3.914 8676	26 2751	- 3479	3.914 8677
10.2	7.764 9313	101 8370	- 6633	3.940 7946	25 9270	- 3366	3.940 7947
		101 1735			25 5903		
10.4	7.866 1048		- 6464	3.966 3849		- 3259	3.966 3850
10.6	7.966 6318	100 5270	- 6302	3.991 6491	25 2643	- 3157	3.991 6493
10.8	8.066 5285	99 8967	- 6147	4.016 5976	24 9485	- 3060	4.016 5977
11.0	8.165 8104	99 2819	- 5998	4.041 2399	24 6423	- 2968	4.041 2400
11.2	8.264 4924	98 6820	- 5856	4.065 5853	24 3454	- 2881	4.065 5854
		98 0963			24 0573		
11.4	8.362 5887		- 5719	4.089 6426		- 2797	4.089 6427
11.6	8.460 1129	97 5243	- 5588	4.113 4201	23 7775	- 2717	4.113 4202
11.8	8.557 0783	96 9654	- 5462	4.136 9259	23 5058	- 2641	4.136 9260
12.0	8.653 4973	96 4191	- 5341	4.160 1675	23 2416	- 2568	4.160 1677
12.2	8.749 3822	95 8848	- 5225	4.183 1524	22 9848	- 2498	4.183 1525
		95 3623			22 7350		
12.4	8.844 7445		- 5113	4.205 8873		- 2431	4.205 8874
12.6	8.939 5954	94 8509	- 5005	4.228 3791	22 4918	- 2367	4.228 3793
12.8	9.033 9458	94 3504	- 4901	4.250 6342	22 2550	- 2306	4.250 6343
13.0	9.127 8060	93 8602	- 4801	4.272 6586	22 0244	- 2247	4.272 6587
13.2	9.221 1861	93 3801	- 4704	4.294 4582	21 7997	- 2191	4.294 4584
		92 9097			21 5806		
13.4	9.314 0958		- 4611	4.316 0388		- 2136	4.316 0389
13.6	9.406 5443	92 4485	- 4520	4.337 4056	21 3669	- 2084	4.337 4058
13.8	9.498 5408	91 9965	- 4433	4.358 5641	21 1584	- 2034	4.358 5642
14.0	9.590 0939	91 5531	- 4349	4.379 5190	20 9550	- 1986	4.379 5192
14.2	9.681 2120	91 1181	- 4268	4.400 2753	20 7563	- 1940	4.400 2755
		90 6913			20 5623		
14.4	9.771 9033		- 4189	4.420 8377		- 1895	4.420 8378
14.6	9.862 1757	90 2724	- 4112	4.441 2105	20 3728	- 1852	4.441 2106
14.8	9.952 0369	89 8611	- 4038	4.461 3981	20 1876	- 1810	4.461 3982
15.0	10.041 4942	89 4573	- 3967	4.481 4046	20 0065	- 1770	4.481 4048

### Hyperbola: $n=4$

$$10^{-3}u = U = \sinh F - F$$

$$10^{-2}c_h = C_h(U) = \cosh F - 1$$

$$10^{-n}s_h = S_h(U) = \sinh F$$

$$10^{-n}x_h = X_h(U) = F$$

u	c <sub>h</sub>	δ	δ <sup>2</sup>	s <sub>h</sub>	δ	δ <sup>2</sup>	x <sub>h</sub>
7.4	6.269 3905		-1 0174	3.541 0142		- 5746	3.541 0141
7.6	6.381 8497	112 4592	- 9819	3.572 6320	31 6179	- 5496	3.572 6320
7.8	6.493 3265	111 4769	- 9485	3.603 7000	31 0679	- 5264	3.603 6999
8.0	6.603 8545	110 5280	- 9170	3.634 2413	30 5413	- 5046	3.634 2412
8.2	6.713 4652	109 6107	- 8873	3.664 2777	30 0364	- 4843	3.664 2776
		108 7230			29 5519		
8.4	6.822 1882		- 8593	3.693 8296		- 4652	3.693 8295
8.6	6.930 0517	107 8635	- 8327	3.722 9160	29 0865	- 4473	3.722 9160
8.8	7.037 0822	107 0305	- 8076	3.751 5550	28 6399	- 4305	3.751 5549
9.0	7.143 3048	106 2226	- 7838	3.779 7632	28 2082	- 4147	3.779 7631
9.2	7.248 7434	105 4386	- 7611	3.807 5566	27 7934	- 3998	3.807 5565
		104 6773			27 3934		
9.4	7.353 4206		- 7396	3.834 9500		- 3857	3.834 9499
9.6	7.457 3581	103 9374	- 7192	3.861 9576	27 0076	- 3724	3.861 9575
9.8	7.560 5761	103 2181	- 6997	3.888 5927	26 6350	- 3598	3.888 5926
10.0	7.663 0944	102 5182	- 6811	3.914 8677	26 2751	- 3479	3.914 8676
10.2	7.764 9314	101 8370	- 6633	3.940 7948	25 9270	- 3366	3.940 7947
		101 1735			25 5903		
10.4	7.866 1049		- 6464	3.966 3851		- 3259	3.966 3850
10.6	7.966 6319	100 5270	- 6302	3.991 6493	25 2643	- 3157	3.991 6492
10.8	8.066 5286	99 8967	- 6147	4.016 5978	24 9485	- 3060	4.016 5977
11.0	8.165 8105	99 2819	- 5998	4.041 2401	24 6423	- 2968	4.041 2400
11.2	8.264 4925	98 6820	- 5856	4.065 5855	24 3454	- 2881	4.065 5854
		98 0963			24 0573		
11.4	8.362 5888		- 5719	4.089 6428		- 2797	4.089 6427
11.6	8.460 1131	97 5243	- 5588	4.113 4203	23 7775	- 2717	4.113 4202
11.8	8.557 0784	96 9654	- 5462	4.136 9261	23 5058	- 2641	4.136 9260
12.0	8.653 4975	96 4191	- 5341	4.160 1678	23 2416	- 2568	4.160 1676
12.2	8.749 3823	95 8848	- 5225	4.183 1526	22 9848	- 2498	4.183 1525
		95 3623			22 7350		
12.4	8.844 7446		- 5113	4.205 8875		- 2431	4.205 8874
12.6	8.939 5956	94 8509	- 5005	4.228 3794	22 4918	- 2367	4.228 3792
12.8	9.033 9460	94 3504	- 4901	4.250 6344	22 2550	- 2306	4.250 6343
13.0	9.127 8062	93 8602	- 4801	4.272 6588	22 0244	- 2247	4.272 6587
13.2	9.221 1863	93 3801	- 4704	4.294 4585	21 7997	- 2191	4.294 4583
		92 9097			21 5806		
13.4	9.314 0960		- 4611	4.316 0390		- 2136	4.316 0389
13.6	9.406 5445	92 4485	- 4520	4.337 4059	21 3669	- 2084	4.337 4058
13.8	9.498 5410	91 9965	- 4433	4.358 5643	21 1584	- 2034	4.358 5642
14.0	9.590 0940	91 5531	- 4349	4.379 5193	20 9550	- 1986	4.379 5191
14.2	9.681 2122	91 1181	- 4268	4.400 2756	20 7563	- 1940	4.400 2755
		90 6913			20 5623		
14.4	9.771 9035		- 4189	4.420 8379		- 1895	4.420 8378
14.6	9.862 1759	90 2724	- 4112	4.441 2107	20 3728	- 1852	4.441 2106
14.8	9.952 0371	89 8611	- 4038	4.461 3983	20 1876	- 1810	4.461 3982
15.0	10.041 4944	89 4573	- 3967	4.481 4049	20 0065	- 1770	4.481 4047

Ellipse:  $n=4$

$$10^{3n}u = U \cdot E - \sin E$$

$$10^{-2n}r_e = C_r(l) \cdot 1 - \cos E$$

$$10^{-n}s_e \cdot S_s(l) = \sin E$$

$$10^{-n}x_e = X_s(l) \cdot E$$

$u$	$r_e$	$\delta$	$\delta^2$	$s_e$	$\delta$	$\delta^2$	$x_e$
15.0	10.041 4942	221 9226	-2 4785	4.481 4046	49 2501	-1 1059	4.481 4048
15.5	10.263 4168	219 5487	-2 3725	4.530 6548	48 2021	-1 0472	4.530 6549
16.0	10.482 9655	217 2732	-2 2743	4.578 8568	47 2080	- 9932	4.578 8570
16.5	10.700 2386	215 0891	-2 1829	4.626 0649	46 2637	- 9436	4.626 0650
17.0	10.915 3278	212 9904	-2 0977	4.672 3286	45 3652	- 8978	4.672 3287
17.5	11.128 3181	210 9712	-2 0182	4.717 6938	44 5092	- 8555	4.717 6940
18.0	11.339 2893	209 0265	-1 9439	4.762 2030	43 6924	- 8163	4.762 2032
18.5	11.548 3158	207 1516	-1 8741	4.805 8954	42 9120	- 7799	4.805 8956
19.0	11.755 4674	205 3421	-1 8087	4.848 8074	42 1657	- 7460	4.848 8076
19.5	11.960 8095	203 5943	-1 7471	4.890 9731	41 4509	- 7144	4.890 9733
20.0	12.164 4038	201 9046	-1 6892	4.932 4240	40 7657	- 6849	4.932 4242
20.5	12.366 3084	200 2695	-1 6345	4.973 1896	40 1081	- 6573	4.973 1899
21.0	12.566 5779	198 6862	-1 5828	5.013 2977	39 4764	- 6314	5.013 2980
21.5	12.765 2641	197 1518	-1 5339	5.052 7742	38 8690	- 6071	5.052 7744
22.0	12.962 4159	195 6637	-1 4876	5.091 6432	38 2845	- 5843	5.091 6434
22.5	13.158 0796	194 2196	-1 4437	5.129 9276	37 7214	- 5628	5.129 9279
23.0	13.352 2992	192 8171	-1 4020	5.167 6490	37 1786	- 5426	5.167 6493
23.5	13.545 1164	191 4544	-1 3624	5.204 8277	36 6549	- 5235	5.204 8279
24.0	13.736 5707	190 1293	-1 3247	5.241 4826	36 1493	- 5054	5.241 4828
24.5	13.926 7000	188 8402	-1 2888	5.277 6319	35 6608	- 4884	5.277 6321
25.0	14.115 5402	187 5854	-1 2546	5.313 2926	35 1884	- 4722	5.313 2929
25.5	14.303 1256	186 3632	-1 2219	5.348 4810	34 7314	- 4569	5.348 4813
26.0	14.489 4888	185 1723	-1 1906	5.383 2124	34 2889	- 4423	5.383 2126
26.5	14.674 6611	184 0113	-1 1608	5.417 5013	33 8603	- 4285	5.417 5015
27.0	14.858 6724	182 8788	-1 1322	5.451 3615	33 4448	- 4154	5.451 3618
27.5	15.041 5512	181 7738	-1 1049	5.484 8063	33 0418	- 4029	5.484 8066
28.0	15.223 3250	180 6949	-1 0786	5.517 8481	32 6507	- 3909	5.517 8484
28.5	15.404 0199	179 6412	-1 0535	5.550 4988	32 2711	- 3796	5.550 4991
29.0	15.583 6612	178 6117	-1 0293	5.582 7699	31 9022	- 3687	5.582 7702
29.5	15.762 2729	177 6054	-1 0062	5.614 6721	31 5438	- 3584	5.614 6724
30.0	15.939 8783	176 6214	- 9839	5.646 2159	31 1952	- 3485	5.646 2162
30.5	16.116 4997	175 6588	- 9624	5.677 4111	30 8561	- 3390	5.677 4114
31.0	16.292 1585	174 7169	- 9418	5.708 2672	30 5261	- 3300	5.708 2675
31.5	16.466 8754	173 7949	- 9219	5.738 7933	30 2047	- 3213	5.738 7936
32.0	16.640 6703	172 8920	- 9027	5.768 9980	29 8917	- 3130	5.768 9983
32.5	16.813 5623	172 0076	- 8843	5.798 8897	29 5867	- 3050	5.798 8900
33.0	16.985 5699	171 1410	- 8665	5.828 4764	29 2893	- 2973	5.828 4767
33.5	17.156 7110	170 2917	- 8493	5.857 7657	28 9993	- 2900	5.857 7660
34.0	17.327 0026	170 2917	- 8327	5.886 7650		- 2829	5.886 7654

Hyperbola:  $n=4$

$$10^{-3n}u = U = \sinh F - F$$

$$10^{-2n}c_A = C_A(U) = \cosh F - 1$$

$$10^{-n}s_A = S_A(U) = \sinh F$$

$$10^{-n}x_A = X_A(U) = F$$

$u$	$c_A$	$\delta$	$\delta^2$	$s_A$	$\delta$	$\delta^2$	$x_A$
15.0	10.041 4944		-2 4785	4.481 4049		-1 1060	4.481 4047
15.5	10.263 4170	221 9226	-2 3725	4.530 6550	49 2502	-1 0472	4.530 6549
16.0	10.482 9657	219 5487	-2 2743	4.578 8571	48 2021	- 9932	4.578 8570
16.5	10.700 2388	217 2732	-2 1829	4.626 0652	47 2080	- 9436	4.626 0650
17.0	10.915 3280	215 0891	-2 0977	4.672 3289	46 2637	- 8978	4.672 3287
		212 9904			45 3653		
17.5	11.128 3184		-2 0182	4.717 6941		- 8555	4.717 6940
18.0	11.339 2896	210 9712	-1 9439	4.762 2033	44 5092	- 8163	4.762 2031
18.5	11.548 3161	209 0265	-1 8741	4.805 8957	43 6924	- 7799	4.805 8955
19.0	11.755 4676	207 1516	-1 8077	4.848 8078	42 9121	- 7460	4.848 8076
19.5	11.960 8098	205 3422	-1 7471	4.890 9734	42 1657	- 7144	4.890 9732
		203 5943			41 4509		
20.0	12.164 4041		-1 6892	4.932 4243		- 6849	4.932 4241
20.5	12.366 3087	201 9046	-1 6345	4.973 1900	40 7657	- 6573	4.973 1898
21.0	12.566 5783	200 2695	-1 5828	5.013 2981	40 1081	- 6314	5.013 2979
21.5	12.765 2645	198 6862	-1 5339	5.052 7745	39 4764	- 6071	5.052 7743
22.0	12.962 4163	197 1518	-1 4876	5.091 6436	38 8690	- 5843	5.091 6433
		195 6637			38 2845		
22.5	13.158 0800		-1 4437	5.129 9280		- 5628	5.129 9278
23.0	13.352 2996	194 2196	-1 4020	5.167 6495	37 7214	- 5426	5.167 6492
23.5	13.545 1167	192 8172	-1 3624	5.204 8281	37 1786	- 5235	5.204 8278
24.0	13.736 5711	191 4544	-1 3247	5.241 4830	36 6549	- 5054	5.241 4828
24.5	13.926 7004	190 1293	-1 2888	5.277 6323	36 1493	- 4884	5.277 6321
		188 8402			35 6608		
25.0	14.115 5406		-1 2546	5.313 2931		- 4722	5.313 2928
25.5	14.303 1260	187 5854	-1 2219	5.348 4815	35 1884	- 4569	5.348 4812
26.0	14.489 4892	186 3632	-1 1906	5.383 2128	34 7314	- 4423	5.383 2126
26.5	14.674 6615	185 1723	-1 1608	5.417 5018	34 2889	- 4285	5.417 5015
27.0	14.858 6728	184 0113	-1 1322	5.451 3620	33 8603	- 4154	5.451 3618
		182 8788			33 4448		
27.5	15.041 5517		-1 1049	5.484 8068		- 4029	5.484 8065
28.0	15.223 3255	181 7738	-1 0786	5.517 8486	33 0418	- 3909	5.517 8483
28.5	15.404 0204	180 6949	-1 0535	5.550 4994	32 6508	- 3796	5.550 4991
29.0	15.583 6616	179 6413	-1 0293	5.582 7704	32 2711	- 3687	5.582 7701
29.5	15.762 2734	178 6117	-1 0062	5.614 6727	31 9022	- 3584	5.614 6724
		177 6054			31 5438		
30.0	15.939 8788		- 9839	5.646 2164		- 3485	5.646 2161
30.5	16.116 5002	176 6214	- 9624	5.677 4116	31 1952	- 3390	5.677 4113
31.0	16.292 1590	175 6588	- 9418	5.708 2678	30 8561	- 3300	5.708 2674
31.5	16.466 8760	174 7169	- 9219	5.738 7938	30 5261	- 3213	5.738 7935
32.0	16.640 6709	173 7949	- 9027	5.768 9986	30 2047	- 3130	5.768 9982
		172 8920			29 8917		
32.5	16.813 5629		- 8843	5.798 8903		- 3050	5.798 8900
33.0	16.985 5705	172 0076	- 8665	5.828 4770	29 5867	- 2973	5.828 4767
33.5	17.156 7116	171 1411	- 8493	5.857 7663	29 2893	- 2900	5.857 7660
34.0	17.327 0032	170 2917	- 8327	5.886 7656	28 9993	- 2829	5.886 7653

Ellipse:  $n=4$

$$10^{-3}u = U - E - \sin E$$

$$10^{-2}r_e = C_e(U) = 1 - \cos E$$

$$10^{-n} s_e = S_e(U) = \sin E$$

$$10^{-n} x_e = X_e(U) = E$$

$u$	$r_e$	$\delta$	$\delta^{**}$	$s_e$	$\delta$	$\delta^{**}$	$x_e$
34	17.327 0026		-3 3299	5.886 7650		-1 1312	5.886 7654
35	17.665 1038	338 1011	-3 2037	5.943 9216	57 1566	-1 0779	5.943 9220
36	17.999 9997	334 8959	-3 0857	5.999 9997	56 0780	-1 0285	6.000 0000
37	18.331 8085	331 8089	-2 9750	6.055 0486	55 0489	- 9826	6.055 0490
38	18.660 6411	328 8326 325 9603	-2 8711	6.109 1144	54 0658 53 1254	- 9399	6.109 1148
39	18.986 6015		-2 7734	6.162 2398		- 9001	6.162 2402
40	19.309 7873	323 1859	-2 6814	6.214 4647	52 2249	- 8629	6.214 4651
41	19.630 2908	320 5035	-2 5946	6.265 8262	51 3615	- 8281	6.265 8266
42	19.948 1989	317 9081	-2 5126	6.316 3592	50 5330	- 7955	6.316 3596
43	20.263 5936	315 3947 312 9590	-2 4350	6.366 0964	49 7372 48 9719	- 7649	6.366 0968
44	20.576 5525		-2 3615	6.415 0683		- 7362	6.415 0687
45	20.887 1493	310 5968	-2 2918	6.463 3037	48 2354	- 7091	6.463 3041
46	21.195 4537	308 3043	-2 2256	6.510 8297	47 5260	- 6836	6.510 8301
47	21.501 5318	306 0781	-2 1627	6.557 6718	46 8421	- 6596	6.557 6722
48	21.805 4466	303 9149 301 8115	-2 1029	6.603 8541	46 1823 45 5453	- 6368	6.603 8545
49	22.107 2581		-2 0458	6.649 3993		- 6153	6.649 3998
50	22.407 0232	299 7651	-1 9915	6.694 3291	44 9297	- 5949	6.694 3296
51	22.704 7964	297 7732	-1 9396	6.738 6636	44 3346	- 5756	6.738 6642
52	23.000 6296	295 8332	-1 8900	6.782 4224	43 7588	- 5573	6.782 4229
53	23.294 5723	293 9427 292 0997	-1 8426	6.825 6237	43 2013 42 6612	- 5399	6.825 6242
54	23.586 6720		-1 7973	6.868 2850		- 5233	6.868 2855
55	23.876 9740	290 3020	-1 7539	6.910 4227	42 1378	- 5076	6.910 4233
56	24.165 5219	288 5478	-1 7122	6.952 0528	41 6301	- 4926	6.952 0533
57	24.452 3572	286 8353	-1 6723	6.993 1901	41 1374	- 4782	6.993 1907
58	24.737 5199	285 1627 283 5284	-1 6340	7.033 8491	40 6590 40 1943	- 4646	7.033 8497
59	25.021 0483		-1 5972	7.074 0434		- 4515	7.074 0440
60	25.302 9793	281 9310	-1 5618	7.113 7861	39 7426	- 4391	7.113 7867
61	25.583 3483	280 3690	-1 5277	7.153 0895	39 3035	- 4271	7.153 0902
62	25.862 1893	278 8410	-1 4950	7.191 9658	38 8762	- 4157	7.191 9664
63	26.139 5351	277 3458 275 8822	-1 4634	7.230 4262	38 4604 38 0556	- 4048	7.230 4269
64	26.415 4173		-1 4330	7.268 4818		- 3943	7.268 4824
65	26.689 8663	274 4490	-1 4037	7.306 1430	37 6612	- 3842	7.306 1436
66	26.962 9113	273 0451	-1 3754	7.343 4199	37 2769	- 3746	7.343 4205
67	27.234 5808	271 6695	-1 3481	7.380 3221	36 9022	- 3653	7.380 3228
68	27.504 9020	270 3212 268 9993	-1 3218	7.416 8589	36 5368 36 1804	- 3564	7.416 8596
69	27.773 9012		-1 2963	7.453 0393		- 3478	7.453 0400
70	28.041 6040	267 7028	-1 2716	7.488 8718	35 8325	- 3396	7.488 8725
71	28.308 0351	266 4310	-1 2478	7.524 3646	35 4928	- 3317	7.524 3653
72	28.573 2181	265 1831	-1 2248	7.559 5257	35 1611	- 3240	7.559 5264
73	28.837 1763	263 9582 262 7556	-1 2025	7.594 3627	34 8370 34 5203	- 3167	7.594 3634
74	29.099 9318		-1 1808	7.628 8830		- 3096	7.628 8837

Hyperbola:  $n=4$

$$10^{-n}u = U - \sinh F - F$$

$$10^{-2n}c_h = C_h(U) \cdot \cosh F - 1$$

$$10^{-n} s_h = S_h(U) = \sinh F$$

$$10^{-n} x_h = X_h(U) = F$$

$u$	$c_h$	$\delta$	$\delta^*$	$s_h$	$\delta$	$\delta^*$	$x_h$
34	17.327 0032		-3 3299	5.886 7656		-1 1312	5.886 7653
35	17.665 1044	338 1012	-3 2037	5.943 9223	57 1566	-1 0779	5.943 9219
36	18.000 0003	334 8959	-3 0857	6.000 0003	56 0781	-1 0285	6.000 0000
37	18.331 8092	331 8089	-2 9750	6.055 0493	55 0490	- 9826	6.055 0489
38	18.660 6418	328 8326	-2 8711	6.109 1151	54 0658	- 9399	6.109 1147
		325 9604			53 1254		
39	18.986 6022		-2 7734	6.162 2405		- 9001	6.162 2401
40	19.309 7881	323 1859	-2 6814	6.214 4654	52 2249	- 8629	6.214 4650
41	19.630 2916	320 5035	-2 5946	6.265 8269	51 3616	- 8281	6.265 8265
42	19.948 1997	317 9081	-2 5126	6.316 3600	50 5331	- 7955	6.316 3596
43	20.263 5944	315 3947	-2 4350	6.366 0971	49 7372	- 7649	6.366 0967
		312 9590			48 9719		
44	20.576 5534		-2 3615	6.415 0691		- 7362	6.415 0686
45	20.887 1502	310 5968	-2 2918	6.463 3045	48 2354	- 7091	6.463 3040
46	21.195 4546	308 3044	-2 2256	6.510 8305	47 5260	- 6836	6.510 8300
47	21.501 5327	306 0782	-2 1627	6.557 6726	46 8421	- 6596	6.557 6721
48	21.805 4476	303 9149	-2 1029	6.603 8549	46 1823	- 6368	6.603 8544
		301 8115			45 5453		
49	22.107 2591		-2 0458	6.649 4002		- 6153	6.649 3997
50	22.407 0242	299 7652	-1 9915	6.694 3300	44 9297	- 5949	6.694 3295
51	22.704 7974	297 7732	-1 9396	6.738 6646	44 3346	- 5756	6.738 6640
52	23.000 6306	295 8332	-1 8900	6.782 4234	43 7588	- 5573	6.782 4228
53	23.294 5734	293 9427	-1 8426	6.825 6247	43 2013	- 5399	6.825 6241
		292 0997			42 6613		
54	23.586 6731		-1 7973	6.868 2859		- 5233	6.868 2854
55	23.876 9752	290 3021	-1 7539	6.910 4237	42 1378	- 5076	6.910 4232
56	24.165 5231	288 5479	-1 7122	6.952 0538	41 6301	- 4926	6.952 0532
57	24.452 3584	286 8353	-1 6723	6.993 1912	41 1374	- 4782	6.993 1906
58	24.737 5211	285 1627	-1 6340	7.033 8502	40 6590	- 4646	7.033 8496
		283 5285			40 1943		
59	25.021 0496		-1 5972	7.074 0445		- 4515	7.074 0439
60	25.302 9806	281 9310	-1 5618	7.113 7871	39 7427	- 4391	7.113 7865
61	25.583 3496	280 3690	-1 5277	7.153 0906	39 3035	- 4271	7.153 0900
62	25.862 1906	278 8410	-1 4950	7.191 9669	38 8763	- 4157	7.191 9663
63	26.139 5365	277 3458	-1 4634	7.230 4274	38 4605	- 4048	7.230 4267
		275 8822			38 0556		
64	26.415 4187		-1 4330	7.268 4829		- 3943	7.268 4823
65	26.689 8677	274 4490	-1 4037	7.306 1442	37 6612	- 3842	7.306 1435
66	26.962 9128	273 0451	-1 3754	7.343 4211	37 2769	- 3746	7.343 4204
67	27.234 5823	271 6695	-1 3481	7.380 3233	36 9022	- 3653	7.380 3226
68	27.504 9035	270 3212	-1 3218	7.416 8602	36 5369	- 3564	7.416 8595
		268 9993			36 1804		
69	27.773 9027		-1 2963	7.453 0405		- 3478	7.453 0398
70	28.041 6056	267 7029	-1 2716	7.488 8730	35 8325	- 3396	7.488 8723
71	28.308 0367	266 4311	-1 2478	7.524 3658	35 4928	- 3317	7.524 3651
72	28.573 2198	265 1831	-1 2248	7.559 5269	35 1611	- 3240	7.559 5262
73	28.837 1779	263 9582	-1 2025	7.594 3640	34 8370	- 3167	7.594 3632
		262 7556			34 5203		
74	29.099 9335		-1 1808	7.628 8843		- 3096	7.628 8836

Ellipse:  $n=4$

$$10^{-3}u = U = E - \sin E$$

$$10^{-3}c_e = C_e(U) = 1 - \cos E$$

$$10^{-3}s_e = S_e(U) = \sin E$$

$$10^{-3}x_e = X_e(U) = E$$

$u$	$c_e$	$\delta$	$\delta^{**}$	$s_e$	$\delta$	$\delta^{**}$	$x_e$
74	29.099 9318	521 9892	-4 7225	7.628 8830	68 1186	-1 2379	7.628 8837
76	29.621 9210	517 4298	-4 5576	7.697 0016	66 9338	-1 1842	7.697 0023
78	30.139 3508	513 0256	-4 4025	7.763 9354	65 7992	-1 1340	7.763 9362
80	30.652 3764	508 7676	-4 2564	7.829 7346	64 7115	-1 0872	7.829 7354
82	31.161 1440	504 6476	-4 1186	7.894 4460	63 6676	-1 0433	7.894 4469
84	31.665 7915	500 6578	-3 9884	7.958 1137	62 6649	-1 0023	7.958 1145
86	32.166 4494	496 7914	-3 8653	8.020 7785	61 7007	- 9637	8.020 7794
88	32.663 2407	493 0416	-3 7486	8.082 4792	60 7728	- 9275	8.082 4801
90	33.156 2824	489 4026	-3 6380	8.143 2520	59 8790	- 8934	8.143 2529
92	33.645 6850	485 8687	-3 5329	8.203 1310	59 0173	- 8613	8.203 1320
94	34.131 5537	482 4347	-3 4331	8.262 1484	58 1860	- 8310	8.262 1493
96	34.613 9885	479 0958	-3 3381	8.320 3344	57 3834	- 8023	8.320 3354
98	35.093 0843	475 8475	-3 2476	8.377 7178	56 6079	- 7752	8.377 7188
100	35.568 9318	472 6855	-3 1613	8.434 3258	55 8581	- 7496	8.434 3268
102	36.041 6172	469 6059	-3 0789	8.490 1838	55 1326	- 7253	8.490 1849
104	36.511 2231	466 6050	-3 0002	8.545 3164	54 4302	- 7022	8.545 3175
106	36.977 8281	463 6794	-2 9250	8.599 7466	53 7498	- 6802	8.599 7477
108	37.441 5074	460 8258	-2 8530	8.653 4964	53 0903	- 6594	8.653 4975
110	37.902 3332	458 0412	-2 7841	8.706 5867	52 4506	- 6395	8.706 5878
112	38.360 3743	455 3226	-2 7180	8.759 0373	51 8298	- 6206	8.759 0384
114	38.815 6970	452 6675	-2 6546	8.810 8671	51 2271	- 6026	8.810 8682
116	39.268 3645	450 0733	-2 5938	8.862 0942	50 6416	- 5853	8.862 0954
118	39.718 4378	447 5376	-2 5354	8.912 7358	50 0726	- 5689	8.912 7370
120	40.165 9754	445 0580	-2 4792	8.962 8084	49 5193	- 5532	8.962 8096
122	40.611 0334	442 6325	-2 4251	9.012 3277	48 9810	- 5382	9.012 3289
124	41.053 6659	440 2590	-2 3731	9.061 3087	48 4571	- 5238	9.061 3099
126	41.493 9249	437 9356	-2 3230	9.109 7658	47 9470	- 5100	9.109 7670
128	41.931 8605	435 6606	-2 2748	9.157 7128	47 4501	- 4968	9.157 7141
130	42.367 5211	433 4320	-2 2282	9.205 1629	46 9659	- 4841	9.205 1642
132	42.800 9531	431 2484	-2 1833	9.252 1288	46 4939	- 4720	9.252 1302
134	43.232 2015	429 1081	-2 1400	9.298 6227	46 0335	- 4603	9.298 6240
136	43.661 3096	427 0097	-2 0981	9.344 6562	45 5844	- 4490	9.344 6576
138	44.088 3193	424 9517	-2 0577	9.390 2406	45 1461	- 4383	9.390 2420
140	44.513 2710	422 9329	-2 0186	9.435 3867	44 7181	- 4279	9.435 3881
142	44.936 2039	420 9519	-1 9808	9.480 1048	44 3002	- 4179	9.480 1062
144	45.357 1557	419 0074	-1 9442	9.524 4050	43 8919	- 4082	9.524 4065
146	45.776 1632	417 0985	-1 9088	9.568 2969	43 4928	- 3990	9.568 2984
148	46.193 2616	415 2238	-1 8745	9.611 7897	43 1028	- 3900	9.611 7912
150	46.608 4854		-1 8413	9.654 8925		- 3814	9.654 8940

Hyperbola:  $n=4$

$$10^{-3}u = U = \sinh F - F$$

$$10^{-2}c_h = C_h(U) = \cosh F - 1$$

$$10^{-n}s_h = S_h(U) = \sinh F$$

$$10^{-n}x_h = X_h(U) = F$$

$u$	$c_h$	$\delta$	$\delta^2$	$s_h$	$\delta$	$\delta^2$	$x_h$
74	29.099 9335		-4 7225	7.628 8843		-1 2379	7.628 8836
76	29.621 9228	521 9893	-4 5576	7.697 0029	68 1187	-1 1842	7.697 0022
78	30.139 3526	517 4298	-4 4025	7.763 9368	66 9338	-1 1340	7.763 9360
80	30.652 3782	513 0256	-4 2564	7.829 7360	65 7992	-1 0872	7.829 7352
82	31.161 1459	508 7677	-4 1186	7.894 4475	64 7115	-1 0433	7.894 4467
		504 6476			63 6677		
84	31.665 7935		-3 9884	7.958 1152		-1 0023	7.958 1143
86	32.166 4514	500 6579	-3 8653	8.020 7801	62 6649	- 9637	8.020 7792
88	32.663 2429	496 7914	-3 7486	8.082 4808	61 7007	- 9275	8.082 4800
90	33.156 2846	493 0417	-3 6380	8.143 2537	60 7728	- 8934	8.143 2528
92	33.645 6873	489 4027	-3 5329	8.203 1327	59 8790	- 8613	8.203 1318
		485 8688			59 0174		
94	34.131 5561		-3 4331	8.262 1501		- 8310	8.262 1491
96	34.613 9909	482 4348	-3 3381	8.320 3362	58 1861	- 8023	8.320 3352
98	35.093 0868	479 0959	-3 2476	8.377 7196	57 3835	- 7752	8.377 7186
100	35.568 9343	475 8475	-3 1613	8.434 3276	56 6079	- 7496	8.434 3266
102	36.041 6198	472 6855	-3 0789	8.490 1857	55 8581	- 7253	8.490 1846
		469 6059			55 1326		
104	36.511 2258		-3 0002	8.545 3183		- 7022	8.545 3173
106	36.977 8308	466 6050	-2 9250	8.599 7486	54 4303	- 6802	8.599 7475
108	37.441 5102	463 6794	-2 8530	8.653 4984	53 7498	- 6594	8.653 4973
110	37.902 3360	460 8258	-2 7841	8.706 5887	53 0903	- 6395	8.706 5876
112	38.360 3773	458 0412	-2 7180	8.759 0393	52 4506	- 6206	8.759 0382
		455 3227			51 8299		
114	38.815 7000		-2 6546	8.810 8691		- 6026	8.810 8680
116	39.268 3676	452 6676	-2 5938	8.862 0963	51 2271	- 5853	8.862 0951
118	39.718 4410	450 0734	-2 5354	8.912 7379	50 6417	- 5689	8.912 7368
120	40.165 9786	447 5376	-2 4792	8.962 8106	50 0726	- 5532	8.962 8094
122	40.611 0367	445 0581	-2 4251	9.012 3299	49 5193	- 5382	9.012 3287
		442 6326			48 9810		
124	41.053 6693		-2 3731	9.061 3109		- 5238	9.061 3097
126	41.493 9284	440 2591	-2 3230	9.109 7680	48 4571	- 5100	9.109 7668
128	41.931 8641	437 9357	-2 2748	9.157 7151	47 9470	- 4968	9.157 7138
130	42.367 5247	435 6606	-2 2282	9.205 1653	47 4502	- 4841	9.205 1640
132	42.800 9568	433 4321	-2 1833	9.252 1312	46 9660	- 4720	9.252 1299
		431 2485			46 4939		
134	43.232 2052		-2 1400	9.298 6251		- 4603	9.298 6238
136	43.661 3134	429 1082	-2 0981	9.344 6587	46 0336	- 4490	9.344 6573
138	44.088 3232	427 0098	-2 0577	9.390 2431	45 5844	- 4383	9.390 2417
140	44.513 2750	424 9518	-2 0186	9.435 3892	45 1461	- 4279	9.435 3878
142	44.936 2079	422 9330	-1 9808	9.480 1074	44 7182	- 4179	9.480 1060
		420 9519			44 3002		
144	45.357 1599		-1 9442	9.524 4076		- 4082	9.524 4062
146	45.776 1674	419 0075	-1 9088	9.568 2995	43 8919	- 3990	9.568 2981
148	46.193 2659	417 0985	-1 8745	9.611 7924	43 4929	- 3900	9.611 7909
150	46.608 4898	415 2239	-1 8412	9.654 8952	43 1028	- 3814	9.654 8937

Ellipse:  $n=3$

$$10^{-3}u = U = E - \sin E$$

$$10^{-2}c_e = C_e(U) = 1 - \cos E$$

$$10^{-n} s_e = S_e(U) = \sin E$$

$$10^{-n} x_e = X_e(U) = E$$

$u$	$c_e$	$\delta$	$\delta''$	$s_e$	$\delta$	$\delta''$	$x_e$
0.150	0.466 08485	10 30074	- 11504	0.965 48925	10 61062	- 23827	0.965 48940
0.155	0.476 38559	10 19055	- 11012	0.976 09987	10 38482	- 22561	0.976 10002
0.160	0.486 57614	10 08493	- 10556	0.986 48469	10 17066	- 21399	0.986 48485
0.165	0.496 66106	9 98355	- 10132	0.996 65534	9 96721	- 20329	0.996 65551
0.170	0.506 64461	9 88614	- 9737	1.006 62256	9 77364	- 19343	1.006 62273
0.175	0.516 53075	9 79241	- 9368	1.016 39620	9 58921	- 18431	1.016 39637
0.180	0.526 32317	9 70215	- 9023	1.025 98541	9 41323	- 17586	1.025 98559
0.185	0.536 02531	9 61512	- 8699	1.035 39864	9 24512	- 16802	1.035 39882
0.190	0.545 64044	9 53114	- 8395	1.044 64376	9 08431	- 16071	1.044 64395
0.195	0.555 17157	9 45001	- 8110	1.053 72807	8 93032	- 15391	1.053 72826
0.200	0.564 62159	9 37158	- 7840	1.062 65839	8 78270	- 14755	1.062 65859
0.205	0.573 99316	9 29569	- 7587	1.071 44109	8 64102	- 14160	1.071 44129
0.210	0.583 28885	9 22220	- 7347	1.080 08211	8 50493	- 13603	1.080 08232
0.215	0.592 51105	9 15097	- 7120	1.088 58704	8 37407	- 13080	1.088 58726
0.220	0.601 66202	9 08190	- 6905	1.096 96111	8 24813	- 12588	1.096 96133
0.225	0.610 74393	9 01487	- 6701	1.105 20925	8 12683	- 12126	1.105 20947
0.230	0.619 75880	8 94978	- 6508	1.113 33607	8 00988	- 11690	1.113 33630
0.235	0.628 70858	8 88652	- 6324	1.121 34596	7 89706	- 11278	1.121 34619
0.240	0.637 59510	8 82502	- 6149	1.129 24302	7 78813	- 10889	1.129 24326
0.245	0.646 42012	8 76518	- 5982	1.137 03114	7 68287	- 10522	1.137 03139
0.250	0.655 18531	8 70694	- 5823	1.144 71402	7 58111	- 10173	1.144 71427
0.255	0.663 89225	8 65021	- 5671	1.152 29512	7 48264	- 9843	1.152 29538
0.260	0.672 54246	8 59494	- 5526	1.159 77777	7 38732	- 9530	1.159 77803
0.265	0.681 13740	8 54105	- 5388	1.167 16508	7 29477	- 9232	1.167 16535
0.270	0.689 67844	8 48848	- 5255	1.174 46005	7 20545	- 8949	1.174 46032
0.275	0.698 16692	8 43719	- 5128	1.181 66550	7 11864	- 8679	1.181 66578
0.280	0.706 60411	8 38711	- 5007	1.188 78414	7 03439	- 8423	1.188 78442
0.285	0.714 99123	8 33821	- 4890	1.195 81852	6 95259	- 8178	1.195 81881
0.290	0.723 32943	8 29042	- 4778	1.202 77111	6 87312	- 7944	1.202 77140
0.295	0.731 61986	8 24371	- 4670	1.209 64424	6 79589	- 7721	1.209 64453
0.300	0.739 86357	8 19804	- 4567	1.216 44013	6 72080	- 7508	1.216 44043
0.305	0.748 06161	8 15336	- 4467	1.223 16093	6 64774	- 7304	1.223 16123
0.310	0.756 21497	8 10964	- 4371	1.229 80867	6 57664	- 7109	1.229 80898
0.315	0.764 32461	8 06684	- 4279	1.236 38531	6 50741	- 6922	1.236 38562
0.320	0.772 39145	8 02494	- 4190	1.242 89271	6 43997	- 6742	1.242 89303
0.325	0.780 41638	7 98389	- 4104	1.249 33269	6 37425	- 6570	1.249 33301
0.330	0.788 40027	7 94366	- 4022	1.255 70694	6 31019	- 6405	1.255 70727
0.335	0.796 34393	7 90424	- 3942	1.262 01713	6 24771	- 6247	1.262 01746
0.340	0.804 24817		- 3865	1.268 26484		- 6094	1.268 26518

Hyperbola:  $n=3$

$$10^{-3}u = U = \sinh F - F$$

$$10^{-3}c_h = C_h(U) = \cosh F - 1$$

$$10^{-3}s_h = S_h(U) = \sinh F$$

$$10^{-3}\lambda_h = X_h(U) = F$$

$u$	$c_h$	$\delta$	$\delta^2$	$s_h$	$\delta$	$\delta^2$	$\lambda_h$
0.150	0.466 08490	10 30074	- 11504	0.965 48952	10 61063	- 23827	0.965 48937
0.155	0.476 38564	10 19055	- 11012	0.976 10015	10 38483	- 22561	0.976 09999
0.160	0.486 57618	10 08493	- 10556	0.986 48497	10 17067	- 21399	0.986 48481
0.165	0.496 66111	9 98355	- 10132	0.996 65564	9 96722	- 20329	0.996 65548
0.170	0.506 64467	9 88614	- 9737	1.006 62286	9 77365	- 19343	1.006 62269
0.175	0.516 53080	9 79242	- 9368	1.016 39651	9 58922	- 18431	1.016 39634
0.180	0.526 32322	9 70215	- 9023	1.025 98573	9 41324	- 17586	1.025 98555
0.185	0.536 02537	9 61512	- 8699	1.035 39897	9 24513	- 16802	1.035 39879
0.190	0.545 64050	9 53114	- 8395	1.044 64410	9 08432	- 16071	1.044 64391
0.195	0.555 17164	9 45001	- 8110	1.053 72842	8 93033	- 15391	1.053 72822
0.200	0.564 62165	9 37158	- 7840	1.062 65875	8 78271	- 14755	1.062 65855
0.205	0.573 99323	9 29569	- 7587	1.071 44145	8 64103	- 14160	1.071 44125
0.210	0.583 28892	9 22220	- 7347	1.080 08249	8 50494	- 13603	1.080 08228
0.215	0.592 51112	9 15098	- 7120	1.088 58743	8 37408	- 13080	1.088 58721
0.220	0.601 66209	9 08191	- 6905	1.096 96151	8 24814	- 12588	1.096 96129
0.225	0.610 74400	9 01488	- 6701	1.105 20965	8 12684	- 12126	1.105 20943
0.230	0.619 75888	8 94978	- 6508	1.113 33649	8 00989	- 11690	1.113 33626
0.235	0.628 70866	8 88653	- 6324	1.121 34638	7 89707	- 11278	1.121 34615
0.240	0.637 59518	8 82502	- 6149	1.129 24345	7 78814	- 10889	1.129 24321
0.245	0.646 42020	8 76519	- 5982	1.137 03159	7 68288	- 10522	1.137 03134
0.250	0.655 18539	8 70694	- 5823	1.144 71447	7 58111	- 10173	1.144 71422
0.255	0.663 89233	8 65022	- 5671	1.152 29558	7 48265	- 9843	1.152 29533
0.260	0.672 54255	8 59494	- 5526	1.159 77823	7 38732	- 9530	1.159 77797
0.265	0.681 13749	8 54105	- 5388	1.167 16556	7 29498	- 9232	1.167 16529
0.270	0.689 67854	8 48849	- 5255	1.174 46054	7 20546	- 8949	1.174 46027
0.275	0.698 16702	8 43719	- 5128	1.181 66600	7 11864	- 8679	1.181 66572
0.280	0.706 60421	8 38712	- 5007	1.188 78464	7 03440	- 8423	1.188 78436
0.285	0.714 99133	8 33821	- 4890	1.195 81904	6 95260	- 8178	1.195 81875
0.290	0.723 32954	8 29042	- 4778	1.202 77163	6 87313	- 7944	1.202 77134
0.295	0.731 61996	8 24371	- 4670	1.209 64477	6 79590	- 7721	1.209 64447
0.300	0.739 86368	8 19804	- 4567	1.216 44067	6 72081	- 7508	1.216 44037
0.305	0.748 06172	8 15336	- 4467	1.223 16148	6 64775	- 7304	1.223 16117
0.310	0.756 21508	8 10964	- 4371	1.229 80923	6 57665	- 7109	1.229 80892
0.315	0.764 32472	8 06685	- 4279	1.236 38587	6 50742	- 6922	1.236 38556
0.320	0.772 39157	8 02494	- 4190	1.242 89329	6 43998	- 6742	1.242 89297
0.325	0.780 41651	7 98389	- 4104	1.249 33327	6 37426	- 6570	1.249 33294
0.330	0.788 40039	7 94367	- 4022	1.255 70753	6 31020	- 6405	1.255 70720
0.335	0.796 34406	7 90424	- 3942	1.262 01773	6 24772	- 6247	1.262 01739
0.340	0.804 24830		- 3865	1.268 26545		- 6094	1.268 26511

Ellipse:  $n=3$

$$10^{-3n}u = U - E - \sin E$$

$$10^{-2n}c_n = C_n(U) = 1 - \cos E$$

$$10^{-n}s_n = S_n(U) = \sin E$$

$$10^{-n}x_n = X_n(U) = E$$

$u$	$c_n$	$\delta$	$\delta''$	$s_n$	$\delta$	$\delta''$	$x_n$
0.34	0.804 24817		-15456	1.268 26484		-24371	1.268 26518
0.35	0.819 94143	15 69326	-14870	1.280 57885	12 31401	-23222	1.280 57920
0.36	0.835 48592	15 54449	-14322	1.292 66049	12 08164	-22157	1.292 66085
0.37	0.850 88712	15 40120	-13809	1.304 52042	11 85993	-21169	1.304 52079
0.38	0.866 15018	15 26306	-13327	1.316 16853	11 64811	-20249	1.316 16891
		15 12974			11 44551		
0.39	0.881 27991		-12873	1.327 61404		-19391	1.327 61443
0.40	0.896 28087	15 0096	-12446	1.338 86554	11 25150	-18590	1.338 86594
0.41	0.911 15732	14 87645	-12043	1.349 93104	11 06550	-17841	1.349 93145
0.42	0.925 91330	14 75598	-11662	1.360 81805	10 88700	-17139	1.360 81847
0.43	0.940 55263	14 63932	-11302	1.371 53358	10 71554	-16480	1.371 53401
		14 52627			10 55067		
0.44	0.955 07889		-10961	1.382 08425		-15860	1.382 08469
0.45	0.969 49552	14 41662	-10638	1.392 47625	10 39200	-15278	1.392 47670
0.46	0.983 80573	14 31022	-10330	1.402 71540	10 23916	-14728	1.402 71586
0.47	0.998 01262	14 20689	-10038	1.412 80722	10 09182	-14210	1.412 80769
0.48	1.012 11910	14 10648	-9761	1.422 75689	9 94967	-13720	1.422 75737
		14 00885			9 81242		
0.49	1.026 12794		-9496	1.432 56931		-13257	1.432 56980
0.50	1.040 04180	13 91386	-9244	1.442 24912	9 67981	-12818	1.442 24962
0.51	1.053 86321	13 82140	-9003	1.451 80071	9 55159	-12402	1.451 80122
0.52	1.067 59456	13 73136	-8773	1.461 22825	9 42754	-12007	1.461 22877
0.53	1.081 23817	13 64361	-8553	1.470 53568	9 30743	-11632	1.470 53621
		13 55806			9 19108		
0.54	1.094 79624		-8342	1.479 72676		-11275	1.479 72730
0.55	1.108 27086	13 47463	-8141	1.488 80506	9 07830	-10935	1.488 80561
0.56	1.121 66407	13 39320	-7947	1.497 77397	8 96892	-10612	1.497 77453
0.57	1.134 97778	13 31371	-7762	1.506 63674	8 86277	-10304	1.506 63731
0.58	1.148 21386	13 23608	-7584	1.515 39645	8 75971	-10009	1.515 39703
		13 16022			8 65959		
0.59	1.161 37408		-7413	1.524 05604		-9728	1.524 05663
0.60	1.174 46015	13 08608	-7249	1.532 61832	8 56229	-9459	1.532 61892
0.61	1.187 47373	13 01357	-7091	1.541 08600	8 46767	-9202	1.541 08661
0.62	1.200 41638	12 94265	-6939	1.549 46162	8 37563	-8956	1.549 46224
0.63	1.213 28963	12 87325	-6793	1.557 74766	8 28604	-8721	1.557 74829
		12 80531			8 19882		
0.64	1.226 09494		-6651	1.565 94648		-8495	1.565 94712
0.65	1.238 83373	12 73879	-6515	1.574 06033	8 11385	-8278	1.574 06098
0.66	1.251 50736	12 67363	-6384	1.582 09138	8 03105	-8070	1.582 09204
0.67	1.264 11714	12 60978	-6257	1.590 04172	7 95034	-7871	1.590 04239
0.68	1.276 66433	12 54719	-6135	1.597 91334	7 87162	-7679	1.597 91402
		12 48584			7 79482		
0.69	1.289 15017		-6017	1.605 70815		-7494	1.605 70884
0.70	1.301 57583	12 42566	-5902	1.613 42802	7 71986	-7316	1.613 42872
0.71	1.313 94246	12 36663	-5792	1.621 07470	7 64669	-7146	1.621 07541
0.72	1.326 25116	12 30870	-5685	1.628 64992	7 57522	-6981	1.628 65064
0.73	1.338 50301	12 25185	-5581	1.636 15532	7 50540	-6822	1.636 15605
		12 19603			7 43717		
0.74	1.350 69904		-5481	1.643 59249		-6669	1.643 59323

Hyperbola:  $n=3$

$$10^{-3n} u = U = \sinh F - F$$

$$10^{-2n} c_h = C_h(U) = \cosh F - 1$$

$$10^{-n} s_h = S_h(U) = \sinh F$$

$$10^{-n} x_h = X_h(U) = F$$

$u$	$c_h$	$\delta$	$\delta''$	$s_h$	$\delta$	$\delta''$	$x_h$
0.34	0.804 24830		- 15456	1.268 26545		- 24371	1.268 26511
0.35	0.819 94157	15 69327	- 14870	1.280 57948	12 31403	- 23222	1.280 57913
0.36	0.835 48606	15 54449	- 14322	1.292 66114	12 08166	- 22157	1.292 66078
0.37	0.850 88727	15 40121	- 13809	1.304 52108	11 85994	- 21169	1.304 52071
0.38	0.866 15033	15 26306	- 13327	1.316 16922	11 64813	- 20249	1.316 16884
		15 12974			11 44553		
0.39	0.881 28007		- 12873	1.327 61475		- 19391	1.327 61436
0.40	0.896 28103	15 00096	- 12446	1.338 86626	11 25152	- 18590	1.338 86586
0.41	0.911 15749	14 87646	- 12043	1.349 93178	11 06552	- 17841	1.349 93137
0.42	0.925 91348	14 75599	- 11662	1.360 81880	10 88702	- 17139	1.360 81838
0.43	0.940 55280	14 63933	- 11302	1.371 53436	10 71556	- 16480	1.371 53393
		14 52627			10 55069		
0.44	0.955 07908		- 10961	1.382 08504		- 15861	1.382 08460
0.45	0.969 49570	14 41663	- 10638	1.392 47705	10 39201	- 15278	1.392 47660
0.46	0.983 80593	14 31022	- 10330	1.402 71623	10 23918	- 14728	1.402 71577
0.47	0.998 01282	14 20689	- 10038	1.412 80807	10 09184	- 14210	1.412 80760
0.48	1.012 11930	14 10648	- 9761	1.422 75775	9 94969	- 13720	1.422 75727
		14 00885			9 81244		
0.49	1.026 12815		- 9496	1.432 57019		- 13257	1.432 56970
0.50	1.040 04202	13 91387	- 9244	1.442 25002	9 67983	- 12818	1.442 24952
0.51	1.053 86343	13 82141	- 9003	1.451 80163	9 55161	- 12407	1.451 80112
0.52	1.067 59479	13 73136	- 8773	1.461 22918	9 42755	- 12002	1.461 22866
0.53	1.081 23841	13 64362	- 8553	1.470 53663	9 30745	- 11632	1.470 53610
		13 55807			9 19110		
0.54	1.094 79648		- 8342	1.479 72773		- 11275	1.479 72719
0.55	1.108 27111	13 47463	- 8141	1.488 80605	9 07832	- 10935	1.488 80550
0.56	1.121 66432	13 39321	- 7947	1.497 77498	8 96893	- 10612	1.497 77442
0.57	1.134 97804	13 31372	- 7762	1.506 63777	8 86279	- 10304	1.506 63720
0.58	1.148 21412	13 23608	- 7584	1.515 39749	8 75972	- 10009	1.515 39691
		13 16023			8 65961		
0.59	1.161 37435		- 7413	1.524 05710		- 9728	1.524 05651
0.60	1.174 46043	13 08608	- 7249	1.532 61940	8 56230	- 9459	1.532 61880
0.61	1.187 47401	13 01358	- 7091	1.541 08709	8 46769	- 9202	1.541 08648
0.62	1.200 41667	12 94266	- 6939	1.549 46274	8 37564	- 8956	1.549 46212
0.63	1.213 28992	12 87326	- 6793	1.557 74880	8 28606	- 8721	1.557 74817
		12 80532			8 19883		
0.64	1.226 09524		- 6651	1.565 94763		- 8495	1.565 94699
0.65	1.238 83404	12 73880	- 6515	1.574 06150	8 11387	- 8278	1.574 06085
0.66	1.251 50767	12 67363	- 6384	1.582 09257	8 03107	- 8070	1.582 09191
0.67	1.264 11745	12 60978	- 6257	1.590 04293	7 95035	- 7870	1.590 04226
0.68	1.276 66466	12 54720	- 6135	1.597 91456	7 87163	- 7679	1.597 91388
		12 48584			7 79483		
0.69	1.289 15050		- 6017	1.605 70939		- 7494	1.605 70870
0.70	1.301 57617	12 42567	- 5902	1.613 42928	7 71988	- 7317	1.613 42858
0.71	1.313 94280	12 36664	- 5792	1.621 07598	7 64670	- 7146	1.621 07527
0.72	1.326 25152	12 30871	- 5685	1.628 65122	7 57524	- 6981	1.628 65050
0.73	1.338 50337	12 25186	- 5581	1.636 15664	7 50542	- 6822	1.636 15591
		12 19604			7 43718		
0.74	1.350 69941		- 5481	1.643 59382		- 6669	1.643 59308

Ellipse:  $n=3$

$$10^{-3n}u = U = E - \sin E$$

$$10^{-3n}c_e = C_e(U) = 1 - \cos E$$

$$10^{-n}s_e = S_e(U) = \sin E$$

$$10^{-n}x_e = X_e(U) = E$$

$u$	$c_e$	$\delta$	$\delta''$	$s_e$	$\delta$	$\delta''$	$x_e$
0.74	1.350 6990	24 2286	- 2192	1.643 5925	14 6757	- 2667	1.643 5932
0.76	1.374 9276	24 0170	- 2115	1.658 2682	14 4204	- 2551	1.658 2689
0.78	1.398 9446	23 8125	- 2043	1.672 6886	14 1760	- 2443	1.672 6894
0.80	1.422 7571	23 6149	- 1976	1.686 8646	13 9417	- 2342	1.686 8654
0.82	1.446 3720	23 4237	- 1912	1.700 8063	13 7168	- 2248	1.700 8071
0.84	1.469 7957	23 2385	- 1851	1.714 5230	13 5007	- 2159	1.714 5239
0.86	1.493 0341	23 0590	- 1794	1.728 0237	13 2930	- 2076	1.728 0246
0.88	1.516 0932	22 8850	- 1740	1.741 3167	13 0931	- 1998	1.741 3176
0.90	1.538 9781	22 7161	- 1689	1.754 4098	12 9005	- 1925	1.754 4107
0.92	1.561 6942	22 5520	- 1640	1.767 3104	12 7149	- 1856	1.767 3113
0.94	1.584 2462	22 3926	- 1594	1.780 0252	12 5358	- 1790	1.780 0262
0.96	1.606 6388	22 2377	- 1549	1.792 5610	12 3629	- 1729	1.792 5620
0.98	1.628 8765	22 0869	- 1507	1.804 9239	12 1958	- 1670	1.804 9249
1.00	1.650 9634	21 9401	- 1467	1.817 1197	12 0342	- 1615	1.817 1207
1.02	1.672 9035	21 7972	- 1429	1.829 1539	11 8779	- 1563	1.829 1550
1.04	1.694 7006	21 6579	- 1393	1.841 0319	11 7266	- 1513	1.841 0329
1.06	1.716 3585	21 5221	- 1358	1.852 7585	11 5800	- 1466	1.852 7596
1.08	1.737 8806	21 3896	- 1324	1.864 3385	11 4379	- 1421	1.864 3396
1.10	1.759 2702	21 2604	- 1292	1.875 7765	11 3001	- 1378	1.875 7776
1.12	1.780 5306	21 1342	- 1262	1.887 0766	11 1664	- 1337	1.887 0777
1.14	1.801 6648	21 0110	- 1232	1.898 2430	11 0365	- 1298	1.898 2441
1.16	1.822 6758	20 8905	- 1204	1.909 2795	10 9104	- 1261	1.909 2807
1.18	1.843 5663	20 7728	- 1177	1.920 1899	10 7878	- 1226	1.920 1911
1.20	1.864 3392	20 6578	- 1151	1.930 9777	10 6686	- 1192	1.930 9789
1.22	1.884 9969	20 5452	- 1126	1.941 6463	10 5526	- 1159	1.941 6475
1.24	1.905 5421	20 4350	- 1102	1.952 1989	10 4398	- 1128	1.952 2001
1.26	1.925 9771	20 3272	- 1078	1.962 6387	10 3299	- 1099	1.962 6399
1.28	1.946 3043	20 2216	- 1056	1.972 9685	10 2228	- 1070	1.972 9698
1.30	1.966 5258	20 1181	- 1034	1.983 1913	10 1185	- 1043	1.983 1926
1.32	1.986 6440	20 0168	- 1013	1.993 3098	10 0168	- 1017	1.993 3111
1.34	2.006 6607	19 9174	- 993	2.003 3266	9 9176	- 992	2.003 3279
1.36	2.026 5781	19 8200	- 974	2.013 2442	9 8208	- 967	2.013 2456
1.38	2.046 3982	19 7245	- 955	2.023 0650	9 7264	- 944	2.023 0664
1.40	2.066 1227	19 6308	- 937	2.032 7915	9 6342	- 922	2.032 7929
1.42	2.085 7535	19 5388	- 919	2.042 4257	9 5442	- 900	2.042 4271
1.44	2.105 2923	19 4486	- 902	2.051 9698	9 4562	- 880	2.051 9713
1.46	2.124 7409	19 3600	- 886	2.061 4260	9 3702	- 860	2.061 4275
1.48	2.144 1009	19 2730	- 870	2.070 7963	9 2862	- 840	2.070 7978
1.50	2.163 3739	19 1875	- 855	2.080 0825	9 2042	- 822	2.080 0840

Hyperbola:  $n=3$

$$10^{-3n}u = U - \sinh F - F$$

$$10^{-3n}c_h = C_h(U) = \cosh F - 1$$

$$10^{-n}s_h = S_h(U) = \sinh F$$

$$10^{-n}x_h = X_h(U) = F$$

$u$	$c_h$	$\delta$	$\delta^2$	$s_h$	$\delta$	$\delta^2$	$x_h$
0.74	1.350 6994		- 2192	1.643 5938		- 2667	1.643 5931
0.76	1.374 9280	24 2286	- 2115	1.658 2696	14 6757	- 2551	1.658 2688
0.78	1.398 9450	24 0170	- 2043	1.672 6900	14 4205	- 2443	1.672 6892
0.80	1.422 7575	23 8125	- 1976	1.686 8661	14 1760	- 2342	1.686 8653
0.82	1.446 3724	23 6149	- 1912	1.700 8077	13 9417	- 2248	1.700 8069
		23 4237			13 7168		
0.84	1.469 7961		- 1851	1.714 5245		- 2159	1.714 5237
0.86	1.493 0346	23 2385	- 1794	1.728 0253	13 5008	- 2076	1.728 0244
0.88	1.516 0936	23 0590	- 1740	1.741 3183	13 2930	- 1998	1.741 3175
0.90	1.538 9786	22 8850	- 1689	1.754 4115	13 0931	- 1925	1.754 4106
0.92	1.561 6947	22 7161	- 1640	1.767 3120	12 9006	- 1856	1.767 3111
		22 5520			12 7149		
0.94	1.584 2467		- 1594	1.780 0269		- 1790	1.780 0260
0.96	1.606 6393	22 3926	- 1549	1.792 5628	12 5358	- 1729	1.792 5618
0.98	1.628 8770	22 2377	- 1507	1.804 9257	12 3629	- 1670	1.804 9247
1.00	1.650 9639	22 0869	- 1467	1.817 1215	12 1958	- 1615	1.817 1205
1.02	1.672 9040	21 9401	- 1429	1.829 1558	12 0343	- 1563	1.829 1548
		21 7972			11 8780		
1.04	1.694 7012		- 1393	1.841 0338		- 1513	1.841 0327
1.06	1.716 3591	21 6579	- 1358	1.852 7604	11 7267	- 1465	1.852 7594
1.08	1.737 8812	21 5221	- 1324	1.864 3405	11 5801	- 1421	1.864 3394
1.10	1.759 2708	21 3896	- 1292	1.875 7784	11 4380	- 1378	1.875 7773
1.12	1.780 5312	21 2604	- 1262	1.887 0786	11 3002	- 1337	1.887 0775
		21 1342			11 1664		
1.14	1.801 6655		- 1232	1.898 2450		- 1298	1.898 2439
1.16	1.822 6764	21 0110	- 1204	1.909 2816	11 0366	- 1261	1.909 2804
1.18	1.843 5670	20 8906	- 1177	1.920 1920	10 9104	- 1226	1.920 1908
1.20	1.864 3399	20 7729	- 1151	1.930 9798	10 7878	- 1192	1.930 9786
1.22	1.884 9976	20 6578	- 1126	1.941 6485	10 6686	- 1159	1.941 6473
		20 5452			10 5527		
1.24	1.905 5428		- 1102	1.952 2011		- 1128	1.952 1999
1.26	1.925 9778	20 4350	- 1078	1.962 6409	10 4398	- 1099	1.962 6397
1.28	1.946 3050	20 3272	- 1056	1.972 9708	10 3299	- 1070	1.972 9695
1.30	1.966 5266	20 2216	- 1034	1.983 1937	10 2228	- 1043	1.983 1924
1.32	1.986 6447	20 1181	- 1013	1.993 3122	10 1185	- 1017	1.993 3109
		20 0168			10 0168		
1.34	2.006 6615		- 993	2.003 3290		- 992	2.003 3277
1.36	2.026 5790	19 9174	- 974	2.013 2466	9 9176	- 967	2.013 2453
1.38	2.046 3990	19 8200	- 955	2.023 0675	9 8209	- 944	2.023 0661
1.40	2.066 1235	19 7245	- 937	2.032 7940	9 7264	- 922	2.032 7926
1.42	2.085 7544	19 6308	- 919	2.042 4282	9 6343	- 900	2.042 4268
		19 5389			9 5442		
1.44	2.105 2932		- 902	2.051 9724		- 880	2.051 9710
1.46	2.124 7418	19 4486	- 886	2.061 4287	9 4562	- 860	2.061 4272
1.48	2.144 1018	19 3600	- 870	2.070 7989	9 3703	- 840	2.070 7975
1.50	2.163 3748	19 2730	- 855	2.080 0852	9 2862	- 822	2.080 0837

Ellipse:  $n=3$

$$10^{-3n}u = U \dots E - \sin E$$

$$10^{-2n}c_e = C_e(U) = 1 - \cos E$$

$$10^{-n}s_e = S_e(U) = \sin E$$

$$10^{-n}x_e = X_e(U) = E$$

$u$	$c_e$	$\delta$	$\delta^{2''}$	$s_e$	$\delta$	$\delta^{2''}$	$x_e$
1.50	2.163 3739	47 8118	- 5340	2.080 0825	22 8598	- 5133	2.080 0840
1.55	2.211 1857	47 3003	- 5111	2.102 9423	22 3734	- 4861	2.102 9439
1.60	2.258 4860	46 8101	- 4900	2.125 3157	21 9120	- 4610	2.125 3173
1.65	2.305 2960	46 3395	- 4703	2.147 2277	21 4737	- 4380	2.147 2293
1.70	2.351 6355	45 8874	- 4519	2.168 7014	21 0566	- 4167	2.168 7031
1.75	2.397 5229	45 4523	- 4348	2.189 7580	20 6593	- 3971	2.189 7597
1.80	2.442 9753	45 0334	- 4188	2.210 4173	20 2802	- 3789	2.210 4191
1.85	2.488 0086	44 6294	- 4038	2.230 6974	19 9180	- 3620	2.230 6993
1.90	2.532 6381	44 2396	- 3897	2.250 6154	19 5715	- 3462	2.250 6173
1.95	2.576 8777	43 8630	- 3764	2.270 1869	19 2398	- 3316	2.270 1889
2.00	2.620 7407	43 4990	- 3639	2.289 4267	18 9217	- 3179	2.289 4287
2.05	2.664 2397	43 1467	- 3521	2.308 3484	18 6165	- 3051	2.308 3504
2.10	2.707 3864	42 8056	- 3410	2.326 9649	18 3233	- 2931	2.326 9670
2.15	2.750 1921	42 4750	- 3305	2.345 2882	18 0414	- 2818	2.345 2903
2.20	2.792 6671	42 1544	- 3205	2.363 3295	17 7700	- 2712	2.363 3317
2.25	2.834 8216	41 8433	- 3110	2.381 0996	17 5087	- 2612	2.381 1018
2.30	2.876 6649	41 5412	- 3021	2.398 6082	17 2567	- 2518	2.398 6105
2.35	2.918 2060	41 2476	- 2935	2.415 8650	17 0137	- 2430	2.415 8673
2.40	2.959 4536	40 9621	- 2854	2.432 8786	16 7790	- 2346	2.432 8810
2.45	3.000 4157	40 6844	- 2777	2.449 6576	16 5522	- 2267	2.449 6601
2.50	3.041 1001	40 4140	- 2703	2.466 2098	16 3330	- 2192	2.466 2123
2.55	3.081 5141	40 1507	- 2632	2.482 5428	16 1208	- 2121	2.482 5453
2.60	3.121 6648	39 8941	- 2565	2.498 6636	15 9155	- 2053	2.498 6662
2.65	3.161 5589	39 6440	- 2501	2.514 5791	15 7165	- 1989	2.514 5817
2.70	3.201 2029	39 4000	- 2439	2.530 2956	15 5236	- 1928	2.530 2983
2.75	3.240 6030	39 1619	- 2380	2.545 8192	15 3366	- 1870	2.545 8220
2.80	3.279 7649	38 9295	- 2324	2.561 1558	15 1551	- 1815	2.561 1586
2.85	3.318 6944	38 7025	- 2270	2.576 3109	14 9789	- 1762	2.576 3138
2.90	3.357 3969	38 4807	- 2218	2.591 2898	14 8077	- 1712	2.591 2927
2.95	3.395 8776	38 2639	- 2168	2.606 0974	14 6413	- 1663	2.606 1004
3.00	3.434 1415	38 0519	- 2120	2.620 7387	14 4795	- 1618	2.620 7417
3.05	3.472 1934	37 8445	- 2073	2.635 2182	14 3221	- 1574	2.635 2212
3.10	3.510 0380	37 6416	- 2029	2.649 5403	14 1689	- 1532	2.649 5434
3.15	3.547 6796	37 4429	- 1986	2.663 7092	14 0198	- 1491	2.663 7123
3.20	3.585 1225	37 2484	- 1945	2.677 7289	13 8745	- 1453	2.677 7321
3.25	3.622 3709	37 0579	- 1905	2.691 6034	13 7329	- 1416	2.691 6066
3.30	3.659 4288	36 8712	- 1867	2.705 3363	13 5949	- 1380	2.705 3396
3.35	3.696 3000	36 6882	- 1830	2.718 9311	13 4602	- 1346	2.718 9345
3.40	3.732 9882	36 5089	- 1794	2.732 3914	13 3287	- 1313	2.732 3948

Hyperbola:  $n=3$

$$10^{-3n}u = U = \sinh F - F$$

$$10^{-2n}c_h = C_h(U) = \cosh F - 1$$

$$10^{-n}s_h = S_h(U) = \sinh F$$

$$10^{-n}x_h = X_h(U) = F$$

$u$	$c_h$	$\delta$	$\delta^2$	$s_h$	$\delta$	$\delta^2$	$x_h$
1.50	2.163 3748		- 5340	2.080 0852		- 5133	2.080 0837
1.55	2.211 1866	47 8118	- 5111	2.102 9451	22 8599	- 4861	2.102 9436
1.60	2.258 4870	47 3004	- 4900	2.125 3186	22 3735	- 4610	2.125 3170
1.65	2.305 2971	46 8101	- 4703	2.147 2307	21 9121	- 4380	2.147 2290
1.70	2.351 6367	46 3396	- 4519	2.168 7044	21 4738	- 4167	2.168 7027
		45 8874			21 0567		
1.75	2.397 5241		- 4348	2.189 7611		- 3971	2.189 7594
1.80	2.442 9765	45 4524	- 4188	2.210 4205	20 6594	- 3789	2.210 4187
1.85	2.488 0099	45 0334	- 4038	2.230 7008	20 2803	- 3620	2.230 6989
1.90	2.532 6393	44 6295	- 3897	2.250 6188	19 9181	- 3462	2.250 6169
1.95	2.576 8790	44 2396	- 3764	2.270 1904	19 5716	- 3316	2.270 1885
		43 8631			19 2398		
2.00	2.620 7421		- 3639	2.289 4303		- 3179	2.289 4283
2.05	2.664 2411	43 4990	- 3521	2.308 3521	18 9218	- 3051	2.308 3500
2.10	2.707 3879	43 1468	- 3410	2.326 9687	18 6166	- 2931	2.326 9666
2.15	2.750 1936	42 8057	- 3305	2.345 2920	18 3234	- 2818	2.345 2899
2.20	2.792 6687	42 4751	- 3205	2.363 3335	18 0414	- 2712	2.363 3313
		42 1545			17 7701		
2.25	2.834 8232		- 3110	2.381 1036		- 2612	2.381 1014
2.30	2.876 6665	41 8434	- 3021	2.398 6124	17 5088	- 2518	2.398 6101
2.35	2.918 2077	41 5412	- 2935	2.415 8692	17 2568	- 2430	2.415 8669
2.40	2.959 4554	41 2476	- 2854	2.432 8830	17 0138	- 2346	2.432 8806
2.45	3.000 4175	40 9621	- 2777	2.449 6620	16 7791	- 2267	2.449 6596
		40 6844			16 5523		
2.50	3.041 1019		- 2703	2.466 2143		- 2192	2.466 2118
2.55	3.081 5160	40 4141	- 2632	2.482 5474	16 3331	- 2121	2.482 5448
2.60	3.121 6668	40 1508	- 2565	2.498 6683	16 1209	- 2053	2.498 6657
2.65	3.161 5609	39 8942	- 2501	2.514 5838	15 9155	- 1989	2.514 5812
2.70	3.201 2050	39 6441	- 2439	2.530 3004	15 7166	- 1928	2.530 2977
		39 4001			15 5237		
2.75	3.240 6051		- 2380	2.545 8242		- 1870	2.545 8214
2.80	3.279 7671	39 1620	- 2324	2.561 1608	15 3367	- 1815	2.561 1580
2.85	3.318 6966	38 9296	- 2270	2.576 3160	15 1552	- 1762	2.576 3132
2.90	3.357 3992	38 7026	- 2218	2.591 2950	14 9789	- 1712	2.591 2921
2.95	3.395 8800	38 4808	- 2168	2.606 1027	14 8078	- 1663	2.606 0998
		38 2640			14 6414		
3.00	3.434 1439		- 2120	2.620 7441		- 1618	2.620 7411
3.05	3.472 1959	38 0520	- 2073	2.635 2237	14 4796	- 1574	2.635 2206
3.10	3.510 0404	37 8446	- 2029	2.649 5458	14 3222	- 1532	2.649 5427
3.15	3.547 6821	37 6416	- 1986	2.663 7148	14 1690	- 1491	2.663 7117
3.20	3.585 1251	37 4430	- 1945	2.677 7347	14 0198	- 1453	2.677 7315
		37 2485			13 8746		
3.25	3.622 3736		- 1905	2.691 6092		- 1416	2.691 6060
3.30	3.659 4315	37 0579	- 1867	2.705 3422	13 7330	- 1380	2.705 3389
3.35	3.696 3028	36 8712	- 1830	2.718 9371	13 5949	- 1346	2.718 9338
3.40	3.732 9910	36 6883	- 1794	2.732 3975	13 4603	- 1313	2.732 3941

Ellipse:  $n=3$

$$10^{-3n}u = U = E - \sin E$$

$$10^{-2n}c_e = C_e(U) = 1 - \cos E$$

$$10^{-n}s_e = S_e(U) = \sin E$$

$$10^{-n}x_e = X_e(U) = E$$

$u$	$c_e$	$\delta$	$\delta^{**}$	$s_e$	$\delta$	$\delta^{**}$	$x_e$
3.4	3.732 9882		- 7174	2.732 3914		- 5251	2.732 3948
3.5	3.805 8299	72 8416	- 6902	2.758 9210	26 5297	- 5003	2.758 9245
3.6	3.877 9809	72 1511	- 6648	2.784 9501	26 0290	- 4774	2.784 9537
3.7	3.949 4669	71 4860	- 6409	2.810 5014	25 5514	- 4561	2.810 5051
3.8	4.020 3117	70 8448	- 6186	2.835 5965	25 0950	- 4362	2.835 6003
		70 2260			24 6585		
3.9	4.090 5377		- 5975	2.860 2550		- 4178	2.860 2589
4.0	4.160 1659	69 6282	- 5777	2.884 4955	24 2405	- 4005	2.884 4995
4.1	4.229 2162	69 0503	- 5590	2.908 3354	23 8398	- 3844	2.908 3395
4.2	4.297 7074	68 4912	- 5413	2.931 7906	23 4553	- 3692	2.931 7948
4.3	4.365 6571	67 9497	- 5246	2.954 8765	23 0859	- 3550	2.954 8808
		67 4249			22 7307		
4.4	4.433 0820		- 5088	2.977 6071		- 3417	2.977 6115
4.5	4.499 9980	66 9160	- 4938	2.999 9960	22 3888	- 3291	3.000 0005
4.6	4.566 4201	66 4221	- 4795	3.022 0555	22 0595	- 3173	3.022 0601
4.7	4.632 3626	65 9425	- 4659	3.043 7976	21 7421	- 3061	3.043 8023
4.8	4.697 8390	65 4764	- 4530	3.065 2334	21 4358	- 2956	3.065 2382
		65 0233			21 1401		
4.9	4.762 8622		- 4408	3.086 3736		- 2856	3.086 3785
5.0	4.827 4446	64 5824	- 4291	3.107 2280	20 8544	- 2761	3.107 2330
5.1	4.891 5978	64 1532	- 4179	3.127 8062	20 5782	- 2672	3.127 8113
5.2	4.955 3331	63 7353	- 4072	3.148 1172	20 3109	- 2587	3.148 1224
5.3	5.018 6611	63 3280	- 3970	3.168 1693	20 0522	- 2506	3.168 1746
		62 9309			19 8015		
5.4	5.081 5920		- 3872	3.187 9708		- 2429	3.187 9762
5.5	5.144 1356	62 5436	- 3779	3.207 5294	19 5585	- 2356	3.207 5349
5.6	5.206 3013	62 1657	- 3689	3.226 8523	19 3229	- 2286	3.226 8579
5.7	5.268 0980	61 7967	- 3603	3.245 9464	19 0942	- 2220	3.245 9521
5.8	5.329 5344	61 4364	- 3520	3.264 8186	18 8721	- 2156	3.264 8244
		61 0843			18 6565		
5.9	5.390 6187		- 3441	3.283 4750		- 2096	3.283 4809
6.0	5.451 3588	60 7401	- 3365	3.301 9218	18 4468	- 2038	3.301 9278
6.1	5.511 7624	60 4036	- 3291	3.320 1648	18 2430	- 1983	3.320 1709
6.2	5.571 8368	60 0744	- 3221	3.338 2095	18 0447	- 1930	3.338 2157
6.3	5.631 5891	59 7523	- 3153	3.356 0612	17 8517	- 1879	3.356 0675
		59 4369			17 6637		
6.4	5.691 0260		- 3087	3.373 7249		- 1830	3.373 7313
6.5	5.750 1542	59 1282	- 3024	3.391 2056	17 4807	- 1783	3.391 2121
6.6	5.808 9799	58 8257	- 2963	3.408 5079	17 3023	- 1739	3.408 5145
6.7	5.867 5093	58 5293	- 2904	3.425 6363	17 1284	- 1696	3.425 6430
6.8	5.925 7481	58 2389	- 2848	3.442 5951	16 9588	- 1654	3.442 6019
		57 9541			16 7934		
6.9	5.983 7022		- 2793	3.459 3885		- 1615	3.459 3954
7.0	6.041 3770	57 6748	- 2740	3.476 0203	16 6319	- 1576	3.476 0273
7.1	6.098 7777	57 4008	- 2688	3.492 4946	16 4742	- 1539	3.492 5017
7.2	6.155 9096	57 1319	- 2639	3.508 8148	16 3202	- 1504	3.508 8220
7.3	6.212 7776	56 8680	- 2591	3.524 9846	16 1698	- 1470	3.524 9919
		56 6089			16 0228		
7.4	6.269 3865		- 2544	3.541 0074		- 1437	3.541 0148

Hyperbola:  $n=3$

$$10^{-3}u = U = \sinh F - F$$

$$10^{-3}c_h = C_h(U) = \cosh F - 1$$

$$10^{-n} s_h = S_h(U) = \sinh F$$

$$10^{-n} x_h = X_h(U) = F$$

$u$	$c_h$	$\delta$	$\delta^{2^*}$	$s_h$	$\delta$	$\delta^{2^*}$	$x_h$
3.4	3.732 9910		- 7174	2.732 3975		- 5251	2.732 3941
3.5	3.805 8328	72 8417	- 6902	2.758 9273	26 5299	- 5003	2.758 9238
3.6	3.877 9839	72 1512	- 6648	2.784 9565	26 0292	- 4774	2.784 9529
3.7	3.949 4701	71 4861	- 6409	2.810 5081	25 5515	- 4561	2.810 5044
3.8	4.020 3150	70 8449	- 6186	2.835 6033	25 0952	- 4362	2.835 5995
		70 2261			24 6587		
3.9	4.090 5410		- 5975	2.860 2620		- 4178	2.860 2581
4.0	4.160 1694	69 6283	- 5777	2.884 5027	24 2407	- 4005	2.884 4987
4.1	4.229 2198	69 0504	- 5590	2.908 3427	23 8400	- 3844	2.908 3386
4.2	4.297 7111	68 4913	- 5413	2.931 7982	23 4555	- 3692	2.931 7940
4.3	4.365 6609	67 9498	- 5246	2.954 8842	23 0860	- 3550	2.954 8799
		67 4250			22 7308		
4.4	4.433 0859		- 5088	2.977 6151		- 3417	2.977 6107
4.5	4.500 0020	66 9161	- 4938	3.000 0041	22 3890	- 3291	2.999 9996
4.6	4.566 4242	66 4222	- 4795	3.022 0638	22 0597	- 3173	3.022 0592
4.7	4.632 3668	65 9426	- 4659	3.043 8060	21 7423	- 3061	3.043 8013
4.8	4.697 8434	65 4765	- 4530	3.065 2420	21 4360	- 2956	3.065 2372
		65 0234			21 1403		
4.9	4.762 8667		- 4408	3.086 3824		- 2856	3.086 3775
5.0	4.827 4493	64 5825	- 4291	3.107 2370	20 8546	- 2761	3.107 2320
5.1	4.891 6026	64 1534	- 4179	3.127 8154	20 5784	- 2672	3.127 8103
5.2	4.955 3380	63 7354	- 4072	3.148 1265	20 3111	- 2587	3.148 1213
5.3	5.018 6661	63 3281	- 3970	3.168 1789	20 0524	- 2506	3.168 1736
		62 9310			19 8017		
5.4	5.081 5971		- 3872	3.187 9806		- 2429	3.187 9752
5.5	5.144 1409	62 5437	- 3779	3.207 5393	19 5587	- 2356	3.207 5338
5.6	5.206 3067	62 1658	- 3689	3.226 8623	19 3231	- 2286	3.226 8567
5.7	5.268 1036	61 7969	- 3603	3.245 9567	19 0944	- 2220	3.245 9510
5.8	5.329 5401	61 4365	- 3520	3.264 8290	18 8723	- 2156	3.264 8232
		61 0844			18 6566		
5.9	5.390 6245		- 3441	3.283 4857		- 2096	3.283 4798
6.0	5.451 3648	60 7403	- 3365	3.301 9326	18 4470	- 2038	3.301 9266
6.1	5.511 7685	60 4037	- 3291	3.320 1758	18 2432	- 1983	3.320 1697
6.2	5.571 8430	60 0745	- 3221	3.338 2206	18 0448	- 1930	3.338 2144
6.3	5.631 5954	59 7524	- 3153	3.356 0725	17 8518	- 1879	3.356 0662
		59 4371			17 6639		
6.4	5.691 0325		- 3087	3.373 7364		- 1830	3.373 7300
6.5	5.750 1608	59 1283	- 3024	3.391 2173	17 4809	- 1783	3.391 2108
6.6	5.808 9867	58 8258	- 2963	3.408 5198	17 3025	- 1739	3.408 5132
6.7	5.867 5162	58 5295	- 2904	3.425 6484	17 1286	- 1696	3.425 6417
6.8	5.925 7552	58 2390	- 2848	3.442 6074	16 9590	- 1654	3.442 6006
		57 9542			16 7935		
6.9	5.983 7094		- 2793	3.459 4009		- 1615	3.459 3940
7.0	6.041 3843	57 6749	- 2740	3.476 0329	16 6321	- 1576	3.476 0259
7.1	6.098 7852	57 4009	- 2688	3.492 5073	16 4744	- 1539	3.492 5002
7.2	6.155 9172	57 1320	- 2639	3.508 8278	16 3204	- 1504	3.508 8206
7.3	6.212 7853	56 8681	- 2591	3.524 9978	16 1700	- 1470	3.524 9905
		56 6090			16 0230		
7.4	6.269 3944		- 2544	3.541 0208		- 1437	3.541 0134

Ellipse:  $n=3$

$$10^{-3n}u = U = E - \sin E$$

$$10^{-2n}c_e = C_e(U) = 1 - \cos E$$

$$10^{-n}v_e = S_e(U) = \sin E$$

$$10^{-n}x_e = X_e(U) = E$$

$u$	$c_e$	$\delta$	$\delta^2$	$s_e$	$\delta$	$\delta^2$	$x_e$
7.4	6.269 3865		- 1 0174	3.541 0074		- 5746	3.541 0148
7.6	6.381 8455	112 4590	- 9819	3.572 6251	31 6177	- 5496	3.572 6327
7.8	6.493 3223	111 4767	- 9485	3.603 6929	31 0677	- 5264	3.603 7007
8.0	6.603 8501	110 5279	- 9170	3.634 2340	30 5411	- 5046	3.634 2420
8.2	6.713 4607	109 6105	- 8873	3.664 2702	30 0362	- 4843	3.664 2784
		108 7229			29 5517		
8.4	6.822 1835		- 8593	3.693 8219		- 4652	3.693 8303
8.6	6.930 0469	107 8633	- 8327	3.722 9082	29 0863	- 4473	3.722 9168
8.8	7.037 0772	107 0303	- 8076	3.751 5470	28 6388	- 4305	3.751 5558
9.0	7.143 2996	106 2225	- 7838	3.779 7550	28 2081	- 4147	3.779 7640
9.2	7.248 7381	105 4385	- 7612	3.807 5482	27 7932	- 3998	3.807 5574
		104 6771			27 3933		
9.4	7.353 4152		- 7396	3.834 9415		- 3857	3.834 9509
9.6	7.457 3525	103 9373	- 7192	3.861 9489	27 0074	- 3724	3.861 9585
9.8	7.560 5704	103 2179	- 6997	3.888 5838	26 6349	- 3598	3.888 5936
10.0	7.663 0885	102 5181	- 6811	3.914 8586	26 2749	- 3479	3.914 8686
10.2	7.764 9253	101 8368	- 6633	3.940 7855	25 9269	- 3366	3.940 7957
		101 1734			25 5901		
10.4	7.866 0987		- 6464	3.966 3756		- 3259	3.966 3860
10.6	7.966 6255	100 5268	- 6302	3.991 6397	25 2641	- 3157	3.991 6503
10.8	8.066 5220	99 8965	- 6147	4.016 5880	24 9483	- 3060	4.016 5988
11.0	8.165 8038	99 2817	- 5998	4.041 2301	24 6421	- 2968	4.041 2411
11.2	8.264 4856	98 6818	- 5856	4.065 5753	24 3452	- 2881	4.065 5865
		98 0961			24 0571		
11.4	8.362 5817		- 5719	4.089 6324		- 2797	4.089 6438
11.6	8.460 1058	97 5241	- 5588	4.113 4098	23 7773	- 2717	4.113 4214
11.8	8.557 0710	96 9652	- 5461	4.136 9154	23 5056	- 2641	4.136 9272
12.0	8.653 4899	96 4189	- 5341	4.160 1568	23 2415	- 2568	4.160 1688
12.2	8.749 3746	95 8847	- 5225	4.183 1415	22 9846	- 2498	4.183 1537
		95 3621			22 7348		
12.4	8.844 7367		- 5113	4.205 8763		- 2431	4.205 8887
12.6	8.939 5875	94 8508	- 5005	4.228 3679	22 4916	- 2367	4.228 3805
12.8	9.033 9377	94 3502	- 4901	4.250 6228	22 2549	- 2306	4.250 6356
13.0	9.127 7978	93 8601	- 4801	4.272 6470	22 0242	- 2247	4.272 6600
13.2	9.221 1777	93 3799	- 4704	4.294 4465	21 7995	- 2191	4.294 4597
		92 9075			21 5804		
13.4	9.314 0872		- 4611	4.316 0268		- 2136	4.316 0402
13.6	9.406 5356	92 4484	- 4520	4.337 3935	21 3667	- 2084	4.337 4071
13.8	9.498 5318	91 9963	- 4433	4.358 5518	21 1582	- 2034	4.358 5656
14.0	9.590 0848	91 5529	- 4349	4.379 5065	20 9548	- 1986	4.379 5205
14.2	9.681 2027	91 1180	- 4268	4.400 2627	20 7561	- 1940	4.400 2769
		90 6912			20 5622		
14.4	9.771 8939		- 4189	4.420 8248		- 1895	4.420 8392
14.6	9.862 1661	90 2722	- 4112	4.441 1975	20 3726	- 1852	4.441 2121
14.8	9.952 0271	89 8610	- 4038	4.461 3849	20 1874	- 1810	4.461 3997
15.0	10.041 4842	89 4571	- 3967	4.481 3912	20 0064	- 1770	4.481 4062

Hyperbola:  $n=3$

$$10^{-n}u = U = \sinh F - F$$

$$10^{-n}c_A = C_A(U) = \cosh F - 1$$

$$10^{-n}s_A = S_A(U) = \sinh F$$

$$10^{-n}x_A = X_A(U) = F$$

$u$	$c_A$	$\delta$	$\delta^2$	$s_A$	$\delta$	$\delta^2$	$x_A$
7.4	6.269 3944		- 1 0174	3.541 0208		- 5746	3.541 0134
7.6	6.381 8537	112 4593	- 9819	3.572 6388	31 6181	- 5496	3.572 6312
7.8	6.493 3307	111 4770	- 9485	3.603 7069	31 0681	- 5264	3.603 6991
8.0	6.603 8589	110 5282	- 9170	3.634 2484	30 5415	- 5046	3.634 2404
8.2	6.713 4697	109 6108	- 8873	3.664 2850	30 0366	- 4843	3.664 2768
		108 7232			29 5521		
8.4	6.822 1928		- 8593	3.693 8371		- 4652	3.693 8287
8.6	6.930 0565	107 8636	- 8327	3.722 9237	29 0866	- 4473	3.722 9151
8.8	7.037 0871	107 0306	- 8076	3.751 5628	28 6391	- 4305	3.751 5540
9.0	7.143 3098	106 2228	- 7838	3.779 7712	28 2084	- 4147	3.779 7622
9.2	7.248 7486	105 4388	- 7611	3.807 5648	27 7936	- 3998	3.807 5556
		104 6774			27 3936		
9.4	7.353 4260		- 7396	3.834 9584		- 3857	3.834 9490
9.6	7.457 3636	103 9376	- 7192	3.861 9662	27 0078	- 3724	3.861 9566
9.8	7.560 5818	103 2182	- 6997	3.888 6014	26 6352	- 3598	3.888 5916
10.0	7.663 1002	102 5184	- 6811	3.914 8766	26 2753	- 3479	3.914 8666
10.2	7.764 9374	101 8372	- 6633	3.940 8039	25 9272	- 3366	3.940 7937
		101 1737			25 5905		
10.4	7.866 1110		- 6464	3.966 3943		- 3259	3.966 3839
10.6	7.966 6382	100 5272	- 6302	3.991 6588	25 2645	- 3157	3.991 6482
10.8	8.066 5351	99 8969	- 6147	4.016 6074	24 9486	- 3060	4.016 5966
11.0	8.165 8171	99 2821	- 5998	4.041 2499	24 6425	- 2968	4.041 2389
11.2	8.264 4993	98 6821	- 5856	4.065 5955	24 3456	- 2881	4.065 5843
		98 0965			24 0575		
11.4	8.362 5957		- 5719	4.089 6530		- 2797	4.089 6416
11.6	8.460 1202	97 5244	- 5588	4.113 4307	23 7777	- 2717	4.113 4191
11.8	8.557 0857	96 9655	- 5462	4.136 9366	23 5057	- 2641	4.136 9248
12.0	8.653 5049	96 4192	- 5341	4.160 1784	23 2418	- 2568	4.160 1664
12.2	8.749 3899	95 8850	- 5225	4.183 1634	22 9850	- 2498	4.183 1512
		95 3625			22 7352		
12.4	8.844 7524		- 5113	4.205 8986		- 2431	4.205 8862
12.6	8.939 6035	94 8511	- 5005	4.228 3906	22 4920	- 2367	4.228 3780
12.8	9.033 9540	94 3506	- 4901	4.250 6458	22 2552	- 2306	4.250 6330
13.0	9.127 8144	93 8604	- 4801	4.272 6704	22 0246	- 2247	4.272 6574
13.2	9.221 1947	93 3803	- 4704	4.294 4702	21 7998	- 2191	4.294 4570
		92 9098			21 5807		
13.4	9.314 1045		- 4610	4.316 0510		- 2136	4.316 0376
13.6	9.406 5533	92 4487	- 4520	4.337 4180	21 3671	- 2084	4.337 4044
13.8	9.498 5499	91 9966	- 4433	4.358 5766	21 1586	- 2034	4.358 5628
14.0	9.590 1031	91 5533	- 4349	4.379 5317	20 9551	- 1986	4.379 5177
14.2	9.681 2215	91 1183	- 4268	4.400 2882	20 7565	- 1940	4.400 2740
		90 6915			20 5625		
14.4	9.771 9130		- 4189	4.420 8508		- 1895	4.420 8364
14.6	9.862 1856	90 2726	- 4112	4.441 2238	20 3730	- 1852	4.441 2092
14.8	9.952 0469	89 8613	- 4038	4.461 4115	20 1878	- 1810	4.461 3967
15.0	10.041 5043	89 4574	- 3967	4.481 4182	20 0067	- 1770	4.481 4032

Ellipse:  $n=3$

$$10^{-3n}u = U = E - \sin E$$

$$10^{-2n}c_e = C_e(U) = 1 - \cos E$$

$$10^{-n}s_e = S_e(U) = \sin E$$

$$10^{-n}x_e = X_e(U) = E$$

$u$	$c_e$	$\delta$	$\delta^2$	$s_e$	$\delta$	$\delta^2$	$x_e$
15.0	10.041 4842		- 2 4785	4.481 3912		-1 1060	4.481 4062
15.5	10.263 4064	221 9222	- 2 3725	4.530 6409	49 2497	-1 0472	4.530 6564
16.0	10.482 9546	219 5482	- 2 2743	4.578 8426	48 2016	- 9932	4.578 8586
16.5	10.700 2273	217 2727	- 2 1829	4.626 0502	47 2076	- 9436	4.626 0667
17.0	10.915 3160	215 0887	- 2 0977	4.672 3134	46 2633	- 8978	4.672 3304
		212 9899			45 3648		
17.5	11.128 3059		- 2 0182	4.717 6782		- 8555	4.717 6957
18.0	11.339 2766	210 9707	- 1 9439	4.762 1870	44 5087	- 8163	4.762 2050
18.5	11.548 3026	209 0260	- 1 8741	4.805 8789	43 6919	- 7799	4.805 8974
19.0	11.755 4537	207 1511	- 1 8087	4.848 7905	42 9116	- 7460	4.848 8095
19.5	11.960 7953	205 3417	- 1 7472	4.890 9557	42 1652	- 7144	4.890 9752
		203 5939			41 4505		
20.0	12.164 3892		- 1 6892	4.932 4061		- 6849	4.932 4261
20.5	12.366 2933	201 9041	- 1 6345	4.973 1714	40 7652	- 6573	4.973 1919
21.0	12.566 5623	200 2690	- 1 5828	5.013 2790	40 1077	- 6314	5.013 3000
21.5	12.765 2480	198 6857	- 1 5339	5.052 7550	39 4760	- 6071	5.052 7765
22.0	12.962 3993	197 1513	- 1 4876	5.091 6236	38 8686	- 5843	5.091 6456
		195 6632			38 2840		
22.5	13.158 0625		- 1 4437	5.129 9076		- 5628	5.129 9301
23.0	13.352 2816	194 2191	- 1 4021	5.167 6286	37 7210	- 5426	5.167 6516
23.5	13.545 0982	192 8166	- 1 3624	5.204 8067	37 1782	- 5235	5.204 8302
24.0	13.736 5520	191 4538	- 1 3247	5.241 4612	36 6545	- 5054	5.241 4852
24.5	13.926 6808	190 1288	- 1 2888	5.277 6100	36 1488	- 4884	5.277 6345
		188 8397			35 6603		
25.0	14.115 5205		- 1 2546	5.313 2703		- 4722	5.313 2953
25.5	14.303 1053	187 5848	- 1 2219	5.348 4583	35 1879	- 4569	5.348 4838
26.0	14.489 4680	186 3627	- 1 1907	5.383 1892	34 7309	- 4423	5.383 2152
26.5	14.674 6398	185 1718	- 1 1608	5.417 4777	34 2885	- 4285	5.417 5042
27.0	14.858 6505	184 0107	- 1 1322	5.451 3375	33 8598	- 4154	5.451 3645
		182 8783			33 4443		
27.5	15.041 5288		- 1 1049	5.484 7818		- 4029	5.484 8093
28.0	15.223 3020	181 7732	- 1 0786	5.517 8232	33 0414	- 3909	5.517 8512
28.5	15.403 9964	180 6944	- 1 0535	5.550 4735	32 6503	- 3796	5.550 5020
29.0	15.583 6371	179 6407	- 1 0293	5.582 7441	32 2706	- 3687	5.582 7731
29.5	15.762 2483	178 6112	- 1 0062	5.614 6459	31 9018	- 3584	5.614 6754
		177 6049			31 5433		
30.0	15.939 8531		- 9839	5.646 1892		- 3485	5.646 2192
30.5	16.116 4740	176 6208	- 9624	5.677 3839	31 1947	- 3390	5.677 4144
31.0	16.292 1322	175 6583	- 9418	5.708 2396	30 8557	- 3300	5.708 2706
31.5	16.466 8486	174 7163	- 9219	5.738 7652	30 5256	- 3213	5.738 7967
32.0	16.640 6429	173 7943	- 9027	5.768 9695	30 2043	- 3130	5.769 0015
		172 8914			29 8913		
32.5	16.813 5343		- 8843	5.798 8607		- 3050	5.798 8932
33.0	16.985 5414	172 0070	- 8665	5.828 4470	29 5862	- 2973	5.828 4800
33.5	17.156 6818	171 1405	- 8493	5.857 7359	29 2889	- 2900	5.857 7694
34.0	17.326 9729	170 2911	- 8327	5.886 7347	28 9989	- 2829	5.886 7687

Hyperbola:  $n=3$

$$10^{-n}u = U = \sinh F - F$$

$$10^{-n}c_h = C_h(U) = \cosh F - 1$$

$$10^{-n}s_h = S_h(U) = \sinh F$$

$$10^{-n}x_h = X_h(U) = F$$

$u$	$c_h$	$\delta$	$\delta^2$	$s_h$	$\delta$	$\delta^2$	$x_h$
15.0	10.041 5043	221 9231	- 2 4785	4.481 4182	49 2506	-1 1060	4.481 4032
15.5	10.263 4274	219 5491	- 2 3725	4.530 6688	48 2025	-1 0472	4.530 6533
16.0	10.482 9766	217 2736	- 2 2742	4.578 8714	47 2085	- 9932	4.578 8554
16.5	10.700 2502	215 0896	- 2 1829	4.626 0799	46 2642	- 9436	4.626 0634
17.0	10.915 3398	212 9908	- 2 0977	4.672 3440	45 3657	- 8978	4.672 3270
17.5	11.128 3306		- 2 0182	4.717 7097		- 8555	4.717 6922
18.0	11.339 3023	210 9717	- 1 9438	4.762 2194	44 5096	- 8163	4.762 2014
18.5	11.548 3293	209 0270	- 1 8741	4.805 9122	43 6928	- 7799	4.805 8937
19.0	11.755 4813	207 1520	- 1 8087	4.848 8247	42 9125	- 7460	4.848 8057
19.5	11.960 8240	205 3426	- 1 7471	4.890 9908	42 1661	- 7144	4.890 9713
		203 5948			41 4514		
20.0	12.164 4188		- 1 6892	4.932 4421		- 6849	4.932 4221
20.5	12.366 3239	201 9051	- 1 6345	4.973 2083	40 7661	- 6573	4.973 1878
21.0	12.566 5939	200 2700	- 1 5828	5.013 3168	40 1086	- 6314	5.013 2958
21.5	12.765 2806	198 6867	- 1 5339	5.052 7937	39 4769	- 6071	5.052 7722
22.0	12.962 4329	197 1523	- 1 4876	5.091 6632	38 8695	- 5843	5.091 6412
		195 6642			38 2849		
22.5	13.158 0971		- 1 4437	5.129 9481		- 5628	5.129 9256
23.0	13.352 3172	194 2201	- 1 4020	5.167 6700	37 7219	- 5426	5.167 6470
23.5	13.545 1349	192 8177	- 1 3624	5.204 8490	37 1791	- 5235	5.204 8255
24.0	13.736 5898	191 4549	- 1 3247	5.241 5044	36 6554	- 5054	5.241 4804
24.5	13.926 7196	190 1298	- 1 2888	5.277 6541	36 1497	- 4884	5.277 6296
		188 8407			35 6612		
25.0	14.115 5604		- 1 2546	5.313 3153		- 4722	5.313 2903
25.5	14.303 1463	187 5859	- 1 2219	5.348 5042	35 1888	- 4569	5.348 4787
26.0	14.489 5100	186 3638	- 1 1906	5.383 2360	34 7318	- 4423	5.383 2100
26.5	14.674 6829	185 1729	- 1 1608	5.417 5254	34 2894	- 4285	5.417 4989
27.0	14.858 6947	184 0118	- 1 1322	5.451 3861	33 8607	- 4154	5.451 3591
		182 8794			33 4452		
27.5	15.041 5741		- 1 1049	5.484 8313		- 4029	5.484 8038
28.0	15.223 3484	181 7743	- 1 0786	5.517 8736	33 0423	- 3909	5.517 8456
28.5	15.404 0439	180 6955	- 1 0535	5.550 5248	32 6512	- 3796	5.550 4963
29.0	15.583 6857	179 6418	- 1 0293	5.582 7963	32 2715	- 3687	5.582 7673
29.5	15.762 2980	178 6123	- 1 0061	5.614 6990	31 9027	- 3584	5.614 6695
		177 6060			31 5442		
30.0	15.939 9039		- 9839	5.646 2432		- 3485	5.646 2132
30.5	16.116 5259	176 6220	- 9624	5.677 4388	31 1956	- 3390	5.677 4083
31.0	16.292 1853	175 6594	- 9418	5.708 2954	30 8566	- 3300	5.708 2644
31.5	16.466 9028	174 7175	- 9219	5.738 8219	30 5265	- 3213	5.738 7904
32.0	16.640 6983	173 7955	- 9027	5.769 0271	30 2052	- 3130	5.768 9951
		172 8926			29 8922		
32.5	16.813 5909		- 8843	5.798 9192		- 3050	5.798 8867
33.0	16.985 5991	172 0082	- 8665	5.828 5064	29 5871	- 2973	5.828 4734
33.5	17.156 7407	171 1416	- 8493	5.857 7962	29 2898	- 2900	5.857 7627
34.0	17.327 0330	170 2923	- 8326	5.886 7959	28 9998	- 2829	5.886 7619

Ellipse:  $n=3$

$$10^{-3n}u = U = E - \sin E$$

$$10^{-2n}c_r = C_r(U) = 1 - \cos E$$

$$10^{-n}s_r = S_r(U) = \sin E$$

$$10^{-n}x_r = X_r(U) = E$$

$u$	$c_r$	$\delta$	$\delta^2$	$s_r$	$\delta$	$\delta^2$	$x_r$
34	17.326 9729		- 3 3299	5.886 7347		-1 1312	5.886 7687
35	17.665 0729	338 1000	- 3 2037	5.943 8905	57 1557	-1 0779	5.943 9255
36	17.999 9676	334 8947	- 3 0857	5.999 9676	56 0771	-1 0285	6.000 0036
37	18.331 7753	331 8077	- 2 9750	6.055 0156	55 0480	- 9826	6.055 0526
38	18.660 6067	328 8314	- 2 8711	6.109 0805	54 0649	- 9399	6.109 1185
		325 9591			53 1245		
39	18.986 5658		- 2 7734	6.162 2050		- 9001	6.162 2440
40	19.309 7504	323 1846	- 2 6814	6.214 4290	52 2240	- 8629	6.214 4690
41	19.630 2527	320 5023	- 2 5946	6.265 7897	51 3606	- 8281	6.265 8307
42	19.948 1595	317 9068	- 2 5126	6.316 3218	50 5321	- 7955	6.316 3638
43	20.263 5529	315 3934	- 2 4350	6.366 0581	49 7363	- 7649	6.366 1011
		312 9577			48 9710		
44	20.576 5106		- 2 3615	6.415 0291		- 7362	6.415 0731
45	20.887 1061	310 5955	- 2 2918	6.463 2636	48 2345	- 7091	6.463 3086
46	21.195 4092	308 3031	- 2 2256	6.510 7887	47 5251	- 6836	6.510 8347
47	21.501 4860	306 0768	- 2 1627	6.557 6299	46 8412	- 6596	6.557 6769
48	21.805 3996	303 9135	- 2 1029	6.603 8113	46 1814	- 6368	6.603 8593
		301 8102			45 5444		
49	22.107 2097		- 2 0459	6.649 3557		- 6153	6.649 4047
50	22.406 9735	299 7638	- 1 9915	6.694 2845	44 9288	- 5949	6.694 3345
51	22.704 7454	297 7719	- 1 9396	6.738 6182	44 3337	- 5756	6.738 6692
52	23.000 5772	295 8318	- 1 8900	6.782 3761	43 7579	- 5573	6.782 4281
53	23.294 5186	293 9414	- 1 8427	6.825 5765	43 2004	- 5399	6.825 6295
		292 0983			42 6604		
54	23.586 6169		- 1 7973	6.868 2369		- 5233	6.868 2909
55	23.876 9176	290 3007	- 1 7539	6.910 3737	42 1369	- 5076	6.910 4287
56	24.165 4641	288 5465	- 1 7122	6.952 0029	41 6292	- 4926	6.952 0589
57	24.452 2980	286 8339	- 1 6723	6.993 1394	41 1365	- 4782	6.993 1964
58	24.737 4593	285 1613	- 1 6340	7.033 7975	40 6581	- 4646	7.033 8555
		283 5270			40 1934		
59	25.020 9863		- 1 5972	7.073 9909		- 4515	7.074 0499
60	25.302 9159	281 9296	- 1 5618	7.113 7326	39 7418	- 4391	7.113 7926
61	25.583 2835	280 3676	- 1 5277	7.153 0352	39 3026	- 4271	7.153 0962
62	25.862 1231	278 8396	- 1 4950	7.191 9105	38 8754	- 4157	7.191 9725
63	26.139 4675	277 3444	- 1 4634	7.230 3701	38 4595	- 4048	7.230 4331
		275 8807			38 0547		
64	26.415 3482		- 1 4330	7.268 4248		- 3943	7.268 4888
65	26.689 7957	274 4475	- 1 4037	7.306 0851	37 6603	- 3842	7.306 1501
66	26.962 8393	273 0436	- 1 3754	7.343 3611	37 2760	- 3746	7.343 4271
67	27.234 5073	271 6680	- 1 3481	7.380 2624	36 9013	- 3653	7.380 3294
68	27.504 8271	270 3197	- 1 3218	7.416 7983	36 5359	- 3564	7.416 8663
		268 9978			36 1795		
69	27.773 8248		- 1 2963	7.452 9778		- 3478	7.453 0468
70	28.041 5262	267 7013	- 1 2717	7.488 8094	35 8316	- 3396	7.488 8794
71	28.307 9557	266 4295	- 1 2478	7.524 3013	35 4919	- 3317	7.524 3723
72	28.573 1373	265 1816	- 1 2248	7.559 4615	35 1602	- 3240	7.559 5335
73	28.837 0939	263 9567	- 1 2025	7.594 2976	34 8361	- 3167	7.594 3706
		262 7541			34 5194		
74	29.099 8480		- 1 1808	7.628 8170		- 3096	7.628 8910

Hyperbola:  $n=3$

$$10^{-3n}u = U = \sinh F - F$$

$$10^{-3n}c_h = C_h(U) = \cosh F - 1$$

$$10^{-n}s_h = S_h(U) = \sinh F$$

$$10^{-n}x_h = X_h(U) = F$$

$u$	$c_h$	$\delta$	$\delta^{2''}$	$s_h$	$\delta$	$\delta^{2''}$	$x_h$
34	17.327 0330		- 3 3299	5.886 7959		-1 1312	5.886 7619
35	17.665 1353	338 1023	- 3 2037	5.943 9535	57 1575	-1 0779	5.943 9185
36	18.000 0324	334 8971	- 3 0857	6.000 0324	56 0789	-1 0285	5.999 9964
37	18.331 8425	331 8101	- 2 9750	6.055 0822	55 0498	- 9826	6.055 0452
38	18.660 6763	328 8338 325 9616	- 2 8711	6.109 1489	54 0667 53 1263	- 9399	6.109 1109
39	18.986 6379		- 2 7734	6.162 2752		- 9001	6.162 2362
40	19.309 8250	323 1871	- 2 6814	6.214 5010	52 2258	- 8629	6.214 4610
41	19.630 3298	320 5048	- 2 5946	6.265 8635	51 3624	- 8281	6.265 8225
42	19.948 2391	317 9093	- 2 5125	6.316 3974	50 5339	- 7955	6.316 3554
43	20.263 6350	315 3960 312 9603	- 2 4350	6.366 1355	49 7381 48 9728	- 7649	6.366 0925
44	20.576 5953		- 2 3615	6.415 1083		- 7362	6.415 0643
45	20.887 1934	310 5981	- 2 2918	6.463 3446	48 2363	- 7091	6.463 2996
46	21.195 4990	308 3057	- 2 2256	6.510 8715	47 5269	- 6836	6.510 8255
47	21.501 5785	306 0794	- 2 1627	6.557 7145	46 8430	- 6596	6.557 6675
48	21.805 4947	303 9162 301 8128	- 2 1029	6.603 8977	46 1832 45 5462	- 6368	6.603 8497
49	22.107 3075		- 2 0458	6.649 4439		- 6153	6.649 3949
50	22.407 0739	299 7665	- 1 9915	6.694 3745	44 9306	- 5949	6.694 3245
51	22.704 8485	297 7745	- 1 9396	6.738 7100	44 3355	- 5756	6.738 6590
52	23.000 6830	295 8345	- 1 8900	6.782 4697	43 7597	- 5573	6.782 4177
53	23.294 6271	293 9441 292 1011	- 1 8426	6.825 6719	43 2022 42 6622	- 5399	6.825 6189
54	23.586 7282		- 1 7973	6.868 3341		- 5233	6.868 2801
55	23.877 0316	290 3034	- 1 7539	6.910 4727	42 1387	- 5076	6.910 4177
56	24.165 5809	288 5492	- 1 7122	6.952 1037	41 6310	- 4926	6.952 0477
57	24.452 4176	286 8367	- 1 6723	6.993 2420	41 1383	- 4782	6.993 1850
58	24.737 5817	285 1641 283 5299	- 1 6340	7.033 9019	40 6599 40 1952	- 4646	7.033 8439
59	25.021 1115		- 1 5972	7.074 0971		- 4515	7.074 0381
60	25.303 0440	281 9324	- 1 5618	7.113 8406	39 7436	- 4391	7.113 7806
61	25.583 4144	280 3704	- 1 5277	7.153 1450	39 3044	- 4271	7.153 0840
62	25.862 2569	278 8425	- 1 4950	7.192 0221	38 8772	- 4157	7.191 9601
63	26.139 6041	277 3473 275 8836	- 1 4634	7.230 4835	38 4613 38 0565	- 4048	7.230 4205
64	26.415 4878		- 1 4330	7.268 5400		- 3943	7.268 4760
65	26.689 9382	274 4504	- 1 4037	7.306 2021	37 6621	- 3842	7.306 1371
66	26.962 9847	273 0465	- 1 3754	7.343 4799	37 2778	- 3746	7.343 4139
67	27.234 6557	271 6710	- 1 3481	7.380 3830	36 9031	- 3653	7.380 3160
68	27.504 9784	270 3227 269 0008	- 1 3217	7.416 9207	36 5377 36 1813	- 3564	7.416 8527
69	27.773 9791		- 1 2963	7.453 1020		- 3478	7.453 0330
70	28.041 6834	267 7043	- 1 2716	7.488 9354	35 8334	- 3396	7.488 8654
71	28.308 1160	266 4325	- 1 2478	7.524 4291	35 4937	- 3317	7.524 3581
72	28.573 3006	265 1846	- 1 2248	7.559 5911	35 1620	- 3240	7.559 5191
73	28.837 2603	263 9597 262 7571	- 1 2024	7.594 4290	34 8379 34 5212	- 3167	7.594 3560
74	29.100 0174		- 1 1808	7.628 9502		- 3096	7.628 8762

Ellipse:  $n=3$

$$10^{-n}u = U = E - \sin E$$

$$10^{-n}c_e = C_e(U) = 1 - \cos E$$

$$10^{-n}s_e = S_e(U) = \sin E$$

$$10^{-n}x_e = X_e(U) = E$$

$u$	$c_e$	$\delta$	$\delta^{2'}$	$s_e$	$\delta$	$\delta^{2'}$	$x_e$
74	29.099 8480			7.628 8170			7.628 8910
76	29.621 8342	521 9862	- 4 7226		68 1168	-1 2379	
78	30.139 2609	517 4267	- 4 5577	7.696 9339	66 9320	-1 1842	7.697 0099
80	30.652 2833	513 0225	- 4 4026	7.763 8659	65 7974	-1 1340	7.763 9439
82	31.161 0478	508 7645	- 4 2565	7.829 6633	64 7097	-1 0872	7.829 7433
		504 6444	- 4 1186	7.894 3730	63 6658	-1 0433	7.894 4550
84	31.665 6923			7.958 0388			7.958 1228
86	32.166 3469	500 6547	- 3 9885	8.020 7019	62 6631	-1 0023	
88	32.663 1351	496 7882	- 3 8653	8.082 4008	61 6989	- 9637	8.020 7879
90	33.156 1736	493 0384	- 3 7486	8.143 1718	60 7710	- 9275	8.082 4888
92	33.645 5729	489 3994	- 3 6380	8.203 0491	59 8772	- 8934	8.143 2618
		485 8655	- 3 5330		59 0156	- 8613	8.203 1411
94	34.131 4384			8.262 0646			8.262 1586
96	34.613 8699	482 4315	- 3 4331	8.320 2489	58 1843	- 8310	
98	35.092 9624	479 0925	- 3 3381	8.377 6305	57 3816	- 8023	8.320 3449
100	35.568 8065	475 8441	- 3 2476	8.434 2367	56 6061	- 7752	8.377 7285
102	36.041 4886	472 6821	- 3 1613	8.490 0929	55 8563	- 7496	8.434 3367
		469 6025	- 3 0790		55 1308	- 7253	8.490 1949
104	36.511 0911			8.545 2238			8.545 3278
106	36.977 6927	466 6016	- 3 0003	8.599 6522	54 4284	- 7022	
108	37.441 3686	463 6759	- 2 9250	8.653 4002	53 7480	- 6802	8.599 7582
110	37.902 1910	460 8223	- 2 8531	8.706 4887	53 0885	- 6594	8.653 5082
112	38.360 2286	458 0377	- 2 7841	8.758 9375	52 4488	- 6395	8.706 5987
		455 3192	- 2 7180		51 8280	- 6206	8.758 9375
114	38.815 5478	452 6640	- 2 6546	8.810 7655	51 2253	- 6026	8.810 8795
116	39.268 2118	450 0698	- 2 5938	8.861 9908	50 6398	- 5853	8.862 1068
118	39.718 2817	447 5340	- 2 5354	8.912 6307	50 0708	- 5689	8.912 7487
120	40.165 8157	445 0544	- 2 4792	8.962 7015	49 5175	- 5532	8.962 8215
122	40.610 8701	442 6289	- 2 4251	9.012 2190	48 9792	- 5382	9.012 3410
124	41.053 4990			9.061 1982			9.061 3222
126	41.493 7545	440 2554	- 2 3731	9.109 6535	48 4553	- 5238	
128	41.931 6865	437 9320	- 2 3231	9.157 5987	47 9452	- 5100	9.109 7795
130	42.367 3434	435 6569	- 2 2748	9.205 0471	47 4483	- 4968	9.157 7267
132	42.800 7717	433 4284	- 2 2283	9.252 0112	46 9641	- 4841	9.205 1771
		431 2447	- 2 1834		46 4921	- 4720	9.252 1432
134	43.232 0165			9.298 5033			9.298 6373
136	43.661 1209	429 1044	- 2 1400	9.344 5351	46 0317	- 4603	
138	44.088 1268	427 0060	- 2 0982	9.390 1177	45 5826	- 4490	9.344 6711
140	44.513 0748	424 9480	- 2 0577	9.435 2620	45 1443	- 4383	9.390 2557
142	44.936 0040	422 9291	- 2 0186	9.479 9783	44 7163	- 4279	9.435 4020
		420 9481	- 1 9808		44 2984	- 4179	9.480 1203
144	45.356 9521			9.524 2767			9.524 4207
146	45.775 9557	419 0037	- 1 9442	9.568 1668	43 8901	- 4082	
148	46.193 0504	417 0947	- 1 9088	9.611 6579	43 4911	- 3990	9.568 3128
150	46.608 2704	415 2200	- 1 8745	9.654 7588	43 1010	- 3900	9.611 8059
			- 1 8412			- 3814	9.654 9088

Hyperbola:  $n=3$

$$10^{-3n}u = U = \sinh F - F$$

$$10^{-2n}c_h = C_h(U) = \cosh F - 1$$

$$10^{-n}s_h = S_h(U) = \sinh F$$

$$10^{-n}x_h = X_h(U) = F$$

$u$	$c_h$	$\delta$	$\delta^2$	$s_h$	$\delta$	$\delta^2$	$x_h$
74	29.100 0174	521 9923	- 4 7225	7.628 9502	68 1204	-1 2379	7.628 8762
76	29.622 0097	517 4329	- 4 5576	7.697 0707	66 9356	-1 1842	7.696 9947
78	30.139 4425	513 0287	- 4 4025	7.764 0063	65 8010	-1 1340	7.763 9283
80	30.652 4713	508 7708	- 4 2564	7.829 8073	64 7133	-1 0872	7.829 7273
82	31.161 2420	504 6508	- 4 1186	7.894 5206	63 6694	-1 0433	7.894 4386
84	31.665 8928	500 6611	- 3 9884	7.958 1900	62 6667	-1 0023	7.958 1060
86	32.166 5539	496 7946	- 3 8652	8.020 8567	61 7025	- 9637	8.020 7707
88	32.663 3485	493 0449	- 3 7486	8.082 5592	60 7746	- 9275	8.082 4712
90	33.156 3934	489 4059	- 3 6380	8.143 3338	59 8808	- 8934	8.143 2438
92	33.645 7994	485 8721	- 3 5329	8.203 2147	59 0192	- 8613	8.203 1227
94	34.131 6714	482 4381	- 3 4331	8.262 2338	58 1879	- 8310	8.262 1398
96	34.614 1095	479 0992	- 3 3381	8.320 4217	57 3852	- 8023	8.320 3257
98	35.093 2087	475 8509	- 3 2476	8.377 8069	56 6097	- 7752	8.377 7089
100	35.569 0596	472 6889	- 3 1613	8.434 4167	55 8599	- 7496	8.434 3167
102	36.041 7484	469 6093	- 3 0789	8.490 2765	55 1344	- 7253	8.490 1745
104	36.511 3577	466 6084	- 3 0002	8.545 4110	54 4320	- 7022	8.545 3070
106	36.977 9662	463 6828	- 2 9250	8.599 8430	53 7516	- 6802	8.599 7370
108	37.441 6490	460 8293	- 2 8530	8.653 5946	53 0921	- 6594	8.653 4866
110	37.902 4783	458 0447	- 2 7841	8.706 6867	52 4524	- 6395	8.706 5767
112	38.360 5229	455 3262	- 2 7180	8.759 1391	51 8316	- 6206	8.759 0271
114	38.815 8491	452 6711	- 2 6546	8.810 9707	51 2289	- 6026	8.810 8567
116	39.268 5203	450 0769	- 2 5938	8.862 1996	50 6434	- 5853	8.862 0836
118	39.718 5972	447 5412	- 2 5353	8.912 8431	50 0744	- 5689	8.912 7251
120	40.166 1383	445 0616	- 2 4791	8.962 9175	49 5211	- 5532	8.962 7975
122	40.611 2000	442 6361	- 2 4251	9.012 4386	48 9828	- 5382	9.012 3166
124	41.053 8361	440 2627	- 2 3731	9.061 4214	48 4589	- 5238	9.061 2974
126	41.494 0988	437 9393	- 2 3230	9.109 8803	47 9488	- 5100	9.109 7543
128	41.932 0381	435 6643	- 2 2747	9.157 8291	47 4519	- 4968	9.157 7011
130	42.367 7024	433 4357	- 2 2282	9.205 2811	46 9677	- 4841	9.205 1511
132	42.801 1381	431 2521	- 2 1833	9.252 2488	46 4957	- 4720	9.252 1168
134	43.232 3903	429 1119	- 2 1400	9.298 7445	46 0353	- 4603	9.298 6105
136	43.661 5021	427 0135	- 2 0981	9.344 7799	45 5862	- 4490	9.344 6439
138	44.088 5156	424 9555	- 2 0577	9.390 3661	45 1479	- 4383	9.390 2281
140	44.513 4711	422 9357	- 2 0186	9.435 5140	44 7199	- 4279	9.435 3740
142	44.936 4078	420 9557	- 1 9808	9.480 2339	44 3020	- 4179	9.480 0919
144	45.357 3635	419 0113	- 1 9442	9.524 5359	43 8937	- 4082	9.524 3919
146	45.776 3748	417 1023	- 1 9088	9.568 4296	43 4947	- 3990	9.568 2836
148	46.193 4771	415 2277	- 1 8744	9.611 9243	43 1046	- 3900	9.611 7763
150	46.608 7048		- 1 8412	9.655 0288		- 3814	9.654 8788

Ellipse:  $n=2$

$$10^{-3n}u = U = E - \sin E$$

$$10^{-2n}c_e = C_e(U) = 1 - \cos E$$

$$10^{-n}s_e = S_e(U) = \sin E$$

$$10^{-n}x_e = X_e(U) = E$$

$u$	$c_e$	$\delta$	$\delta''$	$s_e$	$\delta$	$\delta''$	$x_e$
0.150	0.466 08270		- 11504	0.965 47588		- 23827	0.965 49088
0.155	0.476 38334	10 30064	- 11012	0.976 08606	10 61017	- 22561	0.976 10156
0.160	0.486 57379	10 19045	- 10556	0.986 47043	10 38437	- 21399	0.986 48643
0.165	0.496 65862	10 08483	- 10132	0.996 64064	10 17021	- 20329	0.996 65714
0.170	0.506 64207	9 98345	- 9737	1.006 60741	9 96677	- 19343	1.006 62441
		9 88604			9 77320		
0.175	0.516 52811		- 9368	1.016 38061		- 18431	1.016 39811
0.180	0.526 32042	9 79231	- 9023	1.025 96937	9 58876	- 17586	1.025 98737
0.185	0.536 02247	9 70205	- 8699	1.035 38216	9 41279	- 16802	1.035 40066
0.190	0.545 63749	9 61502	- 8395	1.044 62683	9 24467	- 16071	1.044 64583
0.195	0.555 16852	9 53103	- 8110	1.053 71069	9 08387	- 15391	1.053 73019
		9 44991			8 92988		
0.200	0.564 61843		- 7841	1.062 64057		- 14755	1.062 66057
0.205	0.573 98990	9 37147	- 7587	1.071 42282	8 78225	- 14160	1.071 44332
0.210	0.583 28548	9 29558	- 7347	1.080 06340	8 64058	- 13603	1.080 08440
0.215	0.592 50757	9 22209	- 7120	1.088 56788	8 50449	- 13080	1.088 58938
0.220	0.601 65844	9 15087	- 6905	1.096 94151	8 37363	- 12588	1.096 96351
		9 08180			8 24769		
0.225	0.610 74023		- 6701	1.105 18920		- 12126	1.105 21170
0.230	0.619 75500	9 01476	- 6508	1.113 31558	8 12638	- 11690	1.113 33858
0.235	0.628 70466	8 94967	- 6324	1.121 32502	8 00944	- 11278	1.121 34852
0.240	0.637 59108	8 88641	- 6149	1.129 22163	7 89661	- 10889	1.129 24563
0.245	0.646 41598	8 82491	- 5982	1.137 00932	7 78768	- 10522	1.137 03382
		8 76507			7 68243		
0.250	0.655 18106		- 5823	1.144 69174		- 10173	1.144 71674
0.255	0.663 88788	8 70683	- 5672	1.152 27240	7 58066	- 9843	1.152 29790
0.260	0.672 53798	8 65010	- 5527	1.159 75460	7 48220	- 9530	1.159 78060
0.265	0.681 13280	8 59482	- 5388	1.167 14147	7 38687	- 9232	1.167 16797
0.270	0.689 67373	8 54093	- 5255	1.174 43599	7 29452	- 8949	1.174 46299
		8 48837			7 20501		
0.275	0.698 16210		- 5128	1.181 64100		- 8679	1.181 66850
0.280	0.706 59917	8 43707	- 5007	1.188 75919	7 11819	- 8423	1.188 78719
0.285	0.714 98617	8 38700	- 4890	1.195 79313	7 03394	- 8178	1.195 82163
0.290	0.723 32426	8 33809	- 4778	1.202 74527	6 95214	- 7944	1.202 77427
0.295	0.731 61456	8 29030	- 4670	1.209 61795	6 87268	- 7721	1.209 64745
		8 24359			6 79545		
0.300	0.739 85815		- 4567	1.216 41340		- 7508	1.216 44340
0.305	0.748 05607	8 19792	- 4467	1.223 13375	6 72035	- 7304	1.223 16425
0.310	0.756 20930	8 15324	- 4371	1.229 78105	6 64730	- 7109	1.229 81205
0.315	0.764 31882	8 10952	- 4279	1.236 35724	6 57619	- 6922	1.236 38874
0.320	0.772 38554	8 06672	- 4190	1.242 86420	6 50696	- 6742	1.242 89620
		8 02481			6 43953		
0.325	0.780 41035		- 4105	1.249 30373		- 6570	1.249 33623
0.330	0.788 39412	7 98376	- 4022	1.255 67754	6 37381	- 6405	1.255 71054
0.335	0.796 33765	7 94354	- 3942	1.261 98728	6 30974	- 6247	1.262 02078
0.340	0.804 24177	7 90411	- 3865	1.268 23454	6 24726	- 6094	1.268 26854

Hyperbola:  $n=2$

$$10^{-2n}u = U = \sinh F - F$$

$$10^{-2n}c_h = C_h(U) = \cosh F - 1$$

$$10^{-n}s_h = S_h(U) = \sinh F$$

$$10^{-n}x_h = X_h(U) = F$$

$u$	$c_h$	$\delta$	$\delta^2$	$s_h$	$\delta$	$\delta^2$	$x_h$
0.150	0.466 08705	10 30083	- 11504	0.965 50288	10 61107	- 23827	0.965 48788
0.155	0.476 38788	10 19065	- 11012	0.976 11396	10 38527	- 22561	0.976 09846
0.160	0.486 57853	10 08503	- 10556	0.986 49923	10 17111	- 21399	0.986 48323
0.165	0.496 66355	9 98365	- 10132	0.996 67034	9 96767	- 20329	0.996 65384
0.170	0.506 64721	9 88624	- 9737	1.006 63801	9 77410	- 19343	1.006 62101
0.175	0.516 53345	9 79252	- 9368	1.016 41211	9 58966	- 18431	1.016 39461
0.180	0.526 32596	9 70225	- 9022	1.026 00177	9 41369	- 17586	1.025 98377
0.185	0.536 02822	9 61523	- 8699	1.035 41546	9 24557	- 16802	1.035 39696
0.190	0.545 64344	9 53124	- 8395	1.044 66103	9 08477	- 16071	1.044 64203
0.195	0.555 17469	9 45012	- 8109	1.053 74579	8 93078	- 15391	1.053 72629
0.200	0.564 62481	9 37169	- 7840	1.062 67657	8 78315	- 14755	1.062 65657
0.205	0.573 99649	9 29580	- 7587	1.071 45972	8 64148	- 14160	1.071 43922
0.210	0.583 29229	9 22231	- 7347	1.080 10120	8 50539	- 13603	1.080 80200
0.215	0.592 51459	9 15109	- 7120	1.088 60658	8 37453	- 13080	1.088 58508
0.220	0.601 66568	9 08202	- 6905	1.096 98111	8 24859	- 12588	1.096 95911
0.225	0.610 74769	9 01499	- 6701	1.105 22970	8 12728	- 12126	1.105 20720
0.230	0.619 76268	8 94989	- 6508	1.113 35698	8 01034	- 11690	1.113 33398
0.235	0.628 71257	8 88664	- 6324	1.121 36732	7 89751	- 11278	1.121 34382
0.240	0.637 59921	8 82513	- 6149	1.129 26483	7 78858	- 10889	1.129 24083
0.245	0.646 42434	8 76530	- 5982	1.137 05342	7 68333	- 10522	1.137 02892
0.250	0.655 18964	8 70706	- 5823	1.144 73674	7 58156	- 10173	1.144 71174
0.255	0.663 89670	8 65033	- 5671	1.152 31830	7 48310	- 9843	1.152 29280
0.260	0.672 54703	8 59505	- 5526	1.159 80140	7 38777	- 9530	1.159 77540
0.265	0.681 14208	8 54116	- 5388	1.167 18917	7 29542	- 9232	1.167 16267
0.270	0.689 68325	8 48860	- 5255	1.174 48459	7 20591	- 8949	1.174 45759
0.275	0.698 17185	8 43731	- 5128	1.181 69050	7 11909	- 8679	1.181 66300
0.280	0.706 60916	8 38723	- 5007	1.188 80959	7 03484	- 8423	1.188 78159
0.285	0.714 99639	8 33833	- 4890	1.195 84443	6 95304	- 8178	1.195 81593
0.290	0.723 33472	8 29054	- 4778	1.202 79747	6 87358	- 7944	1.202 76847
0.295	0.731 62526	8 24383	- 4670	1.209 67105	6 79635	- 7721	1.209 64155
0.300	0.739 86910	8 19816	- 4567	1.216 46740	6 72125	- 7508	1.216 43740
0.305	0.748 06726	8 15348	- 4467	1.223 18865	6 64820	- 7304	1.223 15815
0.310	0.756 22074	8 10976	- 4371	1.229 83685	6 57709	- 7109	1.229 80585
0.315	0.764 33051	8 06697	- 4279	1.236 41394	6 50786	- 6922	1.236 38244
0.320	0.772 39747	8 02506	- 4190	1.242 92180	6 44043	- 6742	1.242 88980
0.325	0.780 42253	7 98401	- 4104	1.249 36223	6 37471	- 6570	1.249 32973
0.330	0.788 40655	7 94379	- 4022	1.255 73694	6 31064	- 6405	1.255 70394
0.335	0.796 35034	7 90437	- 3942	1.262 04758	6 24816	- 6247	1.262 01408
0.340	0.804 25470		- 3865	1.268 29574		- 6094	1.268 26174

Ellipse:  $n=2$

$$10^{-3}u = U = E - \sin E$$

$$10^{-2}c_e = C_e(U) = 1 - \cos E$$

$$10^{-n}s_e = S_e(U) = \sin E$$

$$10^{-n}x_e = X_e(U) = E$$

$u$	$c_e$	$\delta$	$\delta^2$	$s_e$	$\delta$	$\delta^2$	$x_e$
0.34	0.804 24177		- 15456	1.268 23454		- 24371	1.268 26854
0.35	0.819 93478	15 69301	- 14871	1.280 54767	12 31312	- 23222	1.280 58267
0.36	0.835 47901	15 54423	- 14323	1.292 62841	12 08075	- 22157	1.292 66441
0.37	0.850 87995	15 40094	- 13809	1.304 48745	11 85904	- 21169	1.304 52445
0.38	0.866 14275	15 26280	- 13327	1.316 13467	11 64722	- 20249	1.316 17267
		15 12947			11 44462		
0.39	0.881 27222		- 12873	1.327 57929		- 19391	1.327 61829
0.40	0.896 27292	15 00069	- 12446	1.338 82990	11 25061	- 18590	1.338 86990
0.41	0.911 14910	14 87619	- 12043	1.349 89451	11 06461	- 17841	1.349 93551
0.42	0.925 90482	14 75571	- 11662	1.360 78062	10 88611	- 17139	1.360 82262
0.43	0.940 54387	14 63905	- 11302	1.371 49527	10 71465	- 16480	1.371 53827
		14 52599			10 54978		
0.44	0.955 06986		- 10961	1.382 04505		- 15860	1.382 08905
0.45	0.969 48621	14 41635	- 10638	1.392 43615	10 39110	- 15278	1.392 48115
0.46	0.983 79615	14 30994	- 10331	1.402 67442	10 23827	- 14728	1.402 72042
0.47	0.998 00276	14 20661	- 10039	1.412 76534	10 09093	- 14210	1.412 81234
0.48	1.012 10895	14 10619	- 9761	1.422 71412	9 94878	- 13720	1.422 76212
		14 00856			9 81153		
0.49	1.026 11752		- 9496	1.432 52565		- 13257	1.432 57465
0.50	1.040 03109	13 91358	- 9244	1.442 20457	9 67892	- 12818	1.442 25457
0.51	1.053 85221	13 82112	- 9003	1.451 75527	9 55070	- 12402	1.451 80627
0.52	1.067 58328	13 73107	- 8773	1.461 18191	9 42664	- 12007	1.461 23391
0.53	1.081 22660	13 64332	- 8553	1.470 48846	9 30654	- 11632	1.470 54146
		13 55777			9 19019		
0.54	1.094 78437		- 8343	1.479 67864		- 11275	1.479 73264
0.55	1.108 25870	13 47433	- 8141	1.488 75605	9 07741	- 10935	1.488 81105
0.56	1.121 65161	13 39291	- 7948	1.497 72408	8 96802	- 10612	1.497 78008
0.57	1.134 96503	13 31342	- 7762	1.506 58595	8 86188	- 10304	1.506 64295
0.58	1.148 20081	13 23578	- 7584	1.515 34477	8 75882	- 10009	1.515 40277
		13 15992			8 65870		
0.59	1.161 36073		- 7414	1.524 00347		- 9728	1.524 06247
0.60	1.174 44650	13 08577	- 7249	1.532 56486	8 56140	- 9459	1.532 62486
0.61	1.187 45977	13 01327	- 7091	1.541 03164	8 46678	- 9202	1.541 09264
0.62	1.200 40211	12 94234	- 6939	1.549 40638	8 37473	- 8956	1.549 46838
0.63	1.213 27505	12 87294	- 6793	1.557 69153	8 28515	- 8721	1.557 75453
		12 80500			8 19793		
0.64	1.226 08006		- 6652	1.565 88946		- 8495	1.565 95346
0.65	1.238 81854	12 73848	- 6516	1.574 00242	8 11296	- 8278	1.574 06742
0.66	1.251 49185	12 67331	- 6384	1.582 03258	8 03016	- 8070	1.582 09858
0.67	1.264 10131	12 60946	- 6258	1.589 98202	7 94944	- 7870	1.590 04902
0.68	1.276 64819	12 54688	- 6135	1.597 85275	7 87073	- 7679	1.597 92075
		12 48552			7 79393		
0.69	1.289 13371		- 6017	1.605 64667		- 7494	1.605 71567
0.70	1.301 55906	12 42534	- 5903	1.613 36565	7 71897	- 7316	1.613 43565
0.71	1.313 92537	12 36631	- 5792	1.621 01144	7 64580	- 7146	1.621 08244
0.72	1.326 23375	12 30838	- 5685	1.628 58577	7 57433	- 6981	1.628 65777
0.73	1.338 48528	12 25153	- 5581	1.636 09028	7 50451	- 6822	1.636 16328
		12 19571			7 43627		
0.74	1.350 68098		- 5481	1.643 52655		- 6669	1.643 60055

Hyperbola:  $n=2$

$$10^{-3n}u = U = \sinh F - F$$

$$10^{-2n}c_h = C_h(U) = \cosh F - 1$$

$$10^{-n}s_h = S_h(U) = \sinh F$$

$$10^{-n}x_h = X_h(U) = F$$

$u$	$c_h$	$\delta$	$\delta^2$	$s_h$	$\delta$	$\delta^2$	$x_h$
0.34	0.804 25470		- 15456	1.268 29574		- 24371	1.268 26174
0.35	0.819 94822	15 69352	- 14870	1.280 61067	12 31492	- 23222	1.280 57567
0.36	0.835 49297	15 54475	- 14322	1.292 69321	12 08255	- 22157	1.292 65721
0.37	0.850 89443	15 40146	- 13809	1.304 55405	11 86084	- 21169	1.304 51705
0.38	0.866 15775	15 26332	- 13326	1.316 20307	11 64902	- 20249	1.316 16507
		15 13000			11 44642		
0.39	0.881 28776		- 12873	1.327 64949		- 19391	1.327 61049
0.40	0.896 28898	15 00123	- 12446	1.338 90190	11 25241	- 18590	1.338 86190
0.41	0.911 16571	14 87672	- 12043	1.349 96831	11 06641	- 17841	1.349 92731
0.42	0.925 92196	14 75626	- 11662	1.360 85622	10 88791	- 17139	1.360 81422
0.43	0.940 56156	14 63960	- 11302	1.371 57267	10 71645	- 16480	1.371 52967
		14 52654			10 55158		
0.44	0.955 08811		- 10961	1.382 12425		- 15860	1.382 08025
0.45	0.969 50501	14 41690	- 10637	1.392 51715	10 39290	- 15278	1.392 47215
0.46	0.983 81551	14 31050	- 10330	1.402 75722	10 24007	- 14728	1.402 71122
0.47	0.998 02268	14 20717	- 10038	1.412 84994	10 09273	- 14210	1.412 80294
0.48	1.012 12944	14 10676	- 9760	1.422 80052	9 95058	- 13720	1.422 75252
		14 00913			9 81333		
0.49	1.026 13858		- 9496	1.432 61385		- 13257	1.432 56485
0.50	1.040 05273	13 91415	- 9243	1.442 29457	9 68072	- 12818	1.442 24457
0.51	1.053 87443	13 82170	- 9003	1.451 84707	9 55250	- 12402	1.451 79607
0.52	1.067 60608	13 73165	- 8773	1.461 27551	9 42844	- 12007	1.461 22351
0.53	1.081 24998	13 64391	- 8553	1.470 58386	9 30834	- 11632	1.470 53086
		13 55836			9 19199		
0.54	1.094 80834		- 8342	1.479 77584		- 11275	1.479 72184
0.55	1.108 28327	13 47493	- 8141	1.488 85505	9 07921	- 10935	1.488 80005
0.56	1.121 67677	13 39350	- 7947	1.497 82488	8 96982	- 10612	1.497 76888
0.57	1.134 99079	13 31402	- 7762	1.506 68855	8 86368	- 10304	1.506 63155
0.58	1.148 22717	13 23638	- 7584	1.515 44917	8 76062	- 10009	1.515 39117
		13 16053			8 66050		
0.59	1.161 38770		- 7413	1.524 10967		- 9728	1.524 05067
0.60	1.174 47409	13 08638	- 7249	1.532 67286	8 56320	- 9459	1.532 61286
0.61	1.187 48797	13 01388	- 7091	1.541 14144	8 46858	- 9202	1.541 08044
0.62	1.200 43093	12 94296	- 6939	1.549 51798	8 37653	- 8956	1.549 45598
0.63	1.213 30450	12 87356	- 6792	1.557 80493	8 28695	- 8721	1.557 74193
		12 80563			8 19973		
0.64	1.226 11012		- 6651	1.566 00466		- 8495	1.565 94066
0.65	1.238 84923	12 73911	- 6515	1.574 11942	8 11476	- 8278	1.574 05442
0.66	1.251 52318	12 67395	- 6384	1.582 15138	8 03196	- 8070	1.582 08538
0.67	1.264 13327	12 61010	- 6257	1.590 10262	7 95124	- 7870	1.590 03562
0.68	1.276 68079	12 54752	- 6135	1.597 97515	7 87253	- 7679	1.597 90715
		12 48616			7 79573		
0.69	1.289 16695		- 6017	1.605 77087		- 7494	1.605 70187
0.70	1.301 59294	12 42599	- 5902	1.613 49165	7 72077	- 7316	1.613 42165
0.71	1.313 95990	12 36696	- 5792	1.621 13924	7 64760	- 7146	1.621 06824
0.72	1.326 26893	12 30903	- 5685	1.628 71537	7 57613	- 6981	1.628 64337
0.73	1.338 52111	12 25218	- 5581	1.636 22168	7 50631	- 6822	1.636 14868
		12 19636			7 43807		
0.74	1.350 71747		- 5481	1.643 65975		- 6669	1.643 58575

Ellipse:  $n=2$

$$10^{-n}u = U = E - \sin E$$

$$10^{-n}e_x = C_x(U) = 1 - \cos E$$

$$10^{-n}s_x = S_x(U) = \sin E$$

$$10^{-n}x_x = X_x(U) = E$$

$u$	$e_x$	$\delta$	$\delta^2$	$s_x$	$\delta$	$\delta^2$	$x_x$
0.74	1.350 6810	24 2279	- 2192	1.643 5266	14 6739	- 2667	1.643 6006
0.76	1.374 9089	24 0163	- 2116	1.658 2005	14 4187	- 2551	1.658 2765
0.78	1.398 9252	23 8119	- 2044	1.672 6191	14 1742	- 2443	1.672 6971
0.80	1.422 7371	23 6142	- 1976	1.686 7933	13 9399	- 2342	1.686 8733
0.82	1.446 3513	23 4230	- 1912	1.700 7332	13 7150	- 2248	1.700 8152
0.84	1.469 7743	23 2378	- 1851	1.714 4482	13 4989	- 2159	1.714 5322
0.86	1.493 0121	23 0583	- 1794	1.727 9471	13 2912	- 2076	1.728 0331
0.88	1.516 0704	22 8843	- 1740	1.741 2383	13 0913	- 1998	1.741 3263
0.90	1.538 9547	22 7154	- 1689	1.754 3296	12 8987	- 1925	1.754 4196
0.92	1.561 6700	22 5513	- 1640	1.767 2284	12 7131	- 1856	1.767 3204
0.94	1.584 2213	22 3919	- 1594	1.779 9415	12 5340	- 1790	1.780 0355
0.96	1.606 6133	22 2369	- 1549	1.792 4755	12 3611	- 1729	1.792 5715
0.98	1.628 8502	22 0862	- 1507	1.804 8366	12 1940	- 1670	1.804 9346
1.00	1.650 9364	21 9394	- 1467	1.817 0306	12 0325	- 1615	1.817 1306
1.02	1.672 8758	21 7964	- 1429	1.829 0631	11 8762	- 1563	1.829 1651
1.04	1.694 6722	21 6571	- 1393	1.840 9392	11 7248	- 1513	1.841 0432
1.06	1.716 3293	21 5213	- 1358	1.852 6641	11 5782	- 1466	1.852 7701
1.08	1.737 8507	21 3889	- 1324	1.864 2423	11 4362	- 1421	1.864 3503
1.10	1.759 2396	21 2596	- 1292	1.875 6785	11 2983	- 1378	1.875 7885
1.12	1.780 4992	21 1334	- 1262	1.886 9768	11 1646	- 1337	1.887 0888
1.14	1.801 6327	21 0102	- 1232	1.898 1414	11 0348	- 1298	1.898 2554
1.16	1.822 6429	20 8898	- 1204	1.909 1761	10 9086	- 1261	1.909 2921
1.18	1.843 5327	20 7721	- 1177	1.920 0848	10 7860	- 1226	1.920 2028
1.20	1.864 3047	20 6570	- 1151	1.930 8708	10 6668	- 1192	1.930 9908
1.22	1.884 9617	20 5444	- 1126	1.941 5376	10 5508	- 1159	1.941 6596
1.24	1.905 5061	20 4342	- 1102	1.952 0884	10 4380	- 1128	1.952 2124
1.26	1.925 9404	20 3264	- 1078	1.962 5264	10 3281	- 1099	1.962 6524
1.28	1.946 2668	20 2208	- 1056	1.972 8545	10 2210	- 1070	1.972 9825
1.30	1.966 4875	20 1173	- 1034	1.983 0755	10 1167	- 1043	1.983 2055
1.32	1.986 6049	20 0160	- 1013	1.993 1922	10 0150	- 1017	1.993 3242
1.34	2.006 6209	19 9166	- 993	2.003 2072	9 9158	- 992	2.003 3412
1.36	2.026 5375	19 8192	- 974	2.013 1230	9 8191	- 967	2.013 2590
1.38	2.046 3567	19 7237	- 955	2.022 9421	9 7246	- 944	2.023 0801
1.40	2.066 0804	19 6300	- 937	2.032 6667	9 6324	- 922	2.032 8067
1.42	2.085 7104	19 5380	- 919	2.042 2991	9 5424	- 900	2.042 4411
1.44	2.105 2484	19 4478	- 902	2.051 8415	9 4544	- 880	2.051 9855
1.46	2.124 6962	19 3592	- 886	2.061 2960	9 3685	- 860	2.061 4420
1.48	2.144 0554	19 2722	- 870	2.070 6644	9 2844	- 840	2.070 8124
1.50	2.163 3276	19 1868	- 855	2.079 9488	9 2018	- 822	2.080 0988

Hyperbola:  $n=2$

$$10^{-3}u = U = \sinh F - F$$

$$10^{-3}c_h = C_h(U) = \cosh F - 1$$

$$10^{-n} s_h = S_h(U) = \sinh F$$

$$10^{-n} x_h = X_h(U) = F$$

$u$	$c_h$	$\delta$	$\delta^2$	$s_h$	$\delta$	$\delta^2$	$x_h$
0.74	1.350 7175	24 2293	- 2192	1.643 6598	14 6775	- 2667	1.643 5858
0.76	1.374 9467	24 0176	- 2115	1.658 3373	14 4223	- 2551	1.658 2613
0.78	1.398 9644	23 8132	- 2043	1.672 7595	14 1778	- 2443	1.672 6815
0.80	1.422 7776	23 6156	- 1976	1.686 9373	13 9435	- 2342	1.686 8573
0.82	1.446 3931	23 4243	- 1912	1.700 8808	13 7186	- 2248	1.700 7988
0.84	1.469 8175	23 2392	- 1851	1.714 5994	13 5025	- 2159	1.714 5154
0.86	1.493 0567	23 0597	- 1794	1.728 1019	13 2948	- 2076	1.728 0159
0.88	1.516 1164	22 8857	- 1740	1.741 3967	13 0949	- 1998	1.741 3087
0.90	1.539 0020	22 7168	- 1689	1.754 4916	12 9023	- 1925	1.754 4016
0.92	1.561 7188	22 5527	- 1640	1.767 3940	12 7167	- 1856	1.767 3020
0.94	1.584 2715	22 3934	- 1593	1.780 1107	12 5376	- 1790	1.780 0167
0.96	1.606 6649	22 2384	- 1549	1.792 6483	12 3647	- 1729	1.792 5523
0.98	1.628 9033	22 0876	- 1507	1.805 0130	12 1976	- 1670	1.804 9150
1.00	1.650 9909	21 9408	- 1467	1.817 2106	12 0361	- 1615	1.817 1106
1.02	1.672 9317	21 7979	- 1429	1.829 2467	11 8798	- 1563	1.829 1447
1.04	1.694 7296	21 6586	- 1393	1.841 1264	11 7284	- 1513	1.841 0224
1.06	1.716 3883	21 5228	- 1358	1.852 8549	11 5818	- 1466	1.852 7489
1.08	1.737 9111	21 3904	- 1324	1.864 4367	11 4398	- 1421	1.864 3287
1.10	1.759 3015	21 2611	- 1292	1.875 8765	11 3019	- 1378	1.875 7665
1.12	1.780 5626	21 1350	- 1262	1.887 1784	11 1682	- 1337	1.887 0664
1.14	1.801 6976	21 0117	- 1232	1.898 3466	11 0384	- 1298	1.898 2326
1.16	1.822 7093	20 8913	- 1204	1.909 3849	10 9122	- 1261	1.909 2689
1.18	1.843 6006	20 7736	- 1177	1.920 2972	10 7896	- 1226	1.920 1792
1.20	1.864 3743	20 6585	- 1151	1.931 0868	10 6704	- 1192	1.930 9668
1.22	1.885 0328	20 5460	- 1126	1.941 7572	10 5544	- 1159	1.941 6352
1.24	1.905 5788	20 4358	- 1101	1.952 3116	10 4416	- 1128	1.952 1876
1.26	1.926 0146	20 3280	- 1078	1.962 7532	10 3317	- 1099	1.962 6272
1.28	1.946 3425	20 2224	- 1056	1.973 0849	10 2246	- 1070	1.972 9569
1.30	1.966 5649	20 1189	- 1034	1.983 3095	10 1203	- 1043	1.983 1795
1.32	1.986 6838	20 0176	- 1013	1.993 4298	10 0186	- 1017	1.993 2978
1.34	2.006 7014	19 9182	- 993	2.003 4484	9 9194	- 992	2.003 3144
1.36	2.026 6196	19 8208	- 974	2.013 3678	9 8227	- 967	2.013 2318
1.38	2.046 4405	19 7253	- 955	2.023 1905	9 7282	- 944	2.023 0525
1.40	2.066 1658	19 6316	- 937	2.032 9187	9 6360	- 922	2.032 7787
1.42	2.085 7974	19 5397	- 919	2.042 5547	9 5460	- 900	2.042 4127
1.44	2.105 3371	19 4494	- 902	2.052 1007	9 4580	- 880	2.051 9567
1.46	2.124 7865	19 3608	- 886	2.061 5588	9 3721	- 860	2.061 4128
1.48	2.144 1473	19 2738	- 870	2.070 9308	9 2880	- 840	2.070 7828
1.50	2.163 4212		- 855	2.080 2188		- 822	2.080 0688

Ellipse:  $n=2$

$$10^{-3n}u = U = E - \sin E$$

$$10^{-2n}c_e = C_e(U) = 1 - \cos E$$

$$10^{-n} s_e = S_e(U) = \sin E$$

$$10^{-n} x_e = X_e(U) = E$$

$u$	$c_e$	$\delta$	$\delta^2$	$s_e$	$\delta$	$\delta^2$	$x_e$
1.50	2.163 3276	47 8097	- 5340	2.079 9488	22 8554	- 5133	2.080 0988
1.55	2.211 1372	47 2982	- 5112	2.102 8042	22 3689	- 4861	2.102 9592
1.60	2.258 4355	46 8079	- 4900	2.125 1731	21 9075	- 4610	2.125 3331
1.65	2.305 2434	46 3374	- 4703	2.147 0807	21 4692	- 4380	2.147 2457
1.70	2.351 5808	45 8852	- 4520	2.168 5499	21 0522	- 4167	2.168 7199
1.75	2.397 4660	45 4502	- 4348	2.189 6021	20 6548	- 3971	2.189 7771
1.80	2.442 9162	45 0312	- 4188	2.210 2569	20 2757	- 3789	2.210 4369
1.85	2.487 9473	44 6272	- 4038	2.230 5326	19 9135	- 3620	2.230 7176
1.90	2.532 5746	44 2374	- 3897	2.250 4461	19 5671	- 3462	2.250 6361
1.95	2.576 8119	43 8608	- 3764	2.270 0132	19 2353	- 3316	2.270 2082
2.00	2.620 6727	43 4967	- 3639	2.289 2485	18 9173	- 3179	2.289 4485
2.05	2.664 1694	43 1444	- 3522	2.308 1657	18 6120	- 3051	2.308 3707
2.10	2.707 3139	42 8033	- 3410	2.326 7778	18 3188	- 2931	2.326 9878
2.15	2.750 1172	42 4727	- 3305	2.345 0966	18 0369	- 2818	2.345 3116
2.20	2.792 5899	42 1521	- 3205	2.363 1335	17 7656	- 2712	2.363 3535
2.25	2.834 7420	41 8409	- 3111	2.380 8991	17 5042	- 2612	2.381 1241
2.30	2.876 5829	41 5388	- 3021	2.398 4033	17 2523	- 2518	2.398 6333
2.35	2.918 1217	41 2452	- 2935	2.415 6556	17 0092	- 2430	2.415 8906
2.40	2.959 3669	40 9597	- 2854	2.432 6648	16 7745	- 2346	2.432 9048
2.45	3.000 3266	40 6819	- 2777	2.449 4393	16 5478	- 2267	2.449 6843
2.50	3.041 0085	40 4116	- 2703	2.465 9871	16 3285	- 2192	2.466 2371
2.55	3.081 4201	40 1482	- 2633	2.482 3156	16 1164	- 2121	2.482 5706
2.60	3.121 5683	39 8917	- 2565	2.498 4320	15 9110	- 2053	2.498 6920
2.65	3.161 4600	39 6415	- 2501	2.514 3430	15 7120	- 1989	2.514 6080
2.70	3.201 1015	39 3975	- 2439	2.530 0550	15 5192	- 1928	2.530 3250
2.75	3.240 4990	39 1594	- 2381	2.545 5742	15 3321	- 1870	2.545 8492
2.80	3.279 6584	38 9270	- 2324	2.560 9063	15 1506	- 1815	2.561 1863
2.85	3.318 5854	38 6999	- 2270	2.576 0570	14 9744	- 1762	2.576 3420
2.90	3.357 2853	38 4781	- 2218	2.591 0314	14 8032	- 1712	2.591 3214
2.95	3.395 7635	38 2613	- 2168	2.605 8346	14 6368	- 1663	2.606 1296
3.00	3.434 0248	38 0493	- 2120	2.620 4714	14 4750	- 1618	2.620 7714
3.05	3.472 0741	37 8419	- 2074	2.634 9464	14 3176	- 1574	2.635 2514
3.10	3.509 9160	37 6390	- 2029	2.649 2641	14 1644	- 1532	2.649 5741
3.15	3.547 5550	37 4403	- 1986	2.663 4285	14 0153	- 1491	2.663 7435
3.20	3.584 9953	37 2458	- 1945	2.677 4438	13 8700	- 1453	2.677 7638
3.25	3.622 2410	37 0552	- 1905	2.691 3138	13 7284	- 1416	2.691 6388
3.30	3.659 2963	36 8685	- 1867	2.705 0422	13 5904	- 1380	2.705 3722
3.35	3.696 1648	36 6855	- 1830	2.718 6326	13 4558	- 1346	2.718 9676
3.40	3.732 8503	36 5058	- 1794	2.732 0884	13 3246	- 1313	2.732 4284

Hyperbola:  $n=2$

$$10^{-3}u = U = \sinh F - F$$

$$10^{-2}c_h = C_h(U) = \cosh F - 1$$

$$10^{-n} s_h = S_h(U) = \sinh F$$

$$10^{-n} x_h = X_h(U) = F$$

$u$	$c_h$	$\delta$	$\delta^{**}$	$s_h$	$\delta$	$\delta^{**}$	$x_h$
1.50	2.163 4212		- 5340	2.080 2188		- 5133	2.080 0688
1.55	2.211 2350	47 8139	- 5111	2.103 0832	22 8644	- 4851	2.102 9282
1.60	2.258 5375	47 3024	- 4900	2.125 4611	22 3779	- 4610	2.125 3011
1.65	2.305 3497	46 8122	- 4703	2.147 3777	21 9165	- 4380	2.147 2127
1.70	2.351 6914	46 3417	- 4519	2.168 8559	21 4782	- 4167	2.168 6859
		45 8896			21 0612		
1.75	2.397 5810		- 4348	2.189 9171		- 3971	2.189 7421
1.80	2.443 0355	45 4546	- 4188	2.210 5809	20 6638	- 3789	2.210 4009
1.85	2.488 0711	45 0356	- 4038	2.230 8656	20 2847	- 3620	2.230 6806
1.90	2.532 7028	44 6317	- 3897	2.250 7881	19 9225	- 3462	2.250 5981
1.95	2.576 9447	44 2419	- 3764	2.270 3642	19 5761	- 3316	2.270 1692
		43 8654			19 2443		
2.00	2.620 8101		- 3639	2.289 6085		- 3179	2.289 4085
2.05	2.664 3114	43 5013	- 3521	2.308 5347	18 9263	- 3051	2.308 3297
2.10	2.707 4605	43 1491	- 3410	2.327 1558	18 6210	- 2931	2.326 9458
2.15	2.750 2685	42 8080	- 3305	2.345 4836	18 3278	- 2818	2.345 2686
2.20	2.792 7459	42 4774	- 3205	2.363 5295	18 0459	- 2712	2.363 3095
		42 1568			17 7746		
2.25	2.834 9027		- 3110	2.381 3041		- 2612	2.381 0791
2.30	2.876 7485	41 8457	- 3020	2.398 8173	17 5132	- 2518	2.398 5873
2.35	2.918 2921	41 5436	- 2935	2.416 0786	17 2613	- 2430	2.415 8436
2.40	2.959 5421	41 2500	- 2854	2.433 0968	17 0182	- 2346	2.432 8568
2.45	3.000 5066	40 9646	- 2776	2.449 8803	16 7835	- 2267	2.449 6353
		40 6868			16 5568		
2.50	3.041 1935		- 2703	2.466 4371		- 2192	2.466 1871
2.55	3.081 6100	40 4165	- 2632	2.482 7746	16 3375	- 2121	2.482 5196
2.60	3.121 7632	40 1532	- 2565	2.498 9000	16 1254	- 2053	2.498 6400
2.65	3.161 6599	39 8967	- 2501	2.514 8200	15 9200	- 1989	2.514 5550
2.70	3.201 3064	39 6466	- 2439	2.530 5410	15 7210	- 1928	2.530 2710
		39 4026			15 5282		
2.75	3.240 7090		- 2380	2.546 0692		- 1870	2.545 7942
2.80	3.279 8736	39 1645	- 2324	2.561 4103	15 3411	- 1815	2.561 1303
2.85	3.318 8057	38 9321	- 2270	2.576 5700	15 1596	- 1762	2.576 2850
2.90	3.357 5108	38 7051	- 2218	2.591 5534	14 9834	- 1712	2.591 2634
2.95	3.395 9941	38 4833	- 2168	2.606 3656	14 8122	- 1663	2.606 0706
		38 2665			14 6458		
3.00	3.434 2607		- 2120	2.621 0114		- 1618	2.620 7114
3.05	3.472 3152	38 0546	- 2073	2.635 4954	14 4840	- 1574	2.635 1904
3.10	3.510 1624	37 8472	- 2029	2.649 8221	14 3266	- 1532	2.649 5121
3.15	3.547 8067	37 6443	- 1986	2.663 9955	14 1734	- 1491	2.663 6805
3.20	3.585 2523	37 4456	- 1945	2.678 0198	14 0243	- 1453	2.677 6998
		37 2511			13 8790		
3.25	3.622 5035		- 1905	2.691 8988		- 1416	2.691 5738
3.30	3.659 5641	37 0606	- 1867	2.705 6362	13 7374	- 1380	2.705 3062
3.35	3.696 4380	36 8739	- 1830	2.719 2356	13 5994	- 1346	2.718 9006
3.40	3.733 1290	36 6910	- 1794	2.732 7004	13 4648	- 1313	2.732 3604

Ellipse:  $n=2$

$$10^{-3}u = U = E - \sin E$$

$$10^{-2}c_e = C_e(U) = 1 - \cos E$$

$$10^{-n}s_e = S_e(U) = \sin E$$

$$10^{-n}x_e = X_e(U) = E$$

$u$	$c_e$	$\delta$	$\delta^{2'}$	$s_e$	$\delta$	$\delta^{2'}$	$x_e$
3.4	3.732 8503		- 7175	2.732 0884		- 5251	2.732 4284
3.5	3.805 6865	72 8362	- 6903	2.758 6092	26 5208	- 5003	2.758 9592
3.6	3.877 8321	72 1456	- 6648	2.784 6293	26 0201	- 4774	2.784 9893
3.7	3.949 3125	71 4805	- 6410	2.810 1718	25 5425	- 4561	2.810 5418
3.8	4.020 1517	70 8392	- 6186	2.835 2579	25 0861	- 4362	2.835 6379
		70 2203			24 6496		
3.9	4.090 3720		- 5976	2.859 9075		- 4178	2.860 2975
4.0	4.159 9946	69 6225	- 5777	2.884 1391	24 2316	- 4005	2.884 5391
4.1	4.229 0392	69 0446	- 5590	2.907 9701	23 8309	- 3844	2.908 3801
4.2	4.297 5245	68 4854	- 5414	2.931 4164	23 4464	- 3692	2.931 8364
4.3	4.365 4684	67 9438	- 5246	2.954 4934	23 0769	- 3550	2.954 9234
		67 4190			22 7217		
4.4	4.432 8874		- 5088	2.977 2151		- 3417	2.977 6551
4.5	4.499 7975	66 9101	- 4938	2.999 5950	22 3799	- 3291	3.000 0450
4.6	4.566 2136	66 4161	- 4795	3.021 6456	22 0506	- 3173	3.022 1056
4.7	4.632 1501	65 9365	- 4660	3.043 3788	21 7332	- 3061	3.043 8488
4.8	4.697 6205	65 4704	- 4531	3.064 8057	21 4269	- 2956	3.065 2857
		65 0172			21 1312		
4.9	4.762 6376		- 4408	3.085 9370		- 2856	3.086 4270
5.0	4.827 2139	64 5762	- 4291	3.106 7825	20 8455	- 2761	3.107 2825
5.1	4.891 3609	64 1471	- 4179	3.127 3518	20 5693	- 2672	3.127 8618
5.2	4.955 0900	63 7290	- 4072	3.147 6538	20 3020	- 2587	3.148 1738
5.3	5.018 4117	63 3217	- 3970	3.167 6971	20 0433	- 2506	3.168 2271
		62 9246			19 7926		
5.4	5.081 3363		- 3873	3.187 4897		- 2429	3.188 0297
5.5	5.143 8736	62 5373	- 3779	3.207 0393	19 5496	- 2356	3.207 5893
5.6	5.206 0329	62 1593	- 3689	3.226 3533	19 3140	- 2286	3.226 9133
5.7	5.267 8233	61 7903	- 3603	3.245 4386	19 0853	- 2220	3.246 0086
5.8	5.329 2532	61 4299	- 3521	3.264 3018	18 8632	- 2156	3.264 8818
		61 0778			18 6475		
5.9	5.390 3310		- 3441	3.282 9493		- 2096	3.283 5393
6.0	5.451 0646	60 7336	- 3365	3.301 3873	18 4379	- 2038	3.301 9873
6.1	5.511 4616	60 3970	- 3292	3.319 6213	18 2341	- 1983	3.320 2313
6.2	5.571 5295	60 0678	- 3221	3.337 6571	18 0358	- 1930	3.338 2771
6.3	5.631 2751	59 7457	- 3153	3.355 4998	17 8428	- 1879	3.356 1298
		59 4303			17 6548		
6.4	5.690 7054		- 3088	3.373 1547		- 1830	3.373 7947
6.5	5.749 8269	59 1215	- 3025	3.390 6264	17 4718	- 1783	3.391 2764
6.6	5.808 6459	58 8190	- 2964	3.407 9198	17 2934	- 1739	3.408 5798
6.7	5.867 1684	58 5226	- 2905	3.425 0393	17 1195	- 1696	3.425 7093
6.8	5.925 4005	58 2321	- 2848	3.441 9892	16 9499	- 1654	3.442 6692
		57 9472			16 7844		
6.9	5.983 3477		- 2793	3.458 7737		- 1615	3.459 4637
7.0	6.041 0156	57 6679	- 2740	3.475 3966	16 6230	- 1576	3.476 0966
7.1	6.098 4095	57 3939	- 2689	3.491 8620	16 4653	- 1539	3.492 5720
7.2	6.155 5344	57 1250	- 2639	3.508 1733	16 3113	- 1504	3.508 8933
7.3	6.212 3955	56 8610	- 2591	3.524 3342	16 1609	- 1470	3.525 0642
		56 6019			16 0139		
7.4	6.268 9974		- 2544	3.540 3481		- 1437	3.541 0881

Hyperbola:  $n=2$

$$10^{-3}u = U = \sinh F - F$$

$$10^{-2}c_h = C_h(U) = \cosh F - 1$$

$$10^{-n} s_h = S_h(U) = \sinh F$$

$$10^{-n} x_h = X_h(U) = F$$

$u$	$c_h$	$\delta$	$\delta^2$	$s_h$	$\delta$	$\delta^2$	$x_h$
3.4	3.733 1290		-- 7174	2.732 7004		-- 5251	2.732 3604
3.5	3.805 9761	72 8472	-- 6902	2.759 2392	26 5388	-- 5003	2.758 8892
3.6	3.878 1328	72 1567	-- 6647	2.785 2773	26 0381	-- 4774	2.784 9173
3.7	3.949 6245	71 4916	-- 6409	2.810 8378	25 5605	-- 4561	2.810 4678
3.8	4.020 4750	70 8505	-- 6185	2.835 9419	25 1041	-- 4362	2.835 5619
		70 2317			24 6676		
3.9	4.090 7067		-- 5975	2.860 6095		-- 4178	2.860 2195
4.0	4.160 3407	69 6340	-- 5776	2.884 8591	24 2496	-- 4005	2.884 4591
4.1	4.229 3969	69 0562	-- 5589	2.908 7081	23 8489	-- 3844	2.908 2981
4.2	4.297 8940	68 4971	-- 5413	2.932 1724	23 4644	-- 3692	2.931 7524
4.3	4.365 8496	67 9556	-- 5246	2.955 2674	23 0949	-- 3550	2.954 8374
		67 4309			22 7397		
4.4	4.433 2805		-- 5087	2.978 0071		-- 3417	2.977 5671
4.5	4.500 2025	66 9220	-- 4937	3.000 4050	22 3979	-- 3291	2.999 9550
4.6	4.566 6307	66 4282	-- 4795	3.022 4736	22 0686	-- 3173	3.022 0136
4.7	4.632 5793	65 9486	-- 4659	3.044 2248	21 7512	-- 3061	3.043 7548
4.8	4.698 0619	65 4826	-- 4530	3.065 6697	21 4449	-- 2956	3.065 1897
		65 0295			21 1492		
4.9	4.763 0913		-- 4407	3.086 8190		-- 2856	3.086 3290
5.0	4.827 6800	64 5886	-- 4290	3.107 6825	20 8635	-- 2761	3.107 1825
5.1	4.891 8395	64 1595	-- 4178	3.128 2698	20 5873	-- 2672	3.127 7598
5.2	4.955 5811	63 7416	-- 4072	3.148 5898	20 3200	-- 2587	3.148 0698
5.3	5.018 9154	63 3344	-- 3969	3.168 6511	20 0613	-- 2506	3.168 1211
		62 9373			19 8106		
5.4	5.081 8528		-- 3872	3.188 4617		-- 2429	3.187 9217
5.5	5.144 4029	62 5501	-- 3778	3.208 0293	19 5676	-- 2356	3.207 4793
5.6	5.206 5750	62 1722	-- 3689	3.227 3613	19 3320	-- 2286	3.226 8013
5.7	5.268 3783	61 8033	-- 3603	3.246 4646	19 1033	-- 2220	3.245 8946
5.8	5.329 8213	61 4430	-- 3520	3.265 3458	18 8812	-- 2156	3.264 7658
		61 0909			18 6655		
5.9	5.390 9122		-- 3441	3.284 0113		-- 2096	3.283 4213
6.0	5.451 6589	60 7469	-- 3364	3.302 4673	18 4559	-- 2038	3.301 8673
6.1	5.512 0692	60 4103	-- 3291	3.320 7193	18 2521	-- 1983	3.320 1093
6.2	5.572 1504	60 0811	-- 3220	3.338 7731	18 0537	-- 1930	3.338 1531
6.3	5.631 9094	59 7590	-- 3152	3.356 6338	17 8608	-- 1879	3.356 0038
		59 4437			17 6728		
6.4	5.691 3532		-- 3087	3.374 3067		-- 1830	3.373 6667
6.5	5.750 4882	59 1350	-- 3024	3.391 7964	17 4898	-- 1783	3.391 1464
6.6	5.809 3207	58 8326	-- 2963	3.409 1078	17 3114	-- 1739	3.408 4478
6.7	5.867 8570	58 5362	-- 2904	3.426 2453	17 1375	-- 1696	3.425 5753
6.8	5.926 1028	58 2458	-- 2847	3.443 2132	16 9679	-- 1654	3.442 5332
		57 9610			16 8024		
6.9	5.984 0638		-- 2792	3.460 0157		-- 1615	3.459 3257
7.0	6.041 7456	57 6818	-- 2739	3.476 6566	16 6410	-- 1576	3.475 9566
7.1	6.099 1534	57 4078	-- 2688	3.493 1400	16 4833	-- 1539	3.492 4300
7.2	6.156 2924	57 1390	-- 2638	3.509 4693	16 3293	-- 1504	3.508 7493
7.3	6.213 1674	56 8751	-- 2590	3.525 6482	16 1789	-- 1470	3.524 9182
		56 6160			16 0319		
7.4	6.269 7835		-- 2544	3.541 6801		-- 1437	3.540 9401

Ellipse:  $n=2$

$$10^{-2n}u = U = E - \sin E$$

$$10^{-2n}c_e - C_e(U) = 1 - \cos E$$

$$10^{-n}v_e = S_e(U) = \sin E$$

$$10^{-n}x_e = X_e(U) = E$$

$u$	$c_e$	$\delta$	$\delta^*$	$s_e$	$\delta$	$\delta^*$	$x_e$
7.4	6.268 9974	112 4449	- 1 0176	3.540 3481	31 5999	- 5746	3.541 0881
7.6	6.381 4423	111 4625	- 9820	3.571 9480	31 0499	- 5496	3.572 7080
7.8	6.492 9048	110 5135	- 9486	3.602 9979	30 5233	- 5264	3.603 7779
8.0	6.603 4184	109 5961	- 9171	3.633 5212	30 0184	- 5046	3.634 3212
8.2	6.713 0144	108 7083	- 8874	3.663 5396	29 5339	- 4843	3.664 3596
8.4	6.821 7228	107 8486	- 8594	3.693 0735	29 0685	- 4652	3.693 9135
8.6	6.929 5714	107 0155	- 8329	3.722 1420	28 6209	- 4473	3.723 0020
8.8	7.036 5869	106 2075	- 8077	3.750 7629	28 1902	- 4305	3.751 6429
9.0	7.142 7945	105 4234	- 7839	3.778 9532	27 7754	- 4147	3.779 8532
9.2	7.248 2179	104 6620	- 7613	3.806 7285	27 3754	- 3998	3.807 6485
9.4	7.352 8798	103 9220	- 7397	3.834 1040	26 9996	- 3857	3.835 0440
9.6	7.456 8019	103 2026	- 7193	3.861 0935	26 6170	- 3724	3.862 0535
9.8	7.560 0044	102 5026	- 6998	3.887 7106	26 2571	- 3598	3.888 6906
10.0	7.662 5071	101 8213	- 6812	3.913 9676	25 9090	- 3479	3.914 9676
10.2	7.764 3284	101 1577	- 6634	3.939 8767	25 5723	- 3366	3.940 8967
10.4	7.865 4861	100 5111	- 6465	3.965 4490	25 2463	- 3259	3.966 4890
10.6	7.965 9972	99 8807	- 6303	3.990 6953	24 9305	- 3157	3.991 7553
10.8	8.065 8778	99 2658	- 6148	4.015 6257	24 6243	- 3060	4.016 7057
11.0	8.165 1436	98 6658	- 5999	4.040 2500	24 3274	- 2968	4.041 3500
11.2	8.263 8094	98 0800	- 5857	4.064 5774	24 0393	- 2881	4.065 6974
11.4	8.361 8894	97 5079	- 5720	4.088 6167	23 7595	- 2797	4.089 7567
11.6	8.459 3972	96 9489	- 5589	4.112 3762	23 4878	- 2717	4.113 5362
11.8	8.556 3461	96 4025	- 5463	4.135 8640	23 2236	- 2641	4.137 0440
12.0	8.652 7486	95 8682	- 5342	4.159 0877	22 9668	- 2568	4.160 2877
12.2	8.748 6167	95 3455	- 5226	4.182 0545	22 7170	- 2498	4.183 2745
12.4	8.843 9622	94 8341	- 5114	4.204 7714	22 4738	- 2431	4.206 0114
12.6	8.938 7963	94 3334	- 5006	4.227 2452	22 2370	- 2367	4.228 5052
12.8	9.033 1297	93 8432	- 4902	4.249 4823	22 0064	- 2306	4.250 7623
13.0	9.126 9729	93 3630	- 4801	4.271 4887	21 7817	- 2247	4.272 7887
13.2	9.220 3359	92 8924	- 4705	4.293 2703	21 5626	- 2191	4.294 5903
13.4	9.313 2283	92 4312	- 4611	4.314 8329	21 3489	- 2136	4.316 1729
13.6	9.405 6595	91 9791	- 4521	4.336 1818	21 1404	- 2084	4.337 5418
13.8	9.497 6386	91 5356	- 4434	4.357 3222	20 9370	- 2034	4.358 7022
14.0	9.589 1742	91 1006	- 4350	4.378 2592	20 7383	- 1986	4.379 6592
14.2	9.680 2748	90 6737	- 4268	4.398 9975	20 5443	- 1940	4.400 4175
14.4	9.770 9485	90 2547	- 4189	4.419 5418	20 3548	- 1895	4.420 9818
14.6	9.861 2032	89 8433	- 4113	4.439 8966	20 1696	- 1852	4.441 3566
14.8	9.951 0465	89 4394	- 4039	4.460 0662	19 9885	- 1810	4.461 5462
15.0	10.040 4859		- 3968	4.480 0548		- 1770	4.481 5548

Hyperbola:  $n=2$

$$10^{-3n}u = U - \sinh F - F'$$

$$10^{-2n}c_h = C_h(U) = \cosh F - 1$$

$$10^{-n} s_h = S_h(U) = \sinh F$$

$$10^{-n} x_h = X_h(U) = F'$$

$u$	$c_h$	$\delta$	$\delta^2$	$s_h$	$\delta$	$\delta^2$	$x_h$
7.4	6.269 7835	112 4734	- 1 0173	3.541 6801	31 6359	- 5746	3.540 9401
7.6	6.382 2569	111 4912	- 9818	3.573 3160	31 0859	- 5264	3.572 5560
7.8	6.493 7481	110 5425	- 9484	3.604 4019	30 5593	- 5046	3.603 6219
8.0	6.604 2906	109 6253	- 9169	3.634 9612	30 0544	- 5046	3.634 1612
8.2	6.713 9159	108 7377	- 8872	3.665 0156	29 5699	- 4843	3.664 1956
8.4	6.822 6536	107 8783	- 8592	3.694 5855	29 1045	- 4652	3.693 7455
8.6	6.930 5319	107 0454	- 8326	3.723 6900	28 6569	- 4473	3.722 8300
8.8	7.037 5773	106 2377	- 8075	3.752 3469	28 2262	- 4305	3.751 4669
9.0	7.143 8150	105 4539	- 7837	3.780 5732	27 8114	- 4147	3.779 6732
9.2	7.249 2688	104 6925	- 7610	3.808 3845	27 4114	- 3998	3.807 4645
9.4	7.353 9613	103 9528	- 7395	3.835 7960	27 0256	- 3857	3.834 8560
9.6	7.457 9141	103 2336	- 7191	3.862 8215	26 6530	- 3724	3.861 8615
9.8	7.561 1477	102 5338	- 6996	3.889 4746	26 2931	- 3598	3.888 4946
10.0	7.663 6815	101 8527	- 6810	3.915 7676	25 9450	- 3479	3.914 7676
10.2	7.765 5342	101 1893	- 6632	3.941 7127	25 6083	- 3366	3.940 6927
10.4	7.866 7236	100 5429	- 6463	3.967 3210	25 2823	- 3259	3.966 2810
10.6	7.967 2665	99 9127	- 6301	3.992 6033	24 9665	- 3157	3.991 5433
10.8	8.067 1792	99 2980	- 6146	4.017 5697	24 6603	- 3060	4.016 4897
11.0	8.166 4772	98 6982	- 5997	4.042 2300	24 3634	- 2968	4.041 1300
11.2	8.265 1754	98 1126	- 5855	4.066 5934	24 0753	- 2881	4.065 4734
11.4	8.363 2880	97 5407	- 5718	4.090 6687	23 7955	- 2797	4.089 5287
11.6	8.460 8287	96 9819	- 5587	4.114 4642	23 5238	- 2717	4.113 3042
11.8	8.557 8106	96 4356	- 5461	4.137 9880	23 2596	- 2641	4.136 8080
12.0	8.654 2462	95 9015	- 5340	4.161 2477	23 0028	- 2568	4.160 0477
12.2	8.750 1478	95 3791	- 5224	4.184 2505	22 7530	- 2498	4.183 0305
12.4	8.845 5268	94 8678	- 5112	4.207 0034	22 5098	- 2431	4.205 7634
12.6	8.940 3946	94 3673	- 5004	4.229 5132	22 2730	- 2367	4.228 2532
12.8	9.034 7620	93 8773	- 4900	4.251 7863	22 0424	- 2306	4.250 5063
13.0	9.128 6392	93 3972	- 4800	4.273 8287	21 8177	- 2247	4.272 5287
13.2	9.222 0365	92 9269	- 4703	4.295 6463	21 5986	- 2191	4.294 3263
13.4	9.314 9634	92 4659	- 4610	4.317 2449	21 3849	- 2136	4.315 9049
13.6	9.407 4292	92 0138	- 4519	4.338 6298	21 1764	- 2084	4.337 2698
13.8	9.499 4431	91 5706	- 4432	4.359 8062	20 9730	- 2034	4.358 4262
14.0	9.591 0136	91 1357	- 4348	4.380 7792	20 7743	- 1986	4.379 3792
14.2	9.682 1493	90 7090	- 4267	4.401 5535	20 5803	- 1940	4.400 1335
14.4	9.772 8583	90 2901	- 4188	4.422 1338	20 3908	- 1895	4.420 6938
14.6	9.863 1484	89 8790	- 4112	4.442 5246	20 2056	- 1852	4.441 0646
14.8	9.953 0274	89 4751	- 4038	4.462 7302	20 0245	- 1810	4.461 2502
15.0	10.042 5025	89 0782	- 3966	4.482 7548	19 8474	- 1770	4.481 2548

Ellipse:  $n=2$

$$10^{-3}u = U = E - \sin E$$

$$10^{-2}c_s = C_s(U) = 1 - \cos E$$

$$10^{-n} s_s = S_s(U) = \sin E$$

$$10^{-n} x_s = X_s(U) = E$$

$u$	$c_s$	$\delta$	$\delta^{2''}$	$s_s$	$\delta$	$\delta^{2''}$	$x_s$
15.0	10.040 4859			4.480 0548			4.481 5548
15.5	10.262 3635	221 8776	- 2 4790	4.529 2599	49 2051	- 1 1060	4.530 8099
16.0	10.481 8666	219 5031	- 2 2747	4.577 4170	48 1571	- 9932	4.579 0170
16.5	10.699 0937	217 2271	- 2 1833	4.624 5800	47 1630	- 9436	4.626 2300
17.0	10.914 1364	215 0426	- 2 0982	4.670 7987	46 2187	- 8978	4.672 4987
		212 9434			45 3203		
17.5	11.127 0798		- 2 0187	4.716 1190		- 8555	4.717 8690
18.0	11.338 0036	210 9238	- 1 9443	4.760 5832	44 4642	- 8163	4.762 3832
18.5	11.546 9822	208 9786	- 1 8746	4.804 2306	43 6474	- 7799	4.806 0806
19.0	11.754 0855	207 1033	- 1 8091	4.847 0976	42 8671	- 7460	4.848 9976
19.5	11.959 3790	205 2934	- 1 7476	4.889 2183	42 1207	- 7144	4.891 1683
		203 5452			41 4059		
20.0	12.162 9242		- 1 6896	4.930 6242		- 6849	4.932 6242
20.5	12.364 7792	201 8550	- 1 6349	4.971 3449	40 7207	- 6573	4.973 3949
21.0	12.564 9988	200 2196	- 1 5832	5.011 4080	40 0631	- 6314	5.013 5080
21.5	12.763 6347	198 6359	- 1 5343	5.050 8394	39 4314	- 6071	5.052 9894
22.0	12.960 7358	197 1011	- 1 4880	5.089 6634	38 8240	- 5843	5.091 8634
		195 6126			38 2395		
22.5	13.156 3484		- 1 4441	5.127 9029		- 5628	5.130 1529
23.0	13.350 5165	194 1681	- 1 4024	5.165 5793	37 6764	- 5426	5.167 8793
23.5	13.543 2817	192 7653	- 1 3628	5.202 7129	37 1336	- 5235	5.205 0629
24.0	13.734 6839	191 4021	- 1 3251	5.239 3228	36 6099	- 5054	5.241 7228
24.5	13.924 7606	190 0767	- 1 2892	5.275 4271	36 1043	- 4884	5.277 8771
		188 7872			35 6158		
25.0	14.113 5478		- 1 2549	5.311 0429		- 4722	5.313 5429
25.5	14.301 0799	187 5320	- 1 2222	5.346 1863	35 1434	- 4569	5.348 7363
26.0	14.487 3894	186 3096	- 1 1910	5.380 8726	34 6864	- 4423	5.383 4726
26.5	14.672 5077	185 1183	- 1 1611	5.415 1165	34 2439	- 4285	5.417 7665
27.0	14.856 4647	183 9569	- 1 1326	5.448 9318	33 8153	- 4154	5.451 6318
		182 8242			33 3998		
27.5	15.039 2888		- 1 1052	5.482 3316		- 4029	5.485 0816
28.0	15.221 0076	181 7187	- 1 0790	5.515 3284	32 9968	- 3909	5.518 1284
28.5	15.401 6472	180 6336	- 1 0538	5.547 9341	32 6058	- 3796	5.550 7841
29.0	15.581 2327	179 5856	- 1 0297	5.580 1602	32 2261	- 3687	5.583 0602
29.5	15.759 7885	178 5557	- 1 0065	5.612 0174	31 8572	- 3584	5.614 9674
		177 5491			31 4988		
30.0	15.937 3376		- 9842	5.643 5162		- 3485	5.646 5162
30.5	16.113 9023	176 5648	- 9627	5.674 6664	31 1502	- 3390	5.677 7164
31.0	16.289 5042	175 6019	- 9421	5.705 4775	30 8111	- 3300	5.708 5775
31.5	16.464 1639	174 6597	- 9222	5.735 9586	30 4811	- 3213	5.739 1086
32.0	16.637 9013	173 7373	- 9030	5.766 1183	30 1597	- 3130	5.769 3183
		172 8342			29 8467		
32.5	16.810 7354		- 8846	5.795 9650		- 3050	5.799 2150
33.0	16.982 6849	171 9495	- 8668	5.825 5067	29 5417	- 2973	5.828 8067
33.5	17.153 7675	171 0826	- 8496	5.854 7511	29 2443	- 2900	5.858 1011
34.0	17.324 0005	170 2329	- 8329	5.883 7054	28 9543	- 2829	5.887 1054

Hyperbola:  $n=2$

$$10^{-3}u = U = \sinh F - F$$

$$10^{-3}c_h = C_h(U) = \cosh F - 1$$

$$10^{-n} s_h = S_h(U) = \sinh F$$

$$10^{-n} x_h = X_h(U) = F$$

$u$	$c_h$	$\delta$	$\delta^2$	$s_h$	$\delta$	$\delta^2$	$x_h$
15.0	10.042 5025			4.482 7548			4.481 2548
15.5	10.264 4702	221 9677	- 2 4780	4.532 0499	49 2952	- 1 1060	4.530 4999
16.0	10.484 0645	219 5942	- 2 3721	4.580 2970	48 2471	- 1 0472	4.578 6970
16.5	10.701 3836	217 3192	- 2 2738	4.627 5500	47 2530	- 9932	4.625 9000
17.0	10.916 5193	215 1356	- 2 1824	4.673 8587	46 3087	- 9436	4.672 1587
		213 0373	- 2 0973		45 4103	- 8978	
17.5	11.129 5566		- 2 0178	4.719 2690		- 8555	4.717 5190
18.0	11.340 5752	211 0186	- 1 9434	4.763 8232	44 5542	- 8163	4.762 0232
18.5	11.549 6495	209 0743	- 1 8737	4.807 5606	43 7374	- 7799	4.805 7106
19.0	11.756 8493	207 1998	- 1 8083	4.850 5176	42 9571	- 7460	4.848 6176
19.5	11.962 2402	205 3908	- 1 7467	4.892 7283	42 2107	- 7144	4.890 7783
		203 6435			41 4959		
20.0	12.165 8836		- 1 6888	4.934 2242		- 6849	4.932 2242
20.5	12.367 8377	201 9541	- 1 6341	4.975 0349	40 8107	- 6573	4.972 9849
21.0	12.568 1572	200 3195	- 1 5824	5.015 1880	40 1531	- 6314	5.013 0880
21.5	12.766 8937	198 7365	- 1 5335	5.054 7094	39 5214	- 6071	5.052 5594
22.0	12.964 0963	197 2025	- 1 4873	5.093 6234	38 9140	- 5843	5.091 4234
		195 7148			38 3295		
22.5	13.159 8111		- 1 4434	5.131 9529		- 5628	5.129 7029
23.0	13.354 0821	194 2711	- 1 4017	5.169 7193	37 7664	- 5426	5.167 4193
23.5	13.546 9511	192 8690	- 1 3621	5.206 9429	37 2236	- 5235	5.204 5929
24.0	13.738 4577	191 5066	- 1 3241	5.243 6428	36 6999	- 5054	5.241 2428
24.5	13.928 6396	190 1819	- 1 2884	5.279 8371	36 1943	- 4884	5.277 3871
		188 8932			35 7058		
25.0	14.117 5328		- 1 2542	5.315 5429		- 4722	5.313 0429
25.5	14.305 1715	187 6387	- 1 2215	5.350 7763	35 2334	- 4569	5.348 2263
26.0	14.491 5883	186 4169	- 1 1903	5.385 5526	34 7764	- 4423	5.382 9526
26.5	14.676 8147	185 2263	- 1 1605	5.419 8865	34 3339	- 4285	5.417 2365
27.0	14.860 8803	184 0656	- 1 1319	5.453 7918	33 9053	- 4154	5.451 0918
		182 9335			33 4898		
27.5	15.043 8138		- 1 1045	5.487 2816		- 4029	5.484 5316
28.0	15.225 6426	181 8288	- 1 0783	5.520 3684	33 0868	- 3909	5.517 5684
28.5	15.406 3928	180 7503	- 1 0532	5.553 0641	32 6958	- 3796	5.550 2141
29.0	15.586 0897	179 6969	- 1 0290	5.585 3802	32 3161	- 3687	5.582 4802
29.5	15.764 7574	178 6677	- 1 0058	5.617 3274	31 9472	- 3584	5.614 3774
		177 6617			31 5888		
30.0	15.942 4192		- 9835	5.648 9162		- 3485	5.645 9162
30.5	16.119 0972	176 6780	- 9621	5.680 1564	31 2402	- 3390	5.677 1064
31.0	16.294 8129	175 7158	- 9415	5.711 0575	30 9011	- 3300	5.707 9575
31.5	16.469 5871	174 7742	- 9216	5.741 6286	30 5711	- 3213	5.738 4786
32.0	16.643 4395	173 8524	- 9024	5.771 8783	30 2497	- 3130	5.768 6783
		172 9499			29 9367		
32.5	16.816 3894		- 8840	5.801 8150		- 3050	5.798 5650
33.0	16.988 4551	172 0658	- 8662	5.831 4467	29 6317	- 2973	5.828 1467
33.5	17.159 6546	171 1995	- 8490	5.860 7811	29 3343	- 2900	5.857 4311
34.0	17.330 0050	170 3504	- 8324	5.889 8254	29 0443	- 2829	5.886 4254

Ellipse:  $n=2$

$$10^{-3}u = U = E - \sin E$$

$$10^{-2}c_u = C_u(U) = 1 - \cos E$$

$$10^{-n} s_u = S_u(U) = \sin E$$

$$10^{-n} x_u = X_u(U) = E$$

$u$	$c_u$	$\delta$	$\delta^2$	$s_u$	$\delta$	$\delta^2$	$x_u$
34	17.324 0005		- 3 3311	5.883 7054		- 1 1312	5.887 1054
35	17.661 9833	337 9828	- 3 2049	5.940 7720	57 0666	- 1 0779	5.944 2720
36	17.996 7598	334 7765	- 3 0868	5.996 7601	55 9880	- 1 0285	6.000 3601
37	18.328 4481	331 6883	- 2 9761	6.051 7190	54 9589	- 9826	6.055 4190
38	18.657 1590	328 7109	- 2 8722	6.105 6948	53 9758	- 9399	6.109 4948
		325 8376			53 0354		
39	18.982 9966		- 2 7745	6.158 7302		- 9001	6.162 6302
40	19.306 0587	323 0621	- 2 6824	6.210 8651	52 1349	- 8629	6.214 8651
41	19.626 4374	320 3787	- 2 5956	6.262 1366	51 2715	- 8281	6.266 2366
42	19.944 2196	317 7822	- 2 5136	6.312 5797	50 4430	- 7955	6.316 7797
43	20.259 4875	315 2679	- 2 4360	6.362 2268	49 6472	- 7649	6.366 5268
		312 8311			48 8819		
44	20.572 3186		- 2 3625	6.411 1087		- 7362	6.415 5087
45	20.882 7866	310 4680	- 2 2927	6.459 2542	48 1454	- 7091	6.463 7542
46	21.190 9612	308 1746	- 2 2266	6.506 6902	47 4360	- 6836	6.511 2902
47	21.496 9087	305 9474	- 2 1636	6.553 4423	46 7521	- 6596	6.558 1423
48	21.800 6919	303 7832	- 2 1038	6.599 5346	46 0923	- 6368	6.604 3346
		301 6789			45 4553		
49	22.102 3708		- 2 0468	6.644 9899		- 6153	6.649 8899
50	22.402 0025	299 6317	- 1 9924	6.689 8296	44 8397	- 5949	6.694 8296
51	22.699 6414	297 6388	- 1 9405	6.734 0742	44 2446	- 5756	6.739 1742
52	22.995 3393	295 6979	- 1 8909	6.777 7430	43 6688	- 5573	6.782 9430
53	23.289 1459	293 8066	- 1 8435	6.820 8543	43 1113	- 5399	6.826 1543
		291 9628			42 5713		
54	23.581 1087		- 1 7981	6.863 4256		- 5233	6.868 8256
55	23.871 2729	290 1643	- 1 7547	6.905 4733	42 0478	- 5076	6.910 9733
56	24.159 6821	288 4092	- 1 7131	6.947 0134	41 5401	- 4926	6.952 6134
57	24.446 3780	286 6958	- 1 6731	6.988 0608	41 0474	- 4782	6.993 7608
58	24.731 4004	285 0224	- 1 6348	7.028 6298	40 5690	- 4646	7.034 4298
		283 3873			40 1043		
59	25.014 7877		- 1 5980	7.068 7341		- 4515	7.074 6341
60	25.296 5769	281 7891	- 1 5626	7.108 3867	39 6527	- 4391	7.114 3867
61	25.576 8032	280 2263	- 1 5285	7.147 6002	39 2135	- 4271	7.153 7002
62	25.855 5007	278 6975	- 1 4957	7.186 3865	38 7863	- 4157	7.192 5865
63	26.132 7023	277 2016	- 1 4642	7.224 7569	38 3704	- 4048	7.231 0569
		275 7372			37 9656		
64	26.408 4395		- 1 4338	7.262 7225		- 3943	7.269 1225
65	26.682 7427	274 3032	- 1 4045	7.300 2937	37 5712	- 3842	7.306 7937
66	26.955 6412	272 8986	- 1 3762	7.337 4806	37 1869	- 3746	7.344 0806
67	27.227 1634	271 5222	- 1 3489	7.374 2928	36 8122	- 3653	7.380 9928
68	27.497 3366	270 1732	- 1 3225	7.410 7397	36 4469	- 3564	7.417 5397
		268 8505			36 0904		
69	27.766 1872		- 1 2970	7.446 8301		- 3478	7.453 7301
70	28.033 7406	267 5534	- 1 2724	7.482 5726	35 7425	- 3396	7.489 5726
71	28.300 0214	266 2809	- 1 2485	7.517 9754	35 4028	- 3317	7.525 0754
72	28.565 0536	265 0322	- 1 2255	7.553 0465	35 0711	- 3240	7.560 2465
73	28.828 8602	263 8066	- 1 2031	7.587 7935	34 7470	- 3167	7.595 0935
		262 6033			34 4303		
74	29.091 4636		- 1 1815	7.622 2238		- 3096	7.629 6238

Hyperbola:  $n=2$

$$10^{-2n}u = U - \sinh F - F$$

$$10^{-2n}c_h = C_h(U) = \cosh F - 1$$

$$10^{-n}s_h = S_h(U) = \sinh F$$

$$10^{-n}x_h = X_h(U) = F$$

$u$	$c_h$	$\delta$	$\delta^{2^*}$	$s_h$	$\delta$	$\delta^{2^*}$	$x_h$
34	17.330 0050		- 3 3288	5.889 8254		- 1 1312	5.886 4254
35	17.668 2244	338 2194	- 3 2026	5.947 0720	57 2466	- 1 0779	5.943 5720
36	18.003 2398	335 0153	- 3 0846	6.003 2401	56 1680	- 1 0285	5.999 6401
37	18.335 1692	331 9294	- 2 9739	6.058 3790	55 1389	- 9826	6.054 6790
38	18.664 1234	328 9542	- 2 8701	6.112 5348	54 1558	- 9399	6.108 7348
		326 0830			53 2154		
39	18.990 2064		- 2 7724	6.165 7502		- 9001	6.161 8502
40	19.313 5161	323 3096	- 2 6804	6.218 0651	52 3149	- 8629	6.214 0651
41	19.634 1444	320 6283	- 2 5936	6.269 5166	51 4515	- 8281	6.265 4166
42	19.952 1782	318 0339	- 2 5116	6.320 1397	50 6230	- 7955	6.315 9397
43	20.267 6998	315 5215	- 2 4340	6.369 9668	49 8272	- 7649	6.365 6668
		313 0868			49 0619		
44	20.580 7865		- 2 3605	6.419 0287		- 7362	6.414 6287
45	20.891 5121	310 7256	- 2 2908	6.467 3542	48 3254	- 7091	6.462 8542
46	21.199 9462	308 4341	- 2 2247	6.514 9702	47 6160	- 6836	6.510 3702
47	21.506 1550	306 2088	- 2 1618	6.561 9023	46 9321	- 6596	6.557 2023
48	21.810 2014	304 0465	- 2 1019	6.608 1746	46 2723	- 6368	6.603 3746
		301 9440			45 6353		
49	22.112 1454		- 2 0449	6.653 8099		- 6153	6.648 9099
50	22.412 0440	299 8986	- 1 9906	6.698 8296	45 0197	- 5949	6.693 8296
51	22.709 9515	297 9075	- 1 9387	6.743 2542	44 4246	- 5756	6.738 1542
52	23.005 9199	295 9684	- 1 8892	6.787 1030	43 8488	- 5573	6.781 9030
53	23.299 9987	294 0788	- 1 8418	6.830 3943	43 2913	- 5399	6.825 0943
		292 2366			42 7513		
54	23.592 2353		- 1 7965	6.873 1456		- 5233	6.867 7456
55	23.882 6751	290 4398	- 1 7530	6.915 3733	42 2278	- 5076	6.909 8733
56	24.171 3616	288 6865	- 1 7114	6.957 0934	41 7201	- 4926	6.951 4934
57	24.458 3363	286 9747	- 1 6715	6.998 3208	41 2274	- 4782	6.992 6208
58	24.743 6393	285 3030	- 1 6332	7.039 0698	40 7490	- 4646	7.033 2698
		283 6695			40 2843		
59	25.027 3088		- 1 5964	7.079 3541		- 4515	7.073 4541
60	25.309 3817	282 0729	- 1 5610	7.119 1867	39 8327	- 4391	7.113 1867
61	25.589 8933	280 5116	- 1 5270	7.158 5802	39 3935	- 4271	7.152 4802
62	25.868 8778	278 9845	- 1 4942	7.197 5465	38 9663	- 4157	7.191 3465
63	26.146 3678	277 4900	- 1 4627	7.236 0969	38 5504	- 4048	7.229 7969
		276 0272			38 1456		
64	26.422 3949		- 1 4323	7.274 2425		- 3943	7.267 8425
65	26.696 9896	274 5947	- 1 4030	7.311 9937	37 7512	- 3842	7.305 4937
66	26.970 1812	273 1915	- 1 3747	7.349 3606	37 3669	- 3746	7.342 7606
67	27.241 9979	271 8167	- 1 3474	7.386 3528	36 9922	- 3653	7.379 6528
68	27.512 4670	270 4691	- 1 3210	7.422 9797	36 6269	- 3564	7.416 1797
		269 1479			36 2704		
69	27.781 6150		- 1 2956	7.459 2501		- 3478	7.452 3501
70	28.049 4672	267 8522	- 1 2709	7.495 1726	35 9225	- 3396	7.488 1726
71	28.316 0483	266 5811	- 1 2471	7.530 7554	35 5828	- 3317	7.523 6554
72	28.581 3822	265 3339	- 1 2241	7.566 0065	35 2511	- 3240	7.558 8065
73	28.845 4919	264 1097	- 1 2018	7.600 9335	34 9270	- 3167	7.593 6335
		262 9078			34 6103		
74	29.108 3997		- 1 1802	7.635 5438		- 3096	7.628 1438

Ellipse:  $n=2$

$$10^{-3}u = U = E - \sin E$$

$$10^{-2}c_e = C_e(U) = 1 - \cos E$$

$$10^{-2}s_e = S_e(U) = \sin E$$

$$10^{-2}x_e = X_e(U) = E$$

$u$	$c_e$		$\delta$	$\delta^2$	$s_e$		$\delta$	$\delta^2$	$x_e$	
74	29.091	4636	521 6826	- 4 7253	7.622	2238	67 9386	-1 2379	7.629	6238
76	29.613	1462	517 1205	- 4 5603	7.690	1625	66 7538	-1 1842	7.697	7625
78	30.130	2667	512 7137	- 4 4052	7.756	9163	65 6192	-1 1340	7.764	7163
80	30.642	9804	508 4531	- 4 2591	7.822	5355	64 5315	-1 0872	7.830	5355
82	31.151	4335	504 3305	- 4 1212	7.887	0670	63 4877	-1 0433	7.895	2670
84	31.655	7639	500 3382	- 3 9910	7.950	5546	62 4849	-1 0023	7.958	9546
86	32.156	1022	496 4693	- 3 8678	8.013	0396	61 5207	- 9637	8.021	6396
88	32.652	5714	492 7171	- 3 7511	8.074	5603	60 5928	- 9275	8.083	3603
90	33.145	2885	489 0757	- 3 6404	8.135	1531	59 6990	- 8934	8.144	1531
92	33.634	3642	485 5394	- 3 5353	8.194	8521	58 8374	- 8613	8.204	0521
94	34.119	9036	482 1030	- 3 4354	8.253	6895	58 0061	- 8310	8.263	0895
96	34.602	0066	478 7618	- 3 3404	8.311	6956	57 2034	- 8023	8.321	2956
98	35.080	7684	475 5112	- 3 2499	8.368	8990	56 4279	- 7752	8.378	6990
100	35.556	2796	472 3469	- 3 1635	8.425	3270	55 6781	- 7496	8.435	3270
102	36.028	6265	469 2651	- 3 0811	8.481	0051	54 9526	- 7253	8.491	2051
104	36.497	8916	466 2620	- 2 9924	8.535	9577	54 2503	- 7022	8.546	3577
106	36.964	1537	463 3342	- 2 9272	8.590	2079	53 5698	- 6802	8.600	8079
108	37.427	4879	460 4785	- 2 8652	8.643	7778	52 9103	- 6594	8.654	5778
110	37.887	9664	457 6918	- 2 7862	8.696	6880	52 2706	- 6395	8.707	6880
112	38.345	6582	454 9712	- 2 7201	8.748	9586	51 6498	- 6206	8.760	1586
114	38.800	6294	452 3140	- 2 6567	8.800	6085	51 0471	- 6026	8.812	0085
116	39.252	9434	449 7178	- 2 5958	8.851	6556	50 4617	- 5853	8.863	2556
118	39.702	6612	447 1800	- 2 5374	8.902	1173	49 8926	- 5689	8.913	9173
120	40.149	8412	444 6984	- 2 4812	8.952	0099	49 3393	- 5532	8.964	0099
122	40.594	5396	442 2710	- 2 4271	9.001	3492	48 8010	- 5382	9.013	5492
124	41.036	8106	439 8955	- 2 3751	9.050	1502	48 2771	- 5238	9.062	5502
126	41.476	7061	437 5702	- 2 3250	9.098	4274	47 7670	- 5100	9.111	0274
128	41.914	2763	435 2932	- 2 2767	9.146	1944	47 2702	- 4968	9.158	9944
130	42.349	5696	433 0628	- 2 2301	9.193	4646	46 7859	- 4841	9.206	4646
132	42.782	6324	430 8773	- 2 1852	9.240	2505	46 3139	- 4720	9.253	4505
134	43.213	5097	428 7352	- 2 1419	9.286	5644	45 8536	- 4603	9.299	9644
136	43.642	2448	426 6349	- 2 1000	9.332	4180	45 4044	- 4490	9.346	0180
138	44.068	8797	424 5751	- 2 0595	9.377	8224	44 9661	- 4383	9.391	6224
140	44.493	4549	422 5545	- 2 0204	9.422	7885	44 5382	- 4279	9.436	7885
142	44.916	0094	420 5717	- 1 9826	9.467	3267	44 1202	- 4179	9.481	5267
144	45.336	5811	418 6255	- 1 9460	9.511	4469	43 7119	- 4082	9.525	8469
146	45.755	2066	416 7148	- 1 9105	9.555	1588	43 3129	- 3990	9.569	7588
148	46.171	9214	414 8384	- 1 8762	9.598	4717	42 9228	- 3900	9.613	2717
150	46.586	7597		- 1 8429	9.641	3944		- 3814	9.656	3944

Hyperbola:  $n=2$

$$10^{-3}u = U = \sinh F - F$$

$$10^{-2\alpha}c_h = C_h(U) = \cosh F - 1$$

$$10^{-n} s_h = S_h(U) = \sinh F$$

$$10^{-n} x_h = X_h(U) = F$$

$u$	$c_h$	$\delta$	$\delta^{2^*}$	$s_h$	$\delta$	$\delta^{2^*}$	$x_h$
74	29.108 3997	522 2957	- 4 7198	7.635 5438	68 2986	-1 2379	7.628 1438
76	29.630 6954	517 7389	- 4 5549	7.703 8425	67 1138	-1 1842	7.696 2425
78	30.148 4343	513 3374	- 4 3999	7.770 9563	65 9792	-1 1340	7.763 1563
80	30.661 7717	509 0821	- 4 2538	7.836 9355	64 8915	-1 0872	7.828 9355
82	31.170 8538	504 9646	- 4 1161	7.901 8270	63 8477	-1 0433	7.893 6270
84	31.675 8184	500 9774	- 3 9859	7.965 6746	62 8449	-1 0023	7.957 2746
86	32.176 7958	497 1134	- 3 8628	8.028 5196	61 8807	- 9637	8.019 9196
88	32.673 9092	493 3661	- 3 7462	8.090 4003	60 9528	- 9275	8.081 6003
90	33.167 2753	489 7295	- 3 6356	8.151 3531	60 0590	- 8934	8.142 3531
92	33.657 0048	486 1980	- 3 5306	8.211 4121	59 1974	- 8613	8.202 2121
94	34.143 2028	482 7664	- 3 4308	8.270 6095	58 3661	- 8310	8.261 2095
96	34.625 9692	479 4297	- 3 3358	8.328 9756	57 5634	- 8023	8.319 3756
98	35.105 3989	476 1837	- 3 2453	8.386 5390	56 7879	- 7752	8.376 7390
100	35.581 5826	473 0239	- 3 1590	8.443 3270	56 0381	- 7496	8.433 3270
102	36.054 6065	469 9465	- 3 0767	8.499 3651	55 3126	- 7253	8.489 1651
104	36.524 5530	466 9478	- 2 9981	8.554 6777	54 6103	- 7022	8.544 2777
106	36.991 5009	464 0244	- 2 9229	8.609 2879	53 9298	- 6802	8.598 6879
108	37.455 5252	461 1729	- 2 8509	8.663 2178	53 2703	- 6594	8.652 4178
110	37.916 6981	458 3904	- 2 7820	8.716 4880	52 6306	- 6395	8.705 4880
112	38.375 0886	455 6740	- 2 7159	8.769 1186	52 0098	- 6206	8.757 9186
114	38.830 7625	453 0210	- 2 6526	8.821 1285	51 4071	- 6026	8.809 7285
116	39.283 7835	450 4288	- 2 5917	8.872 5356	50 8217	- 5853	8.860 9356
118	39.734 2123	447 8950	- 2 5333	8.923 3573	50 2526	- 5689	8.911 5573
120	40.182 1073	445 4174	- 2 4772	8.973 6099	49 6993	- 5532	8.961 6099
122	40.627 5247	442 9939	- 2 4232	9.023 3092	49 1610	- 5382	9.011 1092
124	41.070 5186	440 6224	- 2 3712	9.072 4702	48 6371	- 5238	9.060 0702
126	41.511 1410	438 3009	- 2 3211	9.121 1074	48 1270	- 5100	9.108 5074
128	41.949 4420	436 0277	- 2 2729	9.169 2344	47 6302	- 4968	9.156 4344
130	42.385 4697	433 8011	- 2 2264	9.216 8646	47 1459	- 4841	9.203 8646
132	42.819 2708	431 6193	- 2 1815	9.264 0105	46 6739	- 4720	9.250 8105
134	43.250 8901	429 4809	- 2 1382	9.310 6844	46 2136	- 4603	9.297 2844
136	43.680 3710	427 3843	- 2 0963	9.356 8980	45 7644	- 4490	9.343 2980
138	44.107 7553	425 3282	- 2 0559	9.402 6624	45 3261	- 4383	9.388 8624
140	44.533 0835	423 3111	- 2 0168	9.447 9885	44 8982	- 4279	9.433 9885
142	44.956 3946	421 3319	- 1 9790	9.492 8867	44 4802	- 4179	9.478 6867
144	45.377 7265	419 3892	- 1 9424	9.537 3669	44 0719	- 4082	9.522 9669
146	45.797 1157	417 4820	- 1 9070	9.581 4388	43 6729	- 3990	9.566 8388
148	46.214 5977	415 6091	- 1 8727	9.625 1117	43 2828	- 3900	9.610 3117
150	46.630 2068	413 7696	- 1 8396	9.668 3944	42 9000	- 3814	9.653 3944

Ellipse:  $n=1$

$$10^{-2n} u = U - E - \sin E$$

$$10^{-2n} e_r = C_r(U) - 1 - \cos E$$

$$10^{-n} v_r = S_r(U) - \sin E$$

$$10^{-n} v_r = X_r(U) - E$$

$u$	$e_r$	$\delta$	$\delta^2$	$s_r$	$\delta$	$\delta^2$	$x_r$
0.150	0.465 86760	10 29103	- 11515	0.964 13944	10 56563	- 23827	0.965 63944
0.155	0.476 15862	10 18073	- 11023	0.974 70507	10 33983	- 22561	0.976 25507
0.160	0.486 33935	10 07501	- 10566	0.985 04490	10 12567	- 21399	0.986 64490
0.165	0.496 41436	9 97353	- 10142	0.995 17056	9 92222	- 20329	0.996 82056
0.170	0.506 38790	9 87602	- 9747	1.005 09278	9 72865	- 19343	1.006 79278
0.175	0.516 26391	9 78220	- 9378	1.014 82143	9 54421	- 18431	1.016 57143
0.180	0.526 04611	9 69184	- 9032	1.024 36565	9 36824	- 17586	1.026 16565
0.185	0.535 73795	9 60472	- 8708	1.033 73389	9 20013	- 16802	1.035 58389
0.190	0.545 34267	9 52064	- 8404	1.042 93402	9 03932	- 16071	1.044 83402
0.195	0.554 86332	9 43943	- 8119	1.051 97334	8 88533	- 15391	1.053 92334
0.200	0.564 30274	9 36091	- 7849	1.060 85867	8 73770	- 14755	1.062 85867
0.205	0.573 66365	9 28493	- 7595	1.069 59637	8 59603	- 14160	1.071 64637
0.210	0.582 94857	9 21135	- 7355	1.078 19240	8 45994	- 13603	1.080 29240
0.215	0.592 15992	9 14004	- 7128	1.086 65234	8 32908	- 13080	1.088 80234
0.220	0.601 29997	9 07089	- 6913	1.094 98142	8 20314	- 12588	1.097 18142
0.225	0.610 37086	9 00378	- 6709	1.103 18457	8 08184	- 12126	1.105 43457
0.230	0.619 37463	8 93860	- 6516	1.111 26640	7 96489	- 11690	1.113 56640
0.235	0.628 31324	8 87527	- 6332	1.119 23130	7 85207	- 11278	1.121 58130
0.240	0.637 18850	8 81369	- 6157	1.127 08337	7 74314	- 10889	1.129 48337
0.245	0.646 00219	8 75377	- 5990	1.134 82650	7 63788	- 10522	1.137 27650
0.250	0.654 75596	8 69545	- 5831	1.142 46438	7 53611	- 10173	1.144 96438
0.255	0.663 45141	8 63865	- 5679	1.150 00050	7 43765	- 9843	1.152 55050
0.260	0.672 09006	8 58330	- 5534	1.157 43815	7 34233	- 9530	1.160 03815
0.265	0.680 67336	8 52933	- 5395	1.164 78047	7 24998	- 9232	1.167 43047
0.270	0.689 20269	8 47670	- 5263	1.172 03045	7 16046	- 8949	1.174 73045
0.275	0.697 67939	8 42533	- 5136	1.179 19092	7 07365	- 8679	1.181 94092
0.280	0.706 10472	8 37519	- 5014	1.186 26456	6 98940	- 8423	1.189 06456
0.285	0.714 47991	8 32621	- 4897	1.193 25396	6 90760	- 8178	1.196 10396
0.290	0.722 80612	8 27835	- 4785	1.200 16155	6 82813	- 7944	1.203 06155
0.295	0.731 08447	8 23158	- 4677	1.206 98969	6 75090	- 7721	1.209 93969
0.300	0.739 31605	8 18584	- 4573	1.213 74059	6 67581	- 7508	1.216 74059
0.305	0.747 50189	8 14109	- 4474	1.220 41640	6 60275	- 7304	1.223 46640
0.310	0.755 64298	8 09730	- 4378	1.227 01915	6 53165	- 7109	1.230 11915
0.315	0.763 74028	8 05444	- 4286	1.233 55080	6 46242	- 6922	1.236 70080
0.320	0.771 79472	8 01247	- 4197	1.240 01321	6 39498	- 6742	1.243 21321
0.325	0.779 80719	7 97135	- 4111	1.246 40820	6 32926	- 6570	1.249 65820
0.330	0.787 77855	7 93107	- 4028	1.252 73746	6 26520	- 6405	1.256 03746
0.335	0.795 70961	7 89158	- 3948	1.259 00266	6 20272	- 6247	1.262 35266
0.340	0.803 60120	7 85287	- 3871	1.265 20538	6 14181	- 6094	1.268 60538

### Hyperbola: $n=1$

$$10^{-2n}u = U = \sinh F - F$$

$$10^{-2n}c_h = C_h(U) = \cosh F - 1$$

$$10^{-n} s_h = S_h(U) = \sinh F$$

$$10^{-n} x_h = X_h(U) = F$$

$u$	$c_h$	$\delta$	$\delta^2$	$s_h$	$\delta$	$\delta^2$	$x_h$
0.150	0.466 30207	10 31044	- 11494	0.966 83944	10 65563	- 23828	0.965 33944
0.155	0.476 61251	10 20036	- 11002	0.977 49507	10 42983	- 22561	0.975 94507
0.160	0.486 81287	10 09484	- 10546	0.987 92490	10 21567	- 21399	0.986 32490
0.165	0.496 90771	9 99357	- 10122	0.998 14056	10 01222	- 20330	0.996 49056
0.170	0.506 90127	9 89625	- 9727	1.008 15278	9 81865	- 19343	1.006 45278
0.175	0.516 79752	9 80262	- 9358	1.017 97143	9 63421	- 18431	1.016 22143
0.180	0.526 60015	9 71245	- 9013	1.027 60565	9 45824	- 17586	1.025 80565
0.185	0.536 31260	9 62552	- 8690	1.037 06389	9 29013	- 16802	1.035 21389
0.190	0.545 93812	9 54163	- 8386	1.046 35402	9 12932	- 16071	1.044 45402
0.195	0.555 47975	9 46059	- 8101	1.055 48334	8 97533	- 15391	1.053 53334
0.200	0.564 94034	9 38225	- 7832	1.064 45867	8 82770	- 14755	1.062 45867
0.205	0.574 32258	9 30644	- 7578	1.073 28637	8 68603	- 14160	1.071 23637
0.210	0.583 62903	9 23304	- 7338	1.081 97240	8 54994	- 13603	1.079 87240
0.215	0.592 86206	9 16190	- 7111	1.090 52234	8 41908	- 13080	1.088 37234
0.220	0.602 02396	9 09291	- 6897	1.098 94142	8 29314	- 12588	1.096 74142
0.225	0.611 11687	9 02596	- 6693	1.107 23457	8 17184	- 12126	1.104 98457
0.230	0.620 14284	8 96095	- 6500	1.115 40640	8 05489	- 11690	1.113 10640
0.235	0.629 10379	8 89777	- 6316	1.123 46130	7 94207	- 11278	1.121 11130
0.240	0.638 00156	8 83635	- 6141	1.131 40337	7 83314	- 10889	1.129 00337
0.245	0.646 83791	8 77659	- 5974	1.139 23650	7 72788	- 10522	1.136 78650
0.250	0.655 61450	8 71842	- 5816	1.146 96438	7 62611	- 10173	1.144 46438
0.255	0.664 33292	8 66177	- 5664	1.154 59050	7 52765	- 9843	1.152 04050
0.260	0.672 99469	8 60657	- 5519	1.162 11815	7 43233	- 9530	1.159 51815
0.265	0.681 60125	8 55275	- 5381	1.169 55047	7 33998	- 9232	1.166 90047
0.270	0.690 15401	8 50026	- 5248	1.176 89045	7 25046	- 8949	1.174 19045
0.275	0.698 65426	8 44904	- 5121	1.184 14091	7 16365	- 8679	1.181 39091
0.280	0.707 10330	8 39903	- 5000	1.191 30456	7 07940	- 8423	1.188 50456
0.285	0.715 50234	8 35020	- 4883	1.198 38396	6 99760	- 8178	1.195 53396
0.290	0.723 85253	8 30248	- 4771	1.205 38155	6 91813	- 7944	1.202 48155
0.295	0.732 15501	8 25584	- 4663	1.212 29969	6 84090	- 7721	1.209 34969
0.300	0.740 41085	8 21023	- 4560	1.219 14059	6 76581	- 7508	1.216 14059
0.305	0.748 62108	8 16562	- 4460	1.225 90640	6 69275	- 7304	1.222 85640
0.310	0.756 78670	8 12197	- 4365	1.232 59915	6 62165	- 7109	1.229 49915
0.315	0.764 90866	8 07923	- 4273	1.239 22080	6 55242	- 6922	1.236 07080
0.320	0.772 98790	8 03739	- 4184	1.245 77321	6 48498	- 6742	1.242 57321
0.325	0.781 02529	7 99641	- 4098	1.252 25819	6 41926	- 6570	1.249 00819
0.330	0.789 02170	7 95625	- 4015	1.258 67746	6 35520	- 6405	1.255 37746
0.335	0.796 97794	7 91688	- 3936	1.265 03266	6 29272	- 6247	1.261 68266
0.340	0.804 89483		- 3859	1.271 32538		- 6094	1.267 92538

Ellipse:  $n=1$

$$10^{-2n}u = U = E - \sin E$$

$$10^{-2n}c_r = C_r(U) = 1 - \cos E$$

$$10^{-n}s_e = S_e(U) = \sin E$$

$$10^{-n}x_e = X_e(U) = E$$

$u$	$c_r$	$\delta$	$\delta^2$	$s_e$	$\delta$	$\delta^2$	$x_e$
0.34	0.803 60120		-15481	1.265 20538		-24371	1.268 60538
0.35	0.819 26896	15 66776	-14895	1.277 42941	12 22404	-23222	1.280 92941
0.36	0.834 78770	15 51874	-14346	1.289 42107	11 99166	-22157	1.293 02107
0.37	0.850 16292	15 37522	-13832	1.301 19102	11 76995	-21169	1.304 89102
0.38	0.865 39976	15 23684	-13350	1.312 74916	11 55814	-20249	1.316 54916
		15 10329			11 35553		
0.39	0.880 50304		-12896	1.324 10469		-19391	1.328 00469
0.40	0.895 47732	14 97428	-12468	1.335 26621	11 16152	-18590	1.339 26621
0.41	0.910 32687	14 84955	-12065	1.346 24173	10 97552	-17841	1.350 34173
0.42	0.925 05573	14 72886	-11684	1.357 03876	10 79703	-17139	1.361 23876
0.43	0.939 66772	14 61198	-11323	1.367 66432	10 62556	-16480	1.371 96432
		14 49872			10 46069		
0.44	0.954 16643		-10982	1.378 12501		-15860	1.382 52501
0.45	0.968 55530	14 38886	-10658	1.388 42702	10 30202	-15278	1.392 92702
0.46	0.982 83755	14 28225	-10351	1.398 57620	10 14918	-14728	1.403 17620
0.47	0.997 01626	14 17872	-10058	1.408 57805	10 00184	-14210	1.413 27805
0.48	1.011 09437	14 07810	-9780	1.418 43774	9 85969	-13720	1.423 23774
		13 98028			9 72244		
0.49	1.025 07464		-9515	1.428 16018		-13256	1.433 06018
0.50	1.038 95974	13 88510	-9263	1.437 75002	9 58983	-12818	1.442 75002
0.51	1.052 75219	13 79245	-9022	1.447 21163	9 46161	-12402	1.452 31163
0.52	1.066 45440	13 70221	-8792	1.456 54919	9 33756	-12007	1.461 74919
0.53	1.080 06867	13 61428	-8571	1.465 76665	9 21746	-11632	1.471 06665
		13 52854			9 10111		
0.54	1.093 59722		-8361	1.474 86775		-11275	1.480 26775
0.55	1.107 04214	13 44492	-8159	1.483 85608	8 98832	-10935	1.489 35608
0.56	1.120 40546	13 36332	-7965	1.492 73502	8 87894	-10612	1.498 33502
0.57	1.133 68911	13 28365	-7780	1.501 50781	8 77279	-10304	1.507 20781
0.58	1.146 89494	13 20584	-7602	1.510 17754	8 66973	-10009	1.515 97754
		13 12981			8 56962		
0.59	1.160 02475		-7431	1.518 74716		-9728	1.524 64716
0.60	1.173 08024	13 05549	-7266	1.527 21947	8 47231	-9459	1.533 21947
0.61	1.186 06306	12 98282	-7108	1.535 59717	8 37770	-9202	1.541 69717
0.62	1.198 97478	12 91172	-6956	1.543 88282	8 28565	-8956	1.550 08282
0.63	1.211 81694	12 84216	-6809	1.552 07889	8 19607	-8721	1.558 37889
		12 77406			8 10884		
0.64	1.224 59099		-6668	1.560 18773		-8495	1.566 58773
0.65	1.237 29836	12 70737	-6532	1.568 21161	8 02388	-8278	1.574 71161
0.66	1.249 94040	12 64204	-6400	1.576 15269	7 94108	-8070	1.582 75269
0.67	1.262 51844	12 57803	-6273	1.584 01305	7 86036	-7871	1.590 71305
0.68	1.275 03373	12 51529	-6151	1.591 79469	7 78164	-7679	1.598 59469
		12 45378			7 70484		
0.69	1.287 48751		-6032	1.599 49954		-7494	1.606 39954
0.70	1.299 88095	12 39345	-5918	1.607 12943	7 62989	-7316	1.614 12943
0.71	1.312 21521	12 33426	-5807	1.614 68614	7 55671	-7145	1.621 78614
0.72	1.324 49140	12 27618	-5700	1.622 17139	7 48525	-6981	1.629 37139
0.73	1.336 71057	12 21918	-5596	1.629 58682	7 41543	-6822	1.636 88682
		12 16321			7 34719		
0.74	1.348 87378		-5496	1.636 93401		-6669	1.644 33401

Hyperbola:  $n=1$

$$10^{-3}u = U \Rightarrow \sinh F - F$$

$$10^{-2n}c_h = C_h(U) = \cosh F - 1$$

$$10^{-n} s_h = S_h(U) = \sinh F$$

$$10^{-n} x_h = X_h(U) = F$$

$u$	$c_h$	$\delta$	$\delta''$	$s_h$	$\delta$	$\delta''$	$x_h$
0.34	0.804 89483		-15431	1.271 32538		-24371	1.267 92538
0.35	0.820 61357	15 71874	-14846	1.283 72941	12 40404	-23222	1.280 22941
0.36	0.836 18378	15 57021	-14299	1.295 90107	12 17166	-22157	1.292 30107
0.37	0.851 61094	15 42716	-13785	1.307 85102	11 94995	-21169	1.304 15102
0.38	0.866 90019	15 28925	-13304	1.319 58915	11 73814	-20249	1.315 78915
		15 15616			11 53553		
0.39	0.882 05635		-12850	1.331 12469		-19391	1.327 22469
0.40	0.897 08396	15 02761	-12424	1.342 46621	11 34152	-18590	1.338 46621
0.41	0.911 98729	14 90333	-12021	1.353 62173	11 15552	-17841	1.349 52173
0.42	0.926 77037	14 78308	-11641	1.364 59876	10 97703	-17139	1.360 39876
0.43	0.941 43700	14 66663	-11281	1.375 40432	10 80556	-16480	1.371 10432
		14 55379			10 64069		
0.44	0.955 99079		-10940	1.386 04501		-15860	1.381 64501
0.45	0.970 43514	14 44436	-10617	1.396 52702	10 48202	-15278	1.392 02702
0.46	0.984 77330	14 33816	-10310	1.406 85620	10 32918	-14728	1.402 25620
0.47	0.999 00832	14 23503	-10018	1.417 03805	10 18184	-14210	1.412 33805
0.48	1.013 14314	14 13482	-9741	1.427 07774	10 03969	-13720	1.422 27774
		14 03738			9 90244		
0.49	1.027 18052		-9476	1.436 98018		-13256	1.432 08018
0.50	1.041 12312	13 94259	-9224	1.446 75002	9 76983	-12818	1.441 75002
0.51	1.054 97345	13 85033	-8984	1.456 39163	9 64162	-12402	1.451 29163
0.52	1.068 73392	13 76047	-8754	1.465 90919	9 51756	-12007	1.460 70919
0.53	1.082 40683	13 67291	-8534	1.475 30665	9 39746	-11632	1.470 00665
		13 58755			9 28111		
0.54	1.095 99438		-8324	1.484 58775		-11275	1.479 18775
0.55	1.109 49867	13 50429	-8123	1.493 75607	9 16832	-10935	1.488 25607
0.56	1.122 92172	13 42305	-7930	1.502 81502	9 05894	-10612	1.497 21502
0.57	1.136 26546	13 34374	-7745	1.511 76781	8 95279	-10304	1.506 06781
0.58	1.149 53174	13 26628	-7567	1.520 61754	8 84973	-10009	1.514 81754
		13 19060			8 74962		
0.59	1.162 72233		-7396	1.529 36716		-9728	1.523 46716
0.60	1.175 83896	13 11662	-7232	1.538 01947	8 65231	-9459	1.532 01947
0.61	1.188 88325	13 04429	-7074	1.546 57716	8 55770	-9202	1.540 47716
0.62	1.201 85678	12 97354	-6922	1.555 04282	8 46565	-8956	1.548 84282
0.63	1.214 76108	12 90430	-6776	1.563 41888	8 37607	-8721	1.557 11888
		12 83653			8 28884		
0.64	1.227 59761		-6635	1.571 70773		-8495	1.565 30773
0.65	1.240 36778	12 77017	-6499	1.579 91161	8 20388	-8278	1.573 41161
0.66	1.253 07295	12 70517	-6368	1.588 03269	8 12108	-8070	1.581 43269
0.67	1.265 71442	12 64148	-6242	1.596 07305	8 04036	-7871	1.589 37305
0.68	1.278 29347	12 57905	-6119	1.604 03469	7 96164	-7679	1.597 23469
		12 51785			7 88484		
0.69	1.290 81132		-6001	1.611 91953		-7494	1.605 01953
0.70	1.303 26915	12 45783	-5887	1.619 72943	7 80989	-7316	1.612 72943
0.71	1.315 66811	12 39895	-5777	1.627 46614	7 73671	-7146	1.620 36614
0.72	1.328 00928	12 34118	-5670	1.635 13139	7 66525	-6981	1.627 93139
0.73	1.340 29376	12 28447	-5566	1.642 72681	7 59543	-6822	1.635 42681
		12 22880			7 52719		
0.74	1.352 52256		-5466	1.650 25401		-6669	1.642 85401

Ellipse:  $n=1$

$$10^{-3}u = U - E - \sin E$$

$$10^{-2}e_c = C_e(U) = 1 - \cos E$$

$$10^{-n}v_c = S_e(U) = \sin E$$

$$10^{-n}x_c = X_e(U) = E$$

$u$	$e_c$	$\delta$	$\delta^2$	$s_e$	$\delta$	$\delta^2$	$x_e$
0.74	1.348 8738	24 1625	- 2198	1.636 9340	14 4958	- 2667	1.644 3340
0.76	1.373 0363	23 9503	- 2121	1.651 4298	14 2405	- 2551	1.659 0298
0.78	1.396 9866	23 7453	- 2049	1.665 6703	13 9960	- 2443	1.673 4703
0.80	1.420 7318	23 5471	- 1981	1.679 6663	13 7617	- 2342	1.687 6663
0.82	1.444 2789	23 3553	- 1917	1.693 4280	13 5368	- 2248	1.701 6280
0.84	1.467 6342	23 1696	- 1857	1.706 9648	13 3208	- 2159	1.715 3648
0.86	1.490 8038	22 9896	- 1799	1.720 2856	13 1131	- 2076	1.728 8856
0.88	1.513 7933	22 8150	- 1745	1.733 3987	12 9131	- 1998	1.742 1987
0.90	1.536 6083	22 6456	- 1694	1.746 3118	12 7206	- 1925	1.755 3118
0.92	1.559 2539	22 4810	- 1645	1.759 0324	12 5350	- 1856	1.768 2324
0.94	1.581 7349	22 3211	- 1599	1.771 5674	12 3559	- 1790	1.780 9674
0.96	1.604 0560	22 1656	- 1554	1.783 9232	12 1829	- 1729	1.793 5232
0.98	1.626 2216	22 0144	- 1512	1.796 1062	12 0159	- 1670	1.805 9062
1.00	1.648 2360	21 8671	- 1472	1.808 1220	11 8543	- 1615	1.818 1220
1.02	1.670 1031	21 7237	- 1434	1.819 9763	11 6980	- 1563	1.830 1763
1.04	1.691 8268	21 5839	- 1397	1.831 6743	11 5467	- 1513	1.842 0743
1.06	1.713 4107	21 4477	- 1362	1.843 2210	11 4001	- 1465	1.853 8210
1.08	1.734 8584	21 3148	- 1329	1.854 6211	11 2580	- 1421	1.865 4211
1.10	1.756 1732	21 1850	- 1297	1.865 8791	11 1202	- 1378	1.876 8791
1.12	1.777 3582	21 0584	- 1266	1.876 9993	10 9865	- 1337	1.888 1993
1.14	1.798 4166	20 9347	- 1237	1.887 9858	10 8566	- 1298	1.899 3858
1.16	1.819 3513	20 8139	- 1208	1.898 8424	10 7305	- 1261	1.910 4424
1.18	1.840 1652	20 6957	- 1181	1.909 5728	10 6079	- 1226	1.921 3728
1.20	1.860 8610	20 5802	- 1155	1.920 1807	10 4887	- 1192	1.932 1807
1.22	1.881 4412	20 4672	- 1130	1.930 6694	10 3727	- 1159	1.942 8694
1.24	1.901 9084	20 3566	- 1106	1.941 0420	10 2598	- 1128	1.953 4420
1.26	1.922 2650	20 2484	- 1082	1.951 3019	10 1499	- 1099	1.963 9019
1.28	1.942 5134	20 1423	- 1060	1.961 4518	10 0429	- 1070	1.974 2518
1.30	1.962 6557	20 0385	- 1038	1.971 4947	9 9386	- 1043	1.984 4947
1.32	1.982 6942	19 9367	- 1017	1.981 4332	9 8369	- 1017	1.994 6332
1.34	2.002 6310	19 8370	- 997	1.991 2701	9 7377	- 992	2.004 6701
1.36	2.022 4680	19 7392	- 978	2.001 0078	9 6409	- 967	2.014 6078
1.38	2.042 2072	19 6433	- 959	2.010 6487	9 5465	- 944	2.024 4487
1.40	2.061 8505	19 5492	- 941	2.020 1952	9 4543	- 922	2.034 1952
1.42	2.081 3997	19 4569	- 923	2.029 6495	9 3642	- 900	2.043 8495
1.44	2.100 8565	19 3662	- 906	2.039 0137	9 2763	- 880	2.053 4137
1.46	2.120 2227	19 2772	- 890	2.048 2900	9 1903	- 860	2.062 8900
1.48	2.139 5000	19 1898	- 874	2.057 4803	9 1063	- 840	2.072 2803
1.50	2.158 6898		- 858	2.066 5866		- 822	2.081 5866

Hyperbola:  $n=1$

$$10^{-3}u = U = \sinh F - F$$

$$10^{-2}c_h - C_h(U) = \cosh F - 1$$

$$10^{-n} s_h = S_h(U) = \sinh F$$

$$10^{-n} x_h = X_h(U) = F$$

$u$	$c_h$	$\delta$	$\delta^2$	$s_h$	$\delta$	$\delta^2$	$x_h$
0.74	1.352 5226		-2186	1.650 2540		-2667	1.642 8540
0.76	1.376 8171	24 2946	-2110	1.665 1098	14 8558	-2551	1.657 5098
0.78	1.400 9007	24 0835	-2038	1.679 7103	14 6005	-2443	1.671 9103
0.80	1.424 7803	23 8797	-1970	1.694 0663	14 3560	-2342	1.686 0663
0.82	1.448 4629	23 6826	-1906	1.708 1880	14 1217	-2248	1.699 9880
		23 4919			13 8968		
0.84	1.471 9548		-1846	1.722 0848		-2159	1.713 6848
0.86	1.495 2621	23 3073	-1789	1.735 7656	13 6808	-2076	1.727 1656
0.88	1.518 3904	23 1283	-1735	1.749 2387	13 4731	-1998	1.740 4387
0.90	1.541 3452	22 9548	-1683	1.762 5118	13 2731	-1925	1.753 5118
0.92	1.564 1317	22 7864	-1635	1.775 5924	13 0806	-1856	1.766 3924
		22 6229			12 8950		
0.94	1.586 7546		-1588	1.788 4874		-1790	1.779 0874
0.96	1.609 2186	22 4640	-1544	1.801 2032	12 7159	-1729	1.791 6032
0.98	1.631 5281	22 3095	-1503	1.813 7462	12 5429	-1670	1.803 9462
1.00	1.653 6874	22 1592	-1463	1.826 1220	12 3759	-1615	1.816 1220
1.02	1.675 7003	22 0130	-1424	1.838 3363	12 2143	-1563	1.828 1363
		21 8705			12 0580		
1.04	1.697 5708		-1388	1.850 3943		-1513	1.839 9943
1.06	1.719 3025	21 7317	-1353	1.862 3010	11 9067	-1465	1.851 7010
1.08	1.740 8989	21 5964	-1320	1.874 0611	11 7601	-1421	1.863 2611
1.10	1.762 3632	21 4644	-1288	1.885 6791	11 6180	-1378	1.874 6791
1.12	1.783 6988	21 3356	-1257	1.897 1593	11 4802	-1337	1.885 9593
		21 2098			11 3465		
1.14	1.804 9086		-1228	1.908 5057		-1298	1.897 1057
1.16	1.825 9957	21 0870	-1200	1.919 7224	11 2166	-1261	1.908 1224
1.18	1.846 9627	20 9671	-1172	1.930 8128	11 0905	-1226	1.919 0128
1.20	1.867 8125	20 8498	-1146	1.941 7807	10 9679	-1192	1.929 7807
1.22	1.888 5476	20 7351	-1121	1.952 6293	10 8487	-1159	1.940 4293
		20 6230			10 7327		
1.24	1.909 1706		-1097	1.963 3620		-1128	1.950 9620
1.26	1.929 6838	20 5132	-1074	1.973 9819	10 6198	-1099	1.961 3819
1.28	1.950 0896	20 4058	-1052	1.984 4918	10 5099	-1070	1.971 6918
1.30	1.970 3902	20 3006	-1030	1.994 8947	10 4029	-1043	1.981 8947
1.32	1.990 5877	20 1976	-1009	2.005 1932	10 2986	-1017	1.991 9932
		20 0966			10 1969		
1.34	2.010 6844		-989	2.015 3901		-992	2.001 9901
1.36	2.030 6820	19 9977	-970	2.025 4878	10 0977	-967	2.011 8878
1.38	2.050 5827	19 9007	-951	2.035 4887	10 0009	-944	2.021 6887
1.40	2.070 3882	19 8055	-933	2.045 3952	9 9065	-922	2.031 3952
1.42	2.090 1004	19 7122	-916	2.055 2095	9 8143	-900	2.041 0095
		19 6206			9 7242		
1.44	2.109 7210		-899	2.064 9337		-880	2.050 5337
1.46	2.129 2518	19 5308	-882	2.074 5700	9 6363	-860	2.059 9700
1.48	2.148 6943	19 4425	-866	2.084 1203	9 5503	-840	2.069 3203
1.50	2.168 0502	19 3559	-851	2.093 5866	9 4663	-822	2.078 5866

Ellipse:  $n=1$

$$10^{-2n}u = U = E - \sin E$$

$$10^{-2n}c_e = C_e(U) = 1 - \cos E$$

$$10^{-n}x_e = S_e(U) = \sin E$$

$$10^{-n}x_e = X_e(U) = E$$

$u$	$c_e$	$\delta$	$\delta^2$	$s_e$	$\delta$	$\delta^2$	$x_e$
1.50	2.158 6898	47 6023	- 5363	2.066 5866	22 4101	- 5133	2.081 5866
1.55	2.206 2922	47 0886	- 5134	2.088 9967	21 9236	- 4861	2.104 4967
1.60	2.253 3808	46 5961	- 4922	2.110 9202	21 4622	- 4610	2.126 9202
1.65	2.299 9769	46 1234	- 4725	2.132 3824	21 0239	- 4380	2.148 8824
1.70	2.346 1003	45 6691	- 4541	2.153 4063	20 6069	- 4167	2.170 4063
1.75	2.391 7694	45 2320	- 4369	2.174 0132	20 2095	- 3971	2.191 5132
1.80	2.437 0015	44 8110	- 4208	2.194 2227	19 8304	- 3789	2.212 2227
1.85	2.481 8124	44 4050	- 4058	2.214 0531	19 4682	- 3620	2.232 5531
1.90	2.526 2175	44 0132	- 3917	2.233 5213	19 1217	- 3462	2.252 5213
1.95	2.570 2307	43 6347	- 3784	2.252 6430	18 7900	- 3316	2.272 1430
2.00	2.613 8654	43 2687	- 3658	2.271 4330	18 4719	- 3179	2.291 4330
2.05	2.657 1341	42 9146	- 3540	2.289 9049	18 1667	- 3051	2.310 4049
2.10	2.700 0487	42 5716	- 3429	2.308 0717	17 8735	- 2931	2.329 0717
2.15	2.742 6203	42 2392	- 3323	2.325 9452	17 5916	- 2818	2.347 4452
2.20	2.784 8595	41 9168	- 3223	2.343 5368	17 3203	- 2712	2.365 5368
2.25	2.826 7764	41 6039	- 3128	2.360 8571	17 0589	- 2612	2.383 3571
2.30	2.868 3803	41 3000	- 3038	2.377 9160	16 8070	- 2518	2.400 9160
2.35	2.909 6803	41 0047	- 2952	2.394 7230	16 5639	- 2430	2.418 2230
2.40	2.950 6850	40 7175	- 2871	2.411 2869	16 3292	- 2346	2.435 2869
2.45	2.991 4025	40 4381	- 2793	2.427 6161	16 1025	- 2267	2.452 1161
2.50	3.031 8406	40 1661	- 2719	2.443 7186	15 8832	- 2192	2.468 7186
2.55	3.072 0067	39 9012	- 2649	2.459 6018	15 6711	- 2121	2.485 1018
2.60	3.111 9079	39 6430	- 2581	2.475 2729	15 4657	- 2053	2.501 2729
2.65	3.151 5509	39 3913	- 2517	2.490 7387	15 2668	- 1989	2.517 2387
2.70	3.190 9422	39 1457	- 2455	2.506 0054	15 0739	- 1928	2.533 0054
2.75	3.230 0879	38 9061	- 2396	2.521 0794	14 8869	- 1870	2.548 5794
2.80	3.268 9940	38 6721	- 2339	2.535 9662	14 7054	- 1815	2.563 9662
2.85	3.307 6661	38 4436	- 2285	2.550 6716	14 5291	- 1762	2.579 1716
2.90	3.346 1097	38 2203	- 2233	2.565 2007	14 3579	- 1712	2.594 2007
2.95	3.384 3300	38 0020	- 2183	2.579 5587	14 1916	- 1663	2.609 0587
3.00	3.422 3320	37 7885	- 2134	2.593 7503	14 0298	- 1618	2.623 7503
3.05	3.460 1205	37 5797	- 2088	2.607 7800	13 8724	- 1574	2.638 2800
3.10	3.497 7002	37 3754	- 2043	2.621 6524	13 7192	- 1531	2.652 6524
3.15	3.535 0756	37 1753	- 2000	2.635 3716	13 5701	- 1491	2.666 8716
3.20	3.572 2509	36 9794	- 1959	2.648 9417	13 4248	- 1453	2.680 9417
3.25	3.609 2302	36 7874	- 1919	2.662 3664	13 2832	- 1416	2.694 8664
3.30	3.646 0177	36 5994	- 1880	2.675 6496	13 1452	- 1380	2.708 6496
3.35	3.682 6170	36 4150	- 1843	2.688 7948	13 0106	- 1346	2.722 2948
3.40	3.719 0320	36 2343	- 1807	2.701 8053		- 1313	2.735 8053

Hyperbola:  $n=1$

$$10^{-3}u = U = \sinh F - F$$

$$10^{-2}c_h = C_h(L) = \cosh F - 1$$

$$10^{-n}x_h = S_h(L) = \sinh F$$

$$10^{-n}x_h = X_h(L) = F$$

$u$	$c_h$	$\delta$	$\delta^{**}$	$s_h$	$\delta$	$\delta^{**}$	$x_h$
1.50	2.168 0502	48 0206	- 5317	2.093 5866	23 3101	- 5133	2.078 5866
1.55	2.216 0709	47 5114	- 5089	2.116 8966	22 8236	- 4861	2.101 3966
1.60	2.263 5823	47 0234	- 4878	2.139 7202	22 3622	- 4610	2.123 7202
1.65	2.310 6057	46 5550	- 4681	2.162 0824	21 9239	- 4380	2.145 5824
1.70	2.357 1607	46 1050	- 4498	2.184 0063	21 5069	- 4167	2.167 0063
1.75	2.403 2657	45 6720	- 4327	2.205 5132	21 1095	- 3971	2.188 0132
1.80	2.448 9378	45 2551	- 4168	2.226 6227	20 7304	- 3789	2.208 6227
1.85	2.494 1929	44 8532	- 4018	2.247 3530	20 3682	- 3620	2.228 8530
1.90	2.539 0460	44 4653	- 3877	2.267 7212	20 0217	- 3462	2.248 7212
1.95	2.583 5113	44 0907	- 3745	2.287 7430	19 6900	- 3316	2.268 2430
2.00	2.627 6020	43 7285	- 3620	2.307 4330	19 3719	- 3179	2.287 4330
2.05	2.671 3305	43 3781	- 3503	2.326 8049	19 0667	- 3051	2.306 3049
2.10	2.714 7086	43 0389	- 3392	2.345 8716	18 7735	- 2931	2.324 8716
2.15	2.757 7475	42 7101	- 3287	2.364 6452	18 4916	- 2818	2.343 1452
2.20	2.800 4576	42 3913	- 3187	2.383 1368	18 2203	- 2712	2.361 1368
2.25	2.842 8488	42 0819	- 3093	2.401 3570	17 9589	- 2612	2.378 8570
2.30	2.884 9307	41 7815	- 3003	2.419 3160	17 7070	- 2518	2.396 3160
2.35	2.926 7122	41 4896	- 2918	2.437 0229	17 4639	- 2430	2.413 5229
2.40	2.968 2018	41 2058	- 2837	2.454 4869	17 2292	- 2346	2.430 4869
2.45	3.009 4076	40 9297	- 2760	2.471 7161	17 0025	- 2267	2.447 2161
2.50	3.050 3373	40 6610	- 2687	2.488 7186	16 7832	- 2192	2.463 7186
2.55	3.090 9983	40 3993	- 2616	2.505 5018	16 5711	- 2121	2.480 0018
2.60	3.131 3976	40 1443	- 2549	2.522 0729	16 3657	- 2053	2.496 0729
2.65	3.171 5419	39 8958	- 2485	2.538 4386	16 1668	- 1989	2.511 9386
2.70	3.211 4377	39 6533	- 2424	2.554 6054	15 9739	- 1928	2.527 6054
2.75	3.251 0910	39 4168	- 2365	2.570 5793	15 7869	- 1870	2.543 0793
2.80	3.290 5078	39 1859	- 2309	2.586 3662	15 6054	- 1815	2.558 3662
2.85	3.329 6937	38 9604	- 2255	2.601 9715	15 4291	- 1762	2.573 4715
2.90	3.368 6540	38 7400	- 2203	2.617 4007	15 2579	- 1712	2.588 4007
2.95	3.407 3941	38 5247	- 2153	2.632 6586	15 0916	- 1663	2.603 1586
3.00	3.445 9188	38 3141	- 2105	2.647 7502	14 9298	- 1618	2.617 7502
3.05	3.484 2329	38 1082	- 2059	2.662 6800	14 7724	- 1574	2.632 1800
3.10	3.522 3411	37 9067	- 2015	2.677 4523	14 6192	- 1531	2.646 4523
3.15	3.560 2478	37 7094	- 1972	2.692 0715	14 4700	- 1491	2.660 5715
3.20	3.597 9572	37 5163	- 1931	2.706 5416	14 3248	- 1453	2.674 5416
3.25	3.635 4735	37 3271	- 1891	2.720 8664	14 1832	- 1416	2.688 3664
3.30	3.672 8007	37 1418	- 1853	2.735 0495	14 0452	- 1380	2.702 0495
3.35	3.709 9425	36 9601	- 1816	2.749 0947	13 9106	- 1346	2.715 5947
3.40	3.746 9026	36 7818	- 1781	2.763 0053	13 7794	- 1313	2.729 0053

Ellipse:  $n=1$

$$10^{-3}a = U = E - \sin E$$

$$10^{-2}e = C_e(U) = 1 - \cos E$$

$$10^{-4}x_s = S_s(U) = \sin E$$

$$10^{-4}x_e = X_e(U) = E$$

$u$	$e_c$	$\delta$	$\delta^{**}$	$s_s$	$\delta$	$\delta^{**}$	$x_e$
3.4	3.719 0320		- 7228	2.701 8053		- 5250	2.735 8053
3.5	3.791 3233	72 2912	- 6955	2.727 4356	25 6303	- 5003	2.762 4356
3.6	3.862 9186	71 5954	- 6700	2.752 5653	25 1297	- 4774	2.788 5653
3.7	3.933 8437	70 9251	- 6461	2.777 2173	24 6520	- 4561	2.814 2173
3.8	4.004 1225	70 2788	- 6236	2.801 4130	24 1957	- 4362	2.839 4130
		69 6549			23 7592		
3.9	4.073 7774		- 6024	2.825 1722		- 4178	2.864 1722
4.0	4.142 8297	69 0523	- 5825	2.848 5135	23 3412	- 4005	2.888 5135
4.1	4.211 2992	68 4695	- 5638	2.871 4540	22 9405	- 3844	2.912 4540
4.2	4.279 2048	67 9055	- 5460	2.894 0100	22 5560	- 3692	2.936 0100
4.3	4.346 5642	67 3594	- 5292	2.916 1965	22 1866	- 3550	2.959 1965
		66 8300			21 8314		
4.4	4.413 3942		- 5133	2.938 0279		- 3417	2.982 0279
4.5	4.479 7108	66 3166	- 4982	2.959 5174	21 4895	- 3291	3.004 5174
4.6	4.545 5290	65 8182	- 4839	2.980 6777	21 1603	- 3173	3.026 6777
4.7	4.610 8631	65 3341	- 4703	3.001 5206	20 8428	- 3061	3.048 5206
4.8	4.675 7268	64 8637	- 4573	3.022 0572	20 5366	- 2956	3.070 0572
		64 4063			20 2409		
4.9	4.740 1331		- 4450	3.042 2981		- 2856	3.091 2981
5.0	4.804 0943	63 9612	- 4332	3.062 2533	19 9552	- 2761	3.112 2533
5.1	4.867 6221	63 5278	- 4220	3.081 9323	19 6790	- 2672	3.132 9323
5.2	4.930 7278	63 1057	- 4113	3.101 3440	19 4117	- 2587	3.153 3440
5.3	4.993 4222	62 6944	- 4010	3.120 4970	19 1530	- 2506	3.173 4970
		62 2933			18 9023		
5.4	5.055 7155		- 3912	3.139 3994		- 2429	3.193 3994
5.5	5.117 6175	61 9020	- 3818	3.158 0587	18 6594	- 2356	3.213 0587
5.6	5.179 1376	61 5202	- 3728	3.176 4824	18 4237	- 2286	3.232 4824
5.7	5.240 2850	61 1473	- 3641	3.194 6775	18 1950	- 2220	3.251 6775
5.8	5.301 0681	60 7831	- 3558	3.212 6505	17 9730	- 2156	3.270 6505
		60 4272			17 7573		
5.9	5.361 4953		- 3478	3.230 4078		- 2096	3.289 4078
6.0	5.421 5747	60 0793	- 3402	3.247 9555	17 5477	- 2038	3.307 9555
6.1	5.481 3138	59 7391	- 3328	3.265 2993	17 3439	- 1983	3.326 2993
6.2	5.540 7200	59 4062	- 3257	3.282 4449	17 1456	- 1930	3.344 4449
6.3	5.599 8005	59 0805	- 3189	3.299 3974	16 9526	- 1879	3.362 3974
		58 7616			16 7647		
6.4	5.658 5621		- 3123	3.316 1621		- 1830	3.380 1621
6.5	5.717 0113	58 4492	- 3059	3.332 7437	16 5816	- 1783	3.397 7437
6.6	5.775 1546	58 1433	- 2998	3.349 1469	16 4032	- 1739	3.415 1469
6.7	5.832 9980	57 8434	- 2939	3.365 3763	16 2293	- 1696	3.432 3763
6.8	5.890 5475	57 5495	- 2882	3.381 4360	16 0598	- 1654	3.449 4360
		57 2613			15 8943		
6.9	5.947 8088		- 2827	3.397 3303		- 1614	3.466 3303
7.0	6.004 7873	56 9786	- 2773	3.413 0631	15 7328	- 1576	3.483 0631
7.1	6.061 4886	56 7012	- 2722	3.428 6383	15 5752	- 1539	3.499 6383
7.2	6.117 9176	56 4290	- 2672	3.444 0595	15 4212	- 1504	3.516 0595
7.3	6.174 0795	56 1619	- 2623	3.459 3303	15 2708	- 1470	3.532 3303
		55 8995			15 1238		
7.4	6.229 9790		- 2576	3.474 4542		- 1437	3.548 4542

Hyperbola:  $u = 1$

$$10^{-u} u = U = \dots \sinh F - F$$

$$10^{-2u} c_h = C_h(U) = \cosh F - 1$$

$$10^{-u} s_h = S_h(U) = \sinh F$$

$$10^{-u} x_h = X_h(U) = F$$

$u$	$c_h$	$\delta$	$\delta^2$	$s_h$	$\delta$	$\delta^2$	$x_h$
3.4	3.746 9026		- 7121	2.763 0053		- 5250	2.729 0053
3.5	3.820 2921	73 3895	- 6850	2.790 4355	27 4303	- 5003	2.755 4355
3.6	3.892 9963	72 7042	- 6597	2.817 3652	26 9297	- 4774	2.781 3652
3.7	3.965 0405	72 0442	- 6359	2.843 8172	26 4520	- 4561	2.806 8172
3.8	4.036 4485	71 4080	- 6136	2.869 8129	25 9957	- 4362	2.831 8129
		70 7941			25 5592		
3.9	4.107 2426		- 5927	2.895 3721		- 4178	2.856 3721
4.0	4.177 4439	70 2013	- 5729	2.920 5133	25 1412	- 4005	2.880 5133
4.1	4.247 0720	69 6281	- 5543	2.945 2539	24 7405	- 3844	2.904 2539
4.2	4.316 1457	69 0736	- 5367	2.969 6098	24 3560	- 3692	2.927 6098
4.3	4.384 6824	68 5368	- 5201	2.993 5964	23 9866	- 3550	2.950 5964
		68 0166			23 6314		
4.4	4.452 6990		- 5043	3.017 2277		- 3417	2.973 2277
4.5	4.520 2111	67 5121	- 4893	3.040 5173	23 2895	- 3291	2.995 5173
4.6	4.587 2337	67 0226	- 4752	3.063 4775	22 9603	- 3173	3.017 4775
4.7	4.653 7811	66 5473	- 4617	3.086 1204	22 6428	- 3061	3.039 1204
4.8	4.719 8666	66 0856	- 4488	3.108 4570	22 3366	- 2956	3.060 4570
		65 6366			22 0409		
4.9	4.785 5032		- 4366	3.130 4979		- 2856	3.081 4979
5.0	4.850 7031	65 1999	- 4249	3.152 2531	21 7552	- 2761	3.102 2531
5.1	4.915 4780	64 7749	- 4138	3.173 7321	21 4790	- 2672	3.122 7321
5.2	4.979 8390	64 3609	- 4032	3.194 9438	21 2117	- 2587	3.142 9438
5.3	5.043 7966	63 9577	- 3930	3.215 8968	20 9530	- 2506	3.162 8968
		63 5645			20 7023		
5.4	5.107 3612		- 3833	3.236 5991		- 2429	3.182 5991
5.5	5.170 5423	63 1811	- 3740	3.257 0584	20 4593	- 2356	3.202 0584
5.6	5.233 3494	62 8071	- 3651	3.277 2821	20 2237	- 2286	3.221 2821
5.7	5.295 7913	62 4419	- 3565	3.297 2772	19 9950	- 2220	3.240 2772
5.8	5.357 8766	62 0853	- 3483	3.317 0501	19 7730	- 2156	3.259 0501
		61 7369			19 5573		
5.9	5.419 6136		- 3404	3.336 6074		- 2096	3.277 6074
6.0	5.481 0100	61 3965	- 3328	3.355 9551	19 3477	- 2038	3.295 9551
6.1	5.542 0736	61 0636	- 3256	3.375 0990	19 1438	- 1983	3.314 0990
6.2	5.602 8115	60 7380	- 3185	3.394 0445	18 9455	- 1930	3.332 0445
6.3	5.663 2309	60 4194	- 3118	3.412 7970	18 7526	- 1879	3.349 7970
		60 1076			18 5646		
6.4	5.723 3385		- 3053	3.431 3617		- 1830	3.367 3617
6.5	5.783 1408	59 8023	- 2990	3.449 7433	18 3816	- 1783	3.384 7433
6.6	5.842 6440	59 5032	- 2929	3.467 9465	18 2032	- 1739	3.401 9465
6.7	5.901 8543	59 2103	- 2871	3.485 9758	18 0293	- 1696	3.418 9758
6.8	5.960 7775	58 9232	- 2814	3.503 8356	17 8597	- 1654	3.435 8356
		58 6417			17 6943		
6.9	6.019 4192		- 2760	3.521 5298		- 1614	3.452 5298
7.0	6.077 7849	58 3657	- 2707	3.539 0627	17 5328	- 1576	3.469 0627
7.1	6.135 8799	58 0950	- 2656	3.556 4378	17 3752	- 1539	3.485 4378
7.2	6.193 7092	57 8294	- 2607	3.573 6590	17 2212	- 1504	3.501 6590
7.3	6.251 2779	57 5687	- 2559	3.590 7298	17 0708	- 1470	3.517 7298
		57 3128			16 9238		
7.4	6.308 5907		- 2513	3.607 6536		- 1437	3.533 6536

Ellipse:  $n=1$

$$10^{-2n}u = U \cdot E - \sin E$$

$$10^{-2n}c_u = C_u(U) = 1 - \cos E$$

$$10^{-n}s_u = S_u(U) = \sin E$$

$$10^{-n}x_u = X_u(U) = E$$

$u$	$c_u$	$\delta$	$\delta^2$	$s_u$	$\delta$	$\delta^2$	$x_u$
7.4	6.229 9790		- 1 0304	3.474 4542		- 5746	3.548 4542
7.6	6.341 0096	111 0306	- 9946	3.504 2738	29 8197	- 5496	3.580 2738
7.8	6.451 0452	110 0356	- 9610	3.533 5436	29 2698	- 5263	3.611 5436
8.0	6.560 1195	109 0743	- 9293	3.562 2868	28 7432	- 5046	3.642 2868
8.2	6.668 2641	108 1446	- 8994	3.590 5251	28 2383	- 4842	3.672 5251
		107 2449			27 7539		
8.4	6.775 5091		- 8712	3.618 2790		- 4652	3.702 2790
8.6	6.881 8826	106 3735	- 8444	3.645 5675	27 2885	- 4473	3.731 5675
8.8	6.987 4113	105 5288	- 8191	3.672 4084	26 8410	- 4305	3.760 4084
9.0	7.092 1208	104 7094	- 7951	3.698 8187	26 4103	- 4147	3.788 8187
9.2	7.196 0348	103 9141	- 7723	3.724 8142	25 9955	- 3998	3.816 8142
		103 1415			25 5955		
9.4	7.299 1763		- 7507	3.750 4097		- 3857	3.844 4097
9.6	7.401 5670	102 3906	- 7301	3.775 6194	25 2097	- 3724	3.871 6194
9.8	7.503 2274	101 6604	- 7104	3.800 4566	24 8372	- 3598	3.898 4566
10.0	7.604 1772	100 9498	- 6917	3.824 9339	24 4773	- 3479	3.924 9339
10.2	7.704 4352	100 2580	- 6738	3.849 0632	24 1293	- 3366	3.951 0632
		99 5841			23 7926		
10.4	7.804 0192		- 6567	3.872 8557		- 3259	3.976 8557
10.6	7.902 9464	98 9272	- 6404	3.896 3223	23 4666	- 3157	4.002 3223
10.8	8.001 2332	98 2867	- 6247	3.919 4730	23 1508	- 3060	4.027 4730
11.0	8.098 8950	97 6618	- 6098	3.942 3177	22 8447	- 2968	4.052 3177
11.2	8.195 9470	97 0520	- 5954	3.964 8655	22 5478	- 2880	4.076 8655
		96 4564			22 2597		
11.4	8.292 4034		- 5816	3.987 1252		- 2797	4.101 1252
11.6	8.388 2781	95 8747	- 5684	4.009 1051	21 9800	- 2717	4.125 1051
11.8	8.483 5843	95 3062	- 5557	4.030 8134	21 7082	- 2640	4.148 8134
12.0	8.578 3346	94 7504	- 5435	4.052 2575	21 4441	- 2567	4.172 2575
12.2	8.672 5414	94 2067	- 5318	4.073 4449	21 1873	- 2498	4.195 4449
		93 6749			20 9375		
12.4	8.766 2163		- 5205	4.094 3824		- 2431	4.218 3824
12.6	8.859 3706	93 1543	- 5096	4.115 0768	20 6944	- 2367	4.241 0768
12.8	8.952 0153	92 6447	- 4991	4.135 5344	20 4576	- 2306	4.263 5344
13.0	9.044 1608	92 1455	- 4890	4.155 7614	20 2270	- 2247	4.285 7614
13.2	9.135 8172	91 6565	- 4792	4.175 7638	20 0023	- 2190	4.307 7638
		91 1772			19 7832		
13.4	9.226 9944		- 4698	4.195 5470		- 2136	4.329 5470
13.6	9.317 7017	90 7073	- 4607	4.215 1166	19 5696	- 2084	4.351 1166
13.8	9.407 9483	90 2466	- 4519	4.234 4777	19 3612	- 2034	4.372 4777
14.0	9.497 7429	89 7946	- 4434	4.253 6355	19 1577	- 1986	4.393 6355
14.2	9.587 0941	89 3512	- 4352	4.272 5946	18 9591	- 1939	4.414 5946
		88 9160			18 7652		
14.4	9.676 0101		- 4272	4.291 3597		- 1895	4.435 3597
14.6	9.764 4987	88 4887	- 4195	4.309 9354	18 5757	- 1852	4.455 9354
14.8	9.852 5679	88 0691	- 4120	4.328 3259	18 3905	- 1810	4.476 3259
15.0	9.940 2250	87 6571	- 4048	4.346 5353	18 2094	- 1770	4.496 5353

Hyperbola:  $n=1$

$$10^{-2n}u \quad U = \sinh F - F$$

$$10^{-2n}c_h - C_h(U) = \cosh F - 1$$

$$10^{-n} s_h - S_h(U) = \sinh F$$

$$10^{-n} x_h - X_h(U) = F$$

$u$	$c_h$	$\delta$	$\delta^2$	$s_h$	$\delta$	$\delta^2$	$x_h$
7.4	6.308 5907		- 1 0048	3.607 6536		- 5746	3.533 6536
7.6	6.422 4668	113 8762	- 9695	3.641 0733	33 4197	- 5496	3.565 0733
7.8	6.535 3731	112 9063	- 9363	3.673 9430	32 8697	- 5263	3.595 9430
8.0	6.647 3427	111 9696	- 9051	3.706 2861	32 3431	- 5046	3.626 2861
8.2	6.758 4068	111 0642	- 8756	3.738 1244	31 8383	- 4842	3.656 1244
		110 1883			31 3538		
8.4	6.868 5951		- 8477	3.769 4783		- 4652	3.685 4783
8.6	6.977 9355	109 3403	- 8214	3.800 3667	30 8884	- 4473	3.714 3667
8.8	7.086 4542	108 5187	- 7964	3.830 8076	30 4409	- 4305	3.742 8076
9.0	7.194 1763	107 7221	- 7727	3.860 8178	30 0102	- 4147	3.770 8178
9.2	7.301 1254	106 9491	- 7503	3.890 4132	29 5954	- 3998	3.798 4132
		106 1987			29 1955		
9.4	7.407 3240		- 7289	3.919 6087		- 3857	3.825 6087
9.6	7.512 7936	105 4695	- 7086	3.948 4184	28 8097	- 3724	3.852 4184
9.8	7.617 5544	104 7608	- 6892	3.976 8556	28 4372	- 3598	3.878 8556
10.0	7.721 6257	104 0714	- 6708	4.004 9328	28 0772	- 3479	3.904 9328
10.2	7.825 0262	103 4004	- 6532	4.032 6620	27 7292	- 3366	3.930 6620
		102 7471			27 3925		
10.4	7.927 7732		- 6364	4.060 0545		- 3259	3.956 0545
10.6	8.029 8838	102 1106	- 6203	4.087 1210	27 0665	- 3157	3.981 1210
10.8	8.131 3740	101 4902	- 6049	4.113 8717	26 7507	- 3060	4.005 8717
11.0	8.232 2592	100 8852	- 5902	4.140 3163	26 4446	- 2968	4.030 3163
11.2	8.332 5540	100 2949	- 5760	4.166 4640	26 1477	- 2880	4.054 4640
		99 7187			25 8596		
11.4	8.432 2728		- 5625	4.192 3237		- 2797	4.078 3237
11.6	8.531 4289	99 1561	- 5495	4.217 9036	25 5799	- 2717	4.101 9036
11.8	8.630 0354	98 6065	- 5370	4.243 2117	25 3082	- 2640	4.125 2117
12.0	8.728 1048	98 0694	- 5250	4.268 2558	25 0441	- 2567	4.148 2558
12.2	8.825 6490	97 5443	- 5135	4.293 0431	24 7873	- 2498	4.171 0431
		97 0307			24 5375		
12.4	8.922 6797		- 5024	4.317 5805		- 2431	4.193 5805
12.6	9.019 2080	96 5283	- 4917	4.341 8748	24 2943	- 2367	4.215 8748
12.8	9.115 2445	96 0365	- 4814	4.365 9324	24 0576	- 2306	4.237 9324
13.0	9.210 7995	95 5550	- 4714	4.389 7594	23 8270	- 2247	4.259 7594
13.2	9.305 8831	95 0835	- 4619	4.413 3616	23 6022	- 2190	4.281 3616
		94 6216			23 3832		
13.4	9.400 5047		- 4526	4.436 7448		- 2136	4.302 7448
13.6	9.494 6736	94 1689	- 4437	4.459 9143	23 1695	- 2084	4.323 9143
13.8	9.588 3988	93 7252	- 4350	4.482 8754	22 9611	- 2034	4.344 8754
14.0	9.681 6889	93 2901	- 4267	4.505 6330	22 7576	- 1986	4.365 6330
14.2	9.774 5522	92 8633	- 4186	4.528 1920	22 5590	- 1939	4.386 1920
		92 4447			22 3651		
14.4	9.866 9969		- 4108	4.550 5571		- 1895	4.406 5571
14.6	9.959 0307	92 0338	- 4033	4.572 7327	22 1756	- 1852	4.426 7327
14.8	10.050 6611	91 6305	- 3960	4.594 7231	22 9904	- 1810	4.446 7231
15.0	10.141 8956	91 2345	- 3889	4.616 5324	21 8094	- 1770	4.466 5324

Ellipse:  $n = 1$

$$10^{-3n}u = U = E - \sin E$$

$$10^{-2n}c_r = C_r(U) = 1 - \cos E$$

$$10^{-n}s_r = S_r(U) = \sin E$$

$$10^{-n}x_r = X_r(U) = E$$

$u$	$c_r$	$\delta$	$\delta^2$	$s_r$	$\delta$	$\delta^2$	$x_r$
15.0	9.940 2250		- 2 5293	4.346 5353		- 1 1058	4.496 5353
15.5	10.157 6117	217 3868	- 2 4222	4.391 2928	44 7575	- 1 0470	4.546 2928
16.0	10.372 5748	214 9631	- 2 3229	4.435 0024	43 7096	- 9931	4.595 0024
16.5	10.585 2137	212 6389	- 2 2306	4.477 7182	42 7157	- 9434	4.642 7182
17.0	10.795 6209	210 4072	- 2 1445	4.519 4897	41 7716	- 8977	4.689 4897
		208 2616			40 8733		
17.5	11.003 8825		- 2 0641	4.560 3630		- 8553	4.735 3630
18.0	11.210 0790	206 1965	- 1 9889	4.600 3803	40 0173	- 8161	4.780 3803
18.5	11.414 2857	204 2067	- 1 9184	4.639 5810	39 2007	- 7797	4.824 5810
19.0	11.616 5732	202 2875	- 1 8522	4.678 0016	38 4205	- 7458	4.868 0016
19.5	11.817 0078	200 4346	- 1 7899	4.715 6759	37 6743	- 7142	4.910 6759
		198 6440			36 9597		
20.0	12.015 6517		- 1 7313	4.752 6355		- 6847	4.952 6355
20.5	12.212 5638	196 9121	- 1 6759	4.788 9102	36 2746	- 6571	4.993 9102
21.0	12.407 7995	195 2356	- 1 6236	4.824 5273	35 6172	- 6312	5.034 5273
21.5	12.601 4110	193 6115	- 1 5741	4.859 5130	34 9856	- 6070	5.074 5130
22.0	12.793 4480	192 0370	- 1 5272	4.893 8914	34 3784	- 5842	5.113 8914
		190 5093			33 7940		
22.5	12.983 9573		- 1 4827	4.927 6854		- 5627	5.152 6854
23.0	13.172 9835	189 0262	- 1 4405	4.960 9165	33 2311	- 5424	5.190 9165
23.5	13.360 5688	187 5853	- 1 4003	4.993 6049	32 6884	- 5233	5.228 6049
24.0	13.546 7535	186 1846	- 1 3621	5.025 7698	32 1649	- 5053	5.265 7698
24.5	13.731 5757	184 8222	- 1 3257	5.057 4292	31 6594	- 4882	5.302 4292
		183 4962			31 1710		
25.0	13.915 0719		- 1 2910	5.088 6002		- 4721	5.338 6002
25.5	14.097 2768	182 2049	- 1 2578	5.119 2989	30 6988	- 4567	5.374 2989
26.0	14.278 2237	180 9468	- 1 2261	5.149 5408	30 2419	- 4422	5.409 5408
26.5	14.457 9441	179 7204	- 1 1959	5.179 3404	29 7996	- 4284	5.444 3404
27.0	14.636 4685	178 5243	- 1 1669	5.208 7114	29 3711	- 4152	5.478 7114
		177 3573			28 9557		
27.5	14.813 8257		- 1 1391	5.237 6671		- 4027	5.512 6671
28.0	14.990 0437	176 2179	- 1 1125	5.266 2200	28 5529	- 3908	5.546 2200
28.5	15.165 1489	175 1053	- 1 0869	5.294 3820	28 1620	- 3795	5.579 3820
29.0	15.339 1671	174 0181	- 1 0624	5.322 1644	27 7824	- 3686	5.612 1644
29.5	15.512 1226	172 9555	- 1 0389	5.349 5781	27 4137	- 3583	5.644 5781
		171 9165			27 0554		
30.0	15.684 0391		- 1 0162	5.376 6335		- 3484	5.676 6335
30.5	15.854 9392	170 9001	- 9944	5.403 3404	26 7069	- 3389	5.708 3404
31.0	16.024 8448	169 9056	- 9735	5.429 7084	26 3680	- 3298	5.739 7084
31.5	16.193 7767	168 9319	- 9533	5.455 7465	26 0381	- 3211	5.770 7465
32.0	16.361 7553	167 9786	- 9338	5.481 4633	25 7169	- 3128	5.801 4633
		167 0446			25 4040		
32.5	16.528 8000		- 9150	5.506 8673		- 3048	5.831 8673
33.0	16.694 9295	166 1295	- 8969	5.531 9664	25 0991	- 2972	5.861 9664
33.5	16.860 1620	165 2325	- 8794	5.556 7682	24 8018	- 2898	5.891 7682
34.0	17.024 5150	164 3530	- 8625	5.581 2802	24 5120	- 2828	5.921 2802

Hyperbola:  $n = 1$

$$10^{-2n}u = U = \sinh F - F$$

$$10^{-2n}c_h = C_h(U) = \cosh F - 1$$

$$10^{-n}s_h = S_h(U) = \sinh F$$

$$10^{-n}x_h = X_h(U) = F$$

$u$	$c_h$	$\delta$	$\delta^{2^*}$	$s_h$	$\delta$	$\delta^{2^*}$	$x_h$
15.0	10.141 8956			4.616 5324			4.466 5324
15.5	10.368 2953	226 3997	- 2 4297	4.670 2897	53 7573	- 1 1060	4.515 2897
16.0	10.592 3688	224 0735	- 2 3248	4.722 9991	52 7094	- 1 0472	4.562 9991
16.5	10.814 2135	221 8447	- 2 2275	4.774 7146	51 7155	- 9931	4.609 7146
17.0	11.033 9200	219 7065	- 2 1371	4.825 4859	50 7713	- 9435	4.655 4859
		217 6526	- 2 0529		49 8730	- 8977	
17.5	11.251 5726			4.875 3589			4.700 3589
18.0	11.467 2500	215 6774	- 1 9742	4.924 3759	49 0171	- 8554	4.744 3759
18.5	11.681 0259	213 7759	- 1 9007	4.972 5763	48 2004	- 8161	4.787 5763
19.0	11.892 9692	211 9433	- 1 8318	5.019 9966	47 4202	- 7797	4.829 9966
19.5	12.103 1447	210 1755	- 1 7671	5.066 6705	46 6740	- 7458	4.871 6705
		208 4685	- 1 7063		45 9594	- 7142	
20.0	12.311 6132			5.112 6299			4.912 6299
20.5	12.518 4321	206 8189	- 1 6490	5.157 9042	45 2743	- 6847	4.952 9042
21.0	12.723 6555	205 2234	- 1 5950	5.202 5210	44 6168	- 6571	4.992 5210
21.5	12.927 3344	203 6789	- 1 5440	5.246 5063	43 9853	- 6313	5.031 5063
22.0	13.129 5171	202 1827	- 1 4957	5.289 8843	43 3780	- 6070	5.069 8843
		200 7323	- 1 4500		42 7936	- 5842	
22.5	13.330 2493			5.332 6780			5.107 6780
23.0	13.529 5745	199 3252	- 1 4067	5.374 9086	42 2307	- 5627	5.144 9086
23.5	13.727 5338	197 9593	- 1 3655	5.416 5967	41 6880	- 5425	5.181 5967
24.0	13.924 1662	196 6325	- 1 3265	5.457 7611	41 1645	- 5234	5.217 7611
24.5	14.119 5091	195 3429	- 1 2893	5.498 4201	40 6590	- 5053	5.253 4201
		194 0887	- 1 2538		40 1705	- 4882	
25.0	14.313 5978			5.538 5907			5.288 5907
25.5	14.506 4662	192 8684	- 1 2201	5.578 2890	39 6983	- 4721	5.323 2890
26.0	14.698 1464	191 6802	- 1 1879	5.617 5304	39 2414	- 4568	5.357 5304
26.5	14.888 6693	190 5229	- 1 1571	5.656 3295	38 7991	- 4422	5.391 3295
27.0	15.078 0644	189 3950	- 1 1277	5.694 7001	38 3706	- 4284	5.424 7001
		188 2953	- 1 0995		37 9552	- 4152	
27.5	15.266 3596			5.732 6553			5.457 6553
28.0	15.453 5821	187 2225	- 1 0726	5.770 2076	37 5524	- 4027	5.490 2076
28.5	15.639 7577	186 1756	- 1 0467	5.807 3691	37 1614	- 3908	5.522 3691
29.0	15.824 9111	185 1534	- 1 0220	5.844 1510	36 7819	- 3795	5.554 1510
29.5	16.009 0662	184 1551	- 9982	5.880 5641	36 4132	- 3686	5.585 5641
		183 1795	- 9754		36 0548	- 3583	
30.0	16.192 2457			5.916 6189			5.616 6189
30.5	16.374 4717	182 2259	- 9534	5.952 3253	35 7064	- 3484	5.647 3253
31.0	16.555 7651	181 2935	- 9323	5.987 6927	35 3674	- 3389	5.677 6927
31.5	16.736 1464	180 3813	- 9120	6.022 7302	35 0375	- 3298	5.707 7302
32.0	16.915 6352	179 4887	- 8925	6.057 4464	34 7163	- 3212	5.737 4464
		178 6149	- 8736		34 4034	- 3128	
32.5	17.094 2501			6.091 8498			5.766 8498
33.0	17.272 0095	177 7594	- 8555	6.125 9483	34 0984	- 3049	5.795 9483
33.5	17.448 9307	176 9213	- 8380	6.159 7495	33 8012	- 2972	5.824 7495
34.0	17.625 0309	176 1001	- 8211	6.193 2608	33 5113	- 2898	5.853 2608
			- 8047			- 2828	

Ellipse:  $n=1$

$$10^{-2n}u = U = E - \sin E$$

$$10^{-2n}c_e = C_e(U) = 1 - \cos E$$

$$10^{-n}s_e = S_e(U) = \sin E$$

$$10^{-n}x_e = X_e(U) = E$$

$u$	$c_e$	$\delta$	$\delta''$	$s_e$	$\delta$	$\delta''$	$x_e$
34	17.024 5150		- 3 4493	5.581 2802		- 1 1307	5.921 2802
35	17.350 6495	326 1345	- 3 3209	5.629 4625	48 1823	- 1 0774	5.979 4625
36	17.673 4615	322 8120	- 3 2008	5.676 5668	47 1043	- 1 0279	6.036 5668
37	17.993 0714	319 6099	- 3 0881	5.722 6424	46 0757	- 9821	6.092 6424
38	18.309 5919	316 5205	- 2 9823	5.767 7355	45 0930	- 9394	6.147 7355
		313 5371			44 1531		
39	18.623 1290		- 2 8828	5.811 8886		- 8996	6.201 8886
40	18.933 7822	310 6533	- 2 7890	5.855 1416	43 2531	- 8624	6.255 1416
41	19.241 6456	307 8633	- 2 7005	5.897 5318	42 3902	- 8276	6.307 5318
42	19.546 8076	305 1620	- 2 6168	5.939 0941	41 5622	- 7950	6.359 0941
43	19.849 3519	302 5443	- 2 5377	5.979 8609	40 7668	- 7644	6.409 8609
		300 0059			40 0020		
44	20.149 3578		- 2 4627	6.019 8629		- 7357	6.459 8629
45	20.446 9003	297 5425	- 2 3916	6.059 1289	39 2660	- 7086	6.509 1289
46	20.742 0506	295 1503	- 2 3240	6.097 6860	38 5571	- 6832	6.557 6860
47	21.034 8763	292 8257	- 2 2597	6.135 5597	37 8737	- 6591	6.605 5597
48	21.325 4416	290 5654	- 2 1986	6.172 7740	37 2143	- 6364	6.652 7740
		288 3662			36 5777		
49	21.613 8079		- 2 1403	6.209 3517		- 6149	6.699 3517
50	21.900 0333	286 2254	- 2 0848	6.245 3144	35 9627	- 5945	6.745 3144
51	22.184 1735	284 1402	- 2 0317	6.280 6824	35 3680	- 5752	6.790 6824
52	22.466 2815	282 1080	- 1 9810	6.315 4750	34 7926	- 5569	6.835 4750
53	22.746 4081	280 1266	- 1 9325	6.349 7107	34 2356	- 5394	6.879 7107
		278 1937			33 6960		
54	23.024 6018		- 1 8861	6.383 4067		- 5229	6.923 4067
55	23.300 9090	276 3072	- 1 8417	6.416 5796	33 1730	- 5071	6.966 5796
56	23.575 3742	274 4652	- 1 7990	6.449 2454	32 6657	- 4921	7.009 2454
57	23.848 0400	272 6658	- 1 7581	6.481 4188	32 1735	- 4778	7.051 4188
58	24.118 9474	270 9074	- 1 7189	6.513 1144	31 6955	- 4641	7.093 1144
		269 1882			31 2313		
59	24.388 1357		- 1 6811	6.544 3456		- 4511	7.134 3456
60	24.655 6425	267 5068	- 1 6449	6.575 1257	30 7801	- 4386	7.175 1257
61	24.921 5042	265 8617	- 1 6100	6.605 4670	30 3413	- 4267	7.215 4670
62	25.185 7557	264 2515	- 1 5764	6.635 3816	29 9145	- 4153	7.255 3816
63	25.448 4306	262 6749	- 1 5440	6.664 8807	29 4992	- 4044	7.294 8807
		261 1307			29 0947		
64	25.709 5613		- 1 5128	6.693 9754		- 3939	7.333 9754
65	25.969 1790	259 6177	- 1 4827	6.722 6762	28 7008	- 3838	7.372 6762
66	26.227 3139	258 1348	- 1 4537	6.750 9931	28 3169	- 3742	7.410 9931
67	26.483 9948	256 6810	- 1 4256	6.778 9357	27 9426	- 3649	7.448 9357
68	26.739 2500	255 2552	- 1 3985	6.806 5134	27 5777	- 3560	7.486 5134
		253 8565			27 2216		
69	26.993 1065		- 1 3724	6.833 7351		- 3474	7.523 7351
70	27.245 5905	252 4840	- 1 3470	6.860 6092	26 8742	- 3392	7.560 6092
71	27.496 7273	251 1368	- 1 3226	6.887 1441	26 5349	- 3313	7.597 1441
72	27.746 5413	249 8141	- 1 2988	6.913 3477	26 2036	- 3236	7.633 3477
73	27.995 0564	248 5151	- 1 2759	6.939 2277	25 8799	- 3163	7.669 2277
		247 2391			25 5636		
74	28.242 2955		- 1 2536	6.964 7913		- 3092	7.704 7913

Hyperbola:  $n=1$

$$10^{-3}u = U' = \sinh F - F$$

$$10^{-2}c_h = C_h(U) = \cosh F - 1$$

$$10^{-n}x_h = S_h(U) = \sinh F$$

$$10^{-n}x_h = X_h(U) = F$$

$u$	$c_h$	$\delta$	$\delta^2$	$s_h$	$\delta$	$\delta^2$	$x_h$
34	17.625 0309		- 3 2182	6.193 2608		- 1 1307	5.853 2608
35	17.974 8324	349 8015	- 3 0943	6.259 4417	66 1810	- 1 0774	5.909 4417
36	18.321 5382	346 7058	- 2 9783	6.324 5446	65 1028	- 1 0280	5.964 5446
37	18.665 2643	343 7261	- 2 8697	6.388 6188	64 0742	- 9821	6.018 6188
38	19.006 1196	340 8553	- 2 7677	6.451 7102	63 0915	- 9394	6.071 7102
		338 0864			62 1515		
39	19.344 2060		- 2 6718	6.513 8618		- 8996	6.123 8618
40	19.679 6196	335 4136	- 2 5815	6.575 1132	61 2514	- 8624	6.175 1132
41	20.012 4507	332 8311	- 2 4964	6.635 5017	60 3885	- 8277	6.225 5017
42	20.342 7845	330 3338	- 2 4160	6.695 0622	59 5605	- 7951	6.275 0622
43	20.670 7015	327 9170	- 2 3400	6.753 8272	58 7650	- 7645	6.323 8272
		325 5763			58 0002		
44	20.996 2778		- 2 2680	6.811 8274		- 7358	6.371 8274
45	21.319 5854	323 3076	- 2 1998	6.869 0915	57 2641	- 7087	6.419 0915
46	21.640 6926	321 1072	- 2 1350	6.925 6466	56 5551	- 6832	6.465 6466
47	21.959 6642	318 9716	- 2 0734	6.981 5182	55 8716	- 6592	6.511 5182
48	22.276 5619	316 8977	- 2 0149	7.036 7305	55 2122	- 6364	6.556 7305
		314 8823			54 5756		
49	22.591 4442		- 1 9591	7.091 3061		- 6149	6.601 3061
50	22.904 3669	312 9227	- 1 9059	7.145 2665	53 9605	- 5945	6.645 2665
51	23.215 3832	311 0163	- 1 8552	7.198 6323	53 3657	- 5752	6.688 6323
52	23.524 5440	309 1607	- 1 8068	7.251 4226	52 7903	- 5569	6.731 4226
53	23.831 8975	307 3535	- 1 7605	7.303 6558	52 2332	- 5395	6.773 6558
		305 5927			51 6936		
54	24.137 4902		- 1 7162	7.355 3494		- 5230	6.815 3494
55	24.441 3663	303 8761	- 1 6738	7.406 5199	51 1705	- 5072	6.856 5199
56	24.743 5683	302 2020	- 1 6332	7.457 1830	50 6631	- 4922	6.897 1830
57	25.044 1369	300 5685	- 1 5942	7.507 3538	50 1708	- 4779	6.937 3538
58	25.343 1109	298 9740	- 1 5568	7.557 0467	49 6928	- 4642	6.977 0467
		297 4169			49 2285		
59	25.640 5278		- 1 5209	7.606 2752		- 4512	7.016 2752
60	25.936 4236	295 8958	- 1 4864	7.655 0524	48 7772	- 4387	7.055 0524
61	26.230 8327	294 4091	- 1 4532	7.703 3909	48 3385	- 4268	7.093 3909
62	26.523 7884	292 9556	- 1 4213	7.751 3025	47 9116	- 4154	7.131 3025
63	26.815 3225	291 5341	- 1 3906	7.798 7986	47 4961	- 4044	7.168 7986
		290 1433			47 0916		
64	27.105 4658		- 1 3610	7.845 8903		- 3939	7.205 8903
65	27.394 2479	288 7821	- 1 3324	7.892 5879	46 6976	- 3839	7.242 5879
66	27.681 6974	287 4495	- 1 3049	7.938 9016	46 3137	- 3742	7.278 9016
67	27.967 8418	286 1444	- 1 2784	7.984 8410	45 9394	- 3650	7.314 8410
68	28.252 7077	284 8659	- 1 2527	8.030 4153	45 5744	- 3561	7.350 4153
		283 6130			45 2182		
69	28.536 3207		- 1 2279	8.075 6336		- 3475	7.385 6336
70	28.818 7056	282 3849	- 1 2040	8.120 5042	44 8707	- 3392	7.420 5042
71	29.099 8864	281 1808	- 1 1808	8.165 0356	44 5314	- 3313	7.455 0356
72	29.379 8862	279 9998	- 1 1584	8.209 2356	44 2000	- 3237	7.489 2356
73	29.658 7275	278 8413	- 1 1368	8.253 1119	43 8763	- 3163	7.523 1119
		277 7044			43 5599		
74	29.936 4318		- 1 1158	8.296 6718		- 3092	7.556 6718

Ellipse:  $n = 1$

$$10^{-3n} u = U - E - \sin E$$

$$10^{-2n} c_r = C_r(U) = 1 - \cos E$$

$$10^{-n} s_r = S_r(U) = \sin E$$

$$10^{-n} x_r = X_r(U) = E$$

$u$	$c_r$	$\delta$	$\delta^2$	$s_r$	$\delta$	$\delta^2$	$x_r$
74	28.242 2955		- 5 0138	6.964 7913		- 1 2363	7.704 7913
76	28.733 0339	490 7384	- 4 8440	7.014 9979	50 2065	- 1 1825	7.774 9979
78	29.218 9264	485 8925	- 4 6843	7.064 0213	49 0234	- 1 1324	7.844 0213
80	29.700 1329	481 2065	- 4 5338	7.111 9116	47 8904	- 1 0855	7.911 9116
82	30.176 8041	476 6712	- 4 3917	7.158 7159	46 8043	- 1 0417	7.978 7159
		472 2780			45 7620		
84	30.649 0821		- 4 2575	7.204 4779		- 1 0007	8.044 4779
86	31.117 1013	468 0192	- 4 1304	7.249 2388	44 7609	- 9622	8.109 2388
88	31.580 9889	463 8876	- 4 0100	7.293 0370	43 7983	- 9260	8.173 0370
90	32.040 8654	459 8765	- 3 8957	7.335 9090	42 8719	- 8919	8.235 9090
92	32.496 8451	455 9797	- 3 7872	7.377 8886	41 9797	- 8598	8.297 8886
		452 1916			41 1196		
94	32.949 0367		- 3 6840	7.419 0082		- 8294	8.359 0082
96	33.397 5434	448 5067	- 3 5857	7.459 2981	40 2898	- 8008	8.419 2981
98	33.842 4635	444 9201	- 3 4921	7.498 7868	39 4887	- 7737	8.478 7868
100	34.283 8908	441 4273	- 3 4027	7.537 5016	38 7148	- 7481	8.537 5016
102	34.721 9146	438 0238	- 3 3174	7.575 4680	37 9664	- 7237	8.595 4680
		434 7057			37 2425		
104	35.156 6202		- 3 2359	7.612 7105		- 7007	8.652 7105
106	35.588 0893	431 4691	- 3 1579	7.649 2521	36 5416	- 6787	8.709 2521
108	36.016 3998	428 3105	- 3 0833	7.685 1148	35 8627	- 6579	8.765 1148
110	36.441 6265	425 2267	- 3 0118	7.720 3194	35 2046	- 6380	8.820 3194
112	36.863 8408	422 2144	- 2 9437	7.754 8858	34 5664	- 6191	8.874 8858
		419 2706			33 9471		
114	37.283 1115		- 2 8774	7.788 8330		- 6011	8.928 8330
116	37.699 5043	416 3928	- 2 8142	7.822 1789	33 3459	- 5839	8.982 1789
118	38.113 0824	413 5782	- 2 7534	7.854 9408	32 7619	- 5674	9.034 9408
120	38.523 9068	410 8243	- 2 6950	7.887 1351	32 1943	- 5517	9.087 1351
122	38.932 0356	408 1289	- 2 6388	7.918 7775	31 6424	- 5367	9.138 7775
		405 4897			31 1056		
124	39.337 5253		- 2 5847	7.949 8831		- 5223	9.189 8831
126	39.740 4299	402 9046	- 2 5326	7.980 4663	30 5832	- 5086	9.240 4663
128	40.140 8015	400 3717	- 2 4823	8.010 5408	30 0745	- 4954	9.290 5408
130	40.538 6906	397 8890	- 2 4338	8.040 1198	29 5790	- 4827	9.340 1198
132	40.934 1454	395 4549	- 2 3870	8.069 2161	29 0963	- 4705	9.389 2161
		393 0675			28 6256		
134	41.327 2130		- 2 3419	8.097 8417		- 4589	9.437 8417
136	41.717 9384	390 7254	- 2 2982	8.126 0084	28 1667	- 4476	9.486 0084
138	42.106 3654	388 4270	- 2 2560	8.153 7274	27 7190	- 4368	9.533 7274
140	42.492 5361	386 1707	- 2 2152	8.181 0095	27 2821	- 4265	9.581 0095
142	42.876 4914	383 9553	- 2 1757	8.207 8650	26 8555	- 4165	9.627 8650
		381 7794			26 4390		
144	43.258 2707		- 2 1375	8.234 3040		- 4069	9.674 3040
146	43.637 9124	379 6417	- 2 1004	8.260 3360	26 0320	- 3976	9.720 3360
148	44.015 4535	377 5410	- 2 0645	8.285 9704	25 6344	- 3886	9.765 9704
150	44.390 9298	375 4763	- 2 0298	8.311 2161	25 2457	- 3800	9.811 2161

Hyperbola:  $n = 1$

$$10^{-3u} u = U \sinh F - F$$

$$10^{-2n} c_h - C_h(U) = \cosh F - 1$$

$$10^{-n} s_h - S_h(U) = \sinh F$$

$$10^{-n} x_h - X_h(U) = F$$

$u$	$c_h$	$\delta$	$\delta^2$	$s_h$	$\delta$	$\delta^2$	$x_h$
74	29.936 4318		- 4 4623	8.296 6718		- 1 2366	7.556 6718
76	30.488 5132	552 0814	- 4 3022	8.382 8707	86 1989	- 1 1828	7.622 8707
78	31.036 2 <sup>o</sup> 07	547 7774	- 4 1517	8.467 8861	85 0154	- 1 1327	7.687 8861
80	31.579 9148	543 6241	- 4 0100	8.551 7682	83 8821	- 1 0858	7.751 7682
82	32.119 5273	539 6126	- 3 8765	8.634 5640	82 7958	- 1 0420	7.814 5640
		535 7347			81 7532		
84	32.655 2620		- 3 7504	8.716 3172		- 1 0010	7.876 3172
86	33.187 2451	531 9831	- 3 6311	8.797 0690	80 7518	- 9625	7.937 0690
88	33.715 5959	528 3508	- 3 5182	8.876 8579	79 7889	- 9262	7.996 8579
90	34.240 4274	524 8315	- 3 4112	8.955 7201	78 8623	- 8922	8.055 7201
92	34.761 8466	521 4192	- 3 3097	9.033 6899	77 9697	- 8601	8.113 6899
		518 1086			77 1094		
94	35.279 9552		- 3 2132	9.110 7992		- 8297	8.170 7992
96	35.794 8497	514 8945	- 3 1215	9.187 0785	76 2793	- 8011	8.227 0785
98	36.306 6220	511 7723	- 3 0341	9.262 5564	75 4779	- 7740	8.282 5564
100	36.815 3594	508 7374	- 2 9508	9.337 2601	74 7036	- 7484	8.337 2601
102	37.321 1452	505 7859	- 2 8714	9.411 2151	73 9550	- 7240	8.391 2151
		502 9138			73 2307		
104	37.824 0590		- 2 7956	9.484 4458		- 7010	8.444 4458
106	38.324 1766	500 1176	- 2 7231	9.556 9754	72 5296	- 6790	8.496 9754
108	38.821 5705	497 3939	- 2 6538	9.628 8257	71 8503	- 6582	8.548 8257
110	39.316 3101	494 7396	- 2 5874	9.700 0177	71 1920	- 6383	8.600 0177
112	39.808 4618	492 1517	- 2 5239	9.770 5711	70 5534	- 6194	8.650 5711
		489 6273			69 9339		
114	40.298 0891		- 2 4629	9.840 5050		- 6014	8.700 5050
116	40.785 2530	487 1640	- 2 4044	9.909 8373	69 3323	- 5842	8.749 8373
118	41.270 0121	484 7591	- 2 3483	9.978 5852	68 7480	- 5678	8.798 5852
120	41.752 4226	482 4104	- 2 2943	10.046 7653	68 1801	- 5521	8.846 7653
122	42.232 5383	480 1157	- 2 2425	10.114 3932	67 6279	- 5370	8.894 3932
		477 8729			67 0907		
124	42.710 4111		- 2 1926	10.181 4839		- 5227	8.941 4839
126	43.186 0911	475 6799	- 2 1446	10.248 0519	66 5680	- 5089	8.988 0519
128	43.659 6261	473 5351	- 2 0983	10.314 1108	66 0590	- 4957	9.034 1108
130	44.131 0626	471 4365	- 2 0537	10.379 6740	65 5632	- 4830	9.079 6740
132	44.600 4451	469 3825	- 2 0107	10.444 7541	65 0801	- 4709	9.124 7541
		467 3715			64 6091		
134	45.067 8166		- 1 9692	10.509 3632		- 4592	9.169 3632
136	45.533 2186	465 4020	- 1 9292	10.573 5130	64 1498	- 4480	9.213 5130
138	45.996 6912	463 4726	- 1 8905	10.637 2148	63 7018	- 4372	9.257 2148
140	46.458 2730	461 5818	- 1 8531	10.700 4793	63 2645	- 4268	9.300 4793
142	46.918 0015	459 7285	- 1 8170	10.763 3169	62 8376	- 4168	9.343 3169
		457 9113			62 4208		
144	47.375 9128		- 1 7820	10.825 7377		- 4072	9.385 7377
146	47.832 0418	456 1290	- 1 7482	10.887 7512	62 0135	- 3979	9.427 7512
148	48.286 4224	454 3806	- 1 7155	10.949 3667	61 6155	- 3890	9.469 3667
150	48.739 0874	452 6650	- 1 6838	11.010 5931	61 2265	- 3804	9.510 5931

Ellipse:  $n=0$

$$10^{-2n}u = U = E - \sin E$$

$$10^{-2n}c_s = C_s(U) = 1 - \cos E$$

$$10^{-n}s_s = S_s(U) = \sin E$$

$$10^{-n}x_s = X_s(U) = E$$

$u$	$c_s$	$\delta$	$\delta''$	$s_s$	$\delta$	$\delta''$	$x_s$
0.150	0.443 90930	9 29883	-12683	0.831 12161			0.981 12161
0.155	0.453 20813	9 17709	-12168	0.837 26856	6 14695	-23741	0.992 26856
0.160	0.462 38521	9 06013	-11690	0.843 19057	5 92201	-22475	1.003 19057
0.165	0.471 44534	8 94762	-11245	0.848 89927	5 70870	-21314	1.013 89927
0.170	0.480 39296	8 83927	-10830	0.854 40536	5 50609	-20245	1.024 40536
					5 31336	-19259	
0.175	0.489 23223	8 73480	-10443	0.859 71872	5 12976	-18348	1.034 71872
0.180	0.497 96703	8 63396	-10080	0.864 84848	4 95461	-17504	1.044 84848
0.185	0.506 60099	8 53653	-9739	0.869 80309	4 78731	-16719	1.054 80309
0.190	0.515 13752	8 44231	-9419	0.874 59040	4 62733	-15990	1.064 59040
0.195	0.523 57983	8 35110	-9118	0.879 21773	4 47415	-15309	1.074 21773
0.200	0.531 93092	8 26273	-8834	0.883 69188	4 32733	-14674	1.083 69188
0.205	0.540 19365	8 17704	-8566	0.888 01921	4 18647	-14080	1.093 01921
0.210	0.548 37070	8 09390	-8312	0.892 20568	4 05117	-13523	1.102 20568
0.215	0.556 46460	8 01315	-8072	0.896 25685	3 92111	-13000	1.111 25685
0.220	0.564 47775	7 93468	-7845	0.900 17796	3 79597	-12509	1.120 17796
0.225	0.572 41243	7 85837	-7629	0.903 97393	3 67545	-12047	1.128 97393
0.230	0.580 27080	7 78412	-7424	0.907 64938	3 55929	-11611	1.137 64938
0.235	0.588 05492	7 71182	-7229	0.911 20868	3 44725	-11200	1.146 20868
0.240	0.595 76674	7 64137	-7043	0.914 65593	3 33910	-10811	1.154 65593
0.245	0.603 40811	7 57271	-6865	0.917 99503	3 23462	-10444	1.162 99503
0.250	0.610 98081	7 50573	-6696	0.921 22965	3 13363	-10096	1.171 22965
0.255	0.618 48654	7 44037	-6535	0.924 36328	3 03594	-9766	1.179 36328
0.260	0.625 92691	7 37655	-6380	0.927 39922	2 94138	-9453	1.187 39922
0.265	0.633 30346	7 31421	-6233	0.930 34061	2 84980	-9155	1.195 34061
0.270	0.640 61767	7 25329	-6091	0.933 19041	2 76105	-8872	1.203 19041
0.275	0.647 87096	7 19372	-5956	0.935 95146	2 67500	-8603	1.210 95146
0.280	0.655 06469	7 13546	-5826	0.938 62646	2 59151	-8347	1.218 62646
0.285	0.662 20015	7 07844	-5701	0.941 21797	2 51046	-8102	1.226 21797
0.290	0.669 27859	7 02263	-5581	0.943 72843	2 43176	-7869	1.233 72843
0.295	0.676 30122	6 96797	-5465	0.946 16019	2 35528	-7646	1.241 16019
0.300	0.683 26919	6 91441	-5354	0.948 51547	2 28093	-7433	1.248 51547
0.305	0.690 18360	6 86193	-5248	0.950 79640	2 20863	-7229	1.255 79640
0.310	0.697 04553	6 81047	-5145	0.953 00503	2 13827	-7034	1.263 00503
0.315	0.703 85600	6 76001	-5046	0.955 14330	2 06979	-6847	1.270 14330
0.320	0.710 61601	6 71050	-4950	0.957 21309	2 00309	-6668	1.277 21309
0.325	0.717 32650	6 66191	-4858	0.959 21619	1 93812	-6496	1.284 21619
0.330	0.723 98841	6 61421	-4769	0.961 15431	1 87479	-6331	1.291 15431
0.335	0.730 60262	6 56737	-4683	0.963 02910	1 81305	-6173	1.298 02910
0.340	0.737 16999		-4600	0.964 84216		-6021	1.304 84216

Hyperbola:  $n=0$

$$10^{-3}u = U = \sinh F - F$$

$$10^{-3}c_h = C_h(U) = \cosh F - 1$$

$$10^{-3}s_h = S_h(U) = \sinh F$$

$$10^{-3}x_h = X_h(U) = F$$

$u$	$c_h$	$\delta$	$\delta^2$	$s_h$	$\delta$	$\delta^2$	$x_h$
0.150	0.487 39087	11 24362	- 10520	1.101 05931	15 14199	- 23763	0.951 05931
0.155	0.498 63450	11 14304	- 10051	1.116 20130	14 91682	- 22497	0.961 20130
0.160	0.509 77754	11 04682	- 9617	1.131 11813	14 70329	- 21336	0.971 11813
0.165	0.520 82436	10 95463	- 9213	1.145 82142	14 50046	- 20268	0.980 82142
0.170	0.531 77899	10 86620	- 8838	1.160 32188	14 30750	- 19282	0.990 32188
0.175	0.542 64519	10 78129	- 8488	1.174 62938	14 12367	- 18371	0.999 62938
0.180	0.553 42648	10 69964	- 8160	1.188 75305	13 94829	- 17527	1.008 75305
0.185	0.564 12612	10 62107	- 7854	1.202 70135	13 78076	- 16743	1.017 70135
0.190	0.574 74719	10 54538	- 7566	1.216 48211	13 62054	- 16013	1.026 48211
0.195	0.585 29257	10 47238	- 7296	1.230 10265	13 46712	- 15333	1.035 10265
0.200	0.595 76495	10 40194	- 7042	1.243 56977	13 32007	- 14698	1.043 56977
0.205	0.606 16689	10 33389	- 6803	1.256 88984	13 17896	- 14104	1.051 88984
0.210	0.616 50077	10 26810	- 6576	1.270 06880	13 04342	- 13547	1.060 06880
0.215	0.626 76887	10 20445	- 6363	1.283 11222	12 91311	- 13025	1.068 11222
0.220	0.636 97332	10 14282	- 6161	1.296 02533	12 78772	- 12534	1.076 02533
0.225	0.647 11615	10 08312	- 5969	1.308 81305	12 66695	- 12072	1.083 81305
0.230	0.657 19926	10 02523	- 5787	1.321 48000	12 55054	- 11636	1.091 48000
0.235	0.667 22449	9 96906	- 5615	1.334 03055	12 43825	- 11225	1.099 03055
0.240	0.677 19355	9 91454	- 5451	1.346 46879	12 32984	- 10837	1.106 46879
0.245	0.687 10810	9 86158	- 5295	1.358 79863	12 22510	- 10470	1.113 79863
0.250	0.696 96968	9 81011	- 5146	1.371 02374	12 12385	- 10122	1.121 02374
0.255	0.706 77979	9 76006	- 5004	1.383 14759	12 02590	- 9792	1.128 14759
0.260	0.716 53985	9 71136	- 4869	1.395 17349	11 93108	- 9479	1.135 17349
0.265	0.726 25121	9 66396	- 4739	1.407 10456	11 83923	- 9182	1.142 10456
0.270	0.735 91517	9 61779	- 4616	1.418 94379	11 75021	- 8899	1.148 94379
0.275	0.745 53297	9 57281	- 4497	1.430 69401	11 66389	- 8630	1.155 69401
0.280	0.755 10578	9 52896	- 4384	1.442 35789	11 58013	- 8374	1.162 35789
0.285	0.764 63474	9 48620	- 4276	1.453 93802	11 49881	- 8130	1.168 93802
0.290	0.774 12094	9 44448	- 4171	1.465 43683	11 41983	- 7896	1.175 43683
0.295	0.783 56541	9 40376	- 4071	1.476 85666	11 34307	- 7674	1.181 85666
0.300	0.792 96917	9 36399	- 3975	1.488 19973	11 26845	- 7461	1.188 19973
0.305	0.802 33316	9 32516	- 3883	1.499 46818	11 19586	- 7257	1.194 46818
0.310	0.811 65832	9 28720	- 3794	1.510 66404	11 12523	- 7062	1.200 66404
0.315	0.820 94552	9 25011	- 3709	1.521 78927	11 05646	- 6875	1.206 78927
0.320	0.830 19563	9 21383	- 3627	1.532 84573	10 98948	- 6697	1.212 84573
0.325	0.839 40946	9 17835	- 3548	1.543 83521	10 92422	- 6525	1.218 83521
0.330	0.848 58781	9 14363	- 3471	1.554 75943	10 86060	- 6360	1.224 75943
0.335	0.857 73144	9 10965	- 3398	1.565 62003	10 79857	- 6202	1.230 62003
0.340	0.866 84108		- 3327	1.576 41861		- 6050	1.236 41861

Ellipse:  $n=0$

$$10^{-3n}u = U = E - \sin E$$

$$10^{-2n}c_s = C_s(U) = 1 - \cos E$$

$$10^{-n}s_s = S_s(U) = \sin E$$

$$10^{-n}x_s = X_s(U) = E$$

$u$	$c_s$	$\delta$	$\delta^2$	$s_s$	$\delta$	$\delta^2$	$x_s$
0.34	0.737 16999		- 18398	0.964 84216		- 24076	1.304 84216
0.35	0.750 16751	12 99752	- 17766	0.968 28907	3 44692	- 22928	1.318 28907
0.36	0.762 98730	12 81979	- 17174	0.971 50655	3 21748	- 21865	1.331 50655
0.37	0.775 63529	12 64798	- 16618	0.974 50525	2 99869	- 20877	1.344 50525
0.38	0.788 11702	12 48174	- 16097	0.977 29504	2 78980	- 19958	1.357 29504
		12 32071			2 59010		
0.39	0.800 43774		- 15605	0.979 88515		- 19101	1.369 88515
0.40	0.812 60235	12 16461	- 15142	0.982 28413	2 39899	- 18301	1.382 28413
0.41	0.824 61549	12 01315	- 14704	0.984 50001	2 21588	- 17553	1.394 50001
0.42	0.836 48156	11 86607	- 14290	0.986 54028	2 04027	- 16851	1.406 54028
0.43	0.848 20469	11 72313	- 13897	0.988 41195	1 87167	- 16193	1.418 41195
		11 58412			1 70967		
0.44	0.859 78881		- 13526	0.990 12162		- 15574	1.430 12162
0.45	0.871 23764	11 44883	- 13173	0.991 67548	1 55386	- 14992	1.441 67548
0.46	0.882 55471	11 31707	- 12837	0.993 07935	1 40388	- 14443	1.453 07935
0.47	0.893 74338	11 18867	- 12518	0.994 33874	1 25939	- 13925	1.464 33874
0.48	0.904 80685	11 06347	- 12213	0.995 45882	1 12008	- 13436	1.475 45882
		10 94131			98567		
0.49	0.915 74816		- 11923	0.996 44449		- 12973	1.486 44449
0.50	0.926 57021	10 82205	- 11647	0.997 30039	85590	- 12535	1.497 30039
0.51	0.937 27577	10 70556	- 11382	0.998 03090	73051	- 12119	1.508 03090
0.52	0.947 86749	10 59172	- 11129	0.998 64018	60928	- 11724	1.518 64018
0.53	0.958 34790	10 48041	- 10887	0.999 13217	49200	- 11350	1.529 13217
		10 37152			37847		
0.54	0.968 71942		- 10655	0.999 51064		- 10993	1.539 51064
0.55	0.978 98437	10 26495	- 10433	0.999 77915	26850	- 10654	1.549 77915
0.56	0.989 14497	10 16060	- 10220	0.999 94108	16194	- 10331	1.559 94108
0.57	0.999 20336	10 05839	- 10015	0.999 99968	5860	- 10023	1.569 99968
0.58	1.009 16158	9 95822	- 9819	0.999 95803	4165	- 9728	1.579 95803
		9 86002			13896		
0.59	1.019 02160		- 9629	0.999 81907		- 9447	1.589 81907
0.60	1.028 78531	9 76371	- 9448	0.999 58562	23346	- 9179	1.599 58562
0.61	1.038 45454	9 66923	- 9272	0.999 26035	32527	- 8922	1.609 26035
0.62	1.048 03103	9 57649	- 9104	0.998 84584	41451	- 8676	1.618 84584
0.63	1.057 51647	9 48544	- 8941	0.998 34456	50129	- 8440	1.628 34456
		9 39602			58571		
0.64	1.066 91249		- 8784	0.997 75885		- 8215	1.637 75885
0.65	1.076 22065	9 30816	- 8633	0.997 09097	66787	- 7998	1.647 09097
0.66	1.085 44247	9 22182	- 8487	0.996 34311	74787	- 7790	1.656 34311
0.67	1.094 57942	9 13694	- 8346	0.995 51732	82579	- 7590	1.665 51732
0.68	1.103 63289	9 05347	- 8210	0.994 61562	90170	- 7398	1.674 61562
		8 97137			97570		
0.69	1.112 60426		- 8078	0.993 63992		- 7214	1.683 63992
0.70	1.121 49484	8 89058	- 7950	0.992 59206	1 04785	- 7036	1.692 59206
0.71	1.130 30591	8 81107	- 7827	0.991 47384	1 11823	- 6865	1.701 47384
0.72	1.139 03870	8 73279	- 7707	0.990 28695	1 18689	- 6701	1.710 28695
0.73	1.147 69442	8 65572	- 7592	0.989 03304	1 25391	- 6542	1.719 03304
		8 57979			1 31933		
0.74	1.156 27421		- 7479	0.987 71371		- 6389	1.727 71371

Hyperbola:  $n=0$

$$10^{-3r}u = U = \sinh F - F$$

$$10^{-2r}c_h = C_h(U) = \cosh F - 1$$

$$10^{-r}s_h = S_h(U) = \sinh F$$

$$10^{-n}v_h = \Lambda_h(U) = F$$

$u$	$c_h$	$\delta$	$\delta''$	$s_h$	$\delta$	$\delta''$	$v_h$
0.34	0.866 84108		- 13304	1.576 41861		- 24193	1.236 41861
0.35	0.884 96124	18 12016	- 12765	1.597 83569	21 41708	- 23046	1.247 83569
0.36	0.902 95368	17 99244	- 12262	1.619 02215	21 18646	- 21984	1.259 02215
0.37	0.920 82344	17 86976	- 11791	1.639 98863	20 96648	- 20998	1.269 98863
0.38	0.938 57525	17 75180	- 11349	1.660 74501	20 75638	- 20080	1.280 74501
		17 63826			20 55547		
0.39	0.956 21351		- 10934	1.681 30048		- 19224	1.291 30048
0.40	0.973 74238	17 52887	- 10544	1.701 66360	20 36312	- 18425	1.301 66360
0.41	0.991 16577	17 42339	- 10177	1.721 84237	20 17877	- 17678	1.311 84237
0.42	1.008 48736	17 32158	- 9830	1.741 84427	20 00190	- 16978	1.321 84427
0.43	1.025 71060	17 22324	- 9503	1.761 67631	19 83204	- 16321	1.331 67631
		17 12818			19 66876		
0.44	1.042 83878		- 9194	1.781 34507		- 15703	1.341 34507
0.45	1.059 87499	17 03621	- 8901	1.800 85673	19 51166	- 15122	1.350 85673
0.46	1.076 82216	16 94718	- 8623	1.820 21710	19 36037	- 14575	1.360 21710
0.47	1.093 68309	16 86093	- 8359	1.839 43167	19 21457	- 14058	1.369 43167
0.48	1.110 46040	16 77731	- 8108	1.858 50561	19 07394	- 13570	1.378 50561
		16 69621			18 93819		
0.49	1.127 15661		- 7870	1.877 44380		- 13108	1.387 44380
0.50	1.143 77409	16 61749	- 7643	1.896 25087	18 80707	- 12671	1.396 25087
0.51	1.160 31513	16 54104	- 7427	1.914 93119	18 68032	- 12256	1.404 93119
0.52	1.176 78189	16 46675	- 7220	1.933 48891	18 55772	- 11863	1.413 48891
0.53	1.193 17642	16 39453	- 7023	1.951 92797	18 43906	- 11489	1.421 92797
		16 32429			18 32414		
0.54	1.209 50071		- 6835	1.970 25211		- 11134	1.430 25211
0.55	1.225 75663	16 25592	- 6655	1.988 46488	18 21277	- 10795	1.438 46488
0.56	1.241 94599	16 18936	- 6483	2.006 56966	18 10478	- 10473	1.446 56966
0.57	1.258 07051	16 12452	- 6317	2.024 56969	18 00002	- 10166	1.454 56969
0.58	1.274 13184	16 06133	- 6159	2.042 46802	17 89834	- 9873	1.462 46802
		15 99973			17 79958		
0.59	1.290 13157		- 6007	2.060 26761		- 9593	1.470 26761
0.60	1.306 07121	15 93964	- 5862	2.077 97123	17 70363	- 9326	1.477 97123
0.61	1.321 95223	15 88102	- 5722	2.095 58158	17 61035	- 9070	1.485 58158
0.62	1.337 77602	15 82379	- 5587	2.113 10121	17 51963	- 8825	1.493 10121
0.63	1.353 54392	15 76791	- 5458	2.130 53256	17 43136	- 8591	1.500 53256
		15 71332			17 34543		
0.64	1.369 25724		- 5333	2.147 87800		- 8366	1.507 87800
0.65	1.384 91722	15 65998	- 5213	2.165 13976	17 26176	- 8150	1.515 13976
0.66	1.400 52506	15 60784	- 5098	2.182 32000	17 18024	- 7943	1.522 32000
0.67	1.416 08191	15 55685	- 4986	2.199 42079	17 10079	- 7745	1.529 42079
0.68	1.431 58889	15 50698	- 4879	2.216 44412	17 02333	- 7554	1.536 44412
		15 45818			16 94778		
0.69	1.447 04708		- 4775	2.233 39191		- 7370	1.543 39191
0.70	1.462 45750	15 41042	- 4675	2.250 26597	16 87407	- 7194	1.550 26597
0.71	1.477 82117	15 36367	- 4579	2.267 06809	16 80217	- 7024	1.557 06809
0.72	1.493 13904	15 31787	- 4485	2.283 79997	16 73187	- 6860	1.563 79997
0.73	1.508 41206	15 27302	- 4395	2.300 46323	16 66326	- 6702	1.570 46323
		15 22907			16 59623		
0.74	1.523 64113		- 4306	2.317 05946		- 6550	1.577 05946

Ellipse:  $n=0$

$$10^{-3}u = U = E - \sin E$$

$$10^{-3}c_s = C_s(U) = 1 - \cos E$$

$$10^{-3}s_s = S_s(U) = \sin E$$

$$10^{-3}x_s = X_s(U) = E$$

$u$	$c_s$	$\delta$	$\delta^2$	$s_s$	$\delta$	$\delta^2$	$x_s$
0.74	1.156 2742		- 748	0.987 7137		- 639	1.727 7137
0.75	1.164 7792	8 5050	- 737	0.986 3305	- 1 3832	- 624	1.736 3305
0.76	1.173 2105	8 4313	- 726	0.984 8848	- 1 4457	- 610	1.744 8848
0.77	1.181 5691	8 3586	- 716	0.983 3782	- 1 5066	- 596	1.753 3782
0.78	1.189 8561	8 2870	- 706	0.981 8119	- 1 5663	- 583	1.761 8119
		8 2164			- 1 6245		
0.79	1.198 0725		- 697	0.980 1874		- 570	1.770 1874
0.80	1.206 2192	8 1467	- 687	0.978 5058	- 1 6815	- 558	1.778 5058
0.81	1.214 2971	8 0780	- 678	0.976 7685	- 1 7373	- 545	1.786 7685
0.82	1.222 3073	8 0101	- 669	0.974 9767	- 1 7919	- 534	1.794 9767
0.83	1.230 2505	7 9432	- 661	0.973 1314	- 1 8453	- 523	1.803 1314
		7 8771			- 1 8975		
0.84	1.238 1276		- 652	0.971 2339		- 512	1.811 2339
0.85	1.245 9395	7 8119	- 644	0.969 2852	- 1 9487	- 501	1.819 2852
0.86	1.253 6870	7 7475	- 636	0.967 2864	- 1 9988	- 491	1.827 2864
0.87	1.261 3708	7 6839	- 628	0.965 2385	- 2 0479	- 481	1.835 2385
0.88	1.268 9918	7 6210	- 621	0.963 1425	- 2 0960	- 471	1.843 1425
		7 5589			- 2 1431		
0.89	1.276 5507		- 614	0.960 9993		- 462	1.850 9993
0.90	1.284 0483	7 4975	- 606	0.958 8100	- 2 1893	- 453	1.858 8100
0.91	1.291 4851	7 4369	- 600	0.956 5754	- 2 2346	- 444	1.866 5754
0.92	1.298 8621	7 3769	- 593	0.954 2963	- 2 2790	- 435	1.874 2963
0.93	1.306 1797	7 3176	- 586	0.951 9737	- 2 3226	- 427	1.881 9737
		7 2590			- 2 3653		
0.94	1.313 4387		- 580	0.949 6084		- 419	1.889 6084
0.95	1.320 6398	7 2011	- 573	0.947 2012	- 2 4072	- 411	1.897 2012
0.96	1.327 7835	7 1437	- 567	0.944 7529	- 2 4483	- 404	1.904 7529
0.97	1.334 8705	7 0870	- 561	0.942 2642	- 2 4887	- 396	1.912 2642
0.98	1.341 9014	7 0309	- 555	0.939 7358	- 2 5283	- 389	1.919 7358
		6 9753			- 2 5672		
0.99	1.348 8768		- 550	0.937 1686		- 382	1.927 1686
1.00	1.355 7971	6 9204	- 544	0.934 5632	- 2 6054	- 375	1.934 5632
1.01	1.362 6631	6 8660	- 539	0.931 9203	- 2 6429	- 368	1.941 9203
1.02	1.369 4752	6 8121	- 533	0.929 2406	- 2 6797	- 362	1.949 2406
1.03	1.376 2341	6 7588	- 528	0.926 5247	- 2 7159	- 355	1.956 5247
		6 7060			- 2 7515		
1.04	1.382 9401		- 523	0.923 7732		- 349	1.963 7732
1.05	1.389 5938	6 6537	- 518	0.920 9868	- 2 7864	- 343	1.970 9868
1.06	1.396 1957	6 6019	- 513	0.918 1661	- 2 8207	- 337	1.978 1661
1.07	1.402 7463	6 5506	- 508	0.915 3116	- 2 8545	- 332	1.985 3116
1.08	1.409 2461	6 4998	- 504	0.912 4240	- 2 8876	- 326	1.992 4240
		6 4495			- 2 9202		
1.09	1.415 6956		- 499	0.909 5038		- 321	1.999 5038
1.10	1.422 0952	6 3996	- 493	0.906 5515	- 2 9523	- 314	2.006 5515
1.11	1.428 4453	6 3501	- 490	0.903 5677	- 2 9838	- 310	2.013 5677
1.12	1.434 7464	6 3011	- 486	0.900 5529	- 3 0148	- 305	2.020 5529
1.13	1.440 9989	6 2525	- 482	0.897 5077	- 3 0453	- 300	2.027 5077
		6 2044			- 3 0753		
1.14	1.447 2032		- 477	0.894 4324		- 295	2.034 4324

Hyperbola:  $n=0$

$$10^{-3n}u = U = \sinh F - F$$

$$10^{-2n}c_h = C_h(U) = \cosh F - 1$$

$$10^{-n}s_h = S_h(U) = \sinh F$$

$$10^{-n}x_h = X_h(U) = F$$

$u$	$c_h$	$\delta$	$\delta^2$	$s_h$	$\delta$	$\delta^2$	$x_h$
0.74	1.523 6411	30 3297	- 1723	2.317 0595	32 9974	- 2619	1.577 0595
0.76	1.553 9709	30 1641	- 1656	2.350 0569	32 7468	- 2504	1.590 0569
0.78	1.584 1349	30 0046	- 1594	2.382 8037	32 5070	- 2398	1.602 8037
0.80	1.614 1396	29 8511	- 1535	2.415 3107	32 2772	- 2297	1.615 3107
0.82	1.643 9907	29 7031	- 1480	2.447 5879	32 0568	- 2203	1.627 5879
0.84	1.673 6937	29 5602	- 1428	2.479 6448	31 8452	- 2115	1.639 6448
0.86	1.703 2540	29 4223	- 1378	2.511 4900	31 6419	- 2033	1.651 4900
0.88	1.732 6763	29 2891	- 1332	2.543 1319	31 4463	- 1956	1.663 1319
0.90	1.761 9654	29 1602	- 1288	2.574 5782	31 2580	- 1883	1.674 5782
0.92	1.791 1256	29 0355	- 1247	2.605 8362	31 0766	- 1814	1.685 8362
0.94	1.820 1611	28 9148	- 1207	2.636 9127	30 9016	- 1749	1.696 9127
0.96	1.849 0759	28 7978	- 1170	2.667 8143	30 7328	- 1688	1.707 8143
0.98	1.877 8736	28 6843	- 1134	2.698 5471	30 5698	- 1630	1.718 5471
1.00	1.906 5759	28 5743	- 1100	2.729 1169	30 4122	- 1575	1.729 1169
1.02	1.935 1322	28 4674	- 1068	2.759 5291	30 2599	- 1523	1.739 5291
1.04	1.963 5996	28 3637	- 1037	2.789 7890	30 1125	- 1474	1.749 7890
1.06	1.991 9633	28 2628	- 1008	2.819 9015	29 9697	- 1427	1.759 9015
1.08	2.020 2261	28 1648	- 980	2.849 8712	29 8315	- 1382	1.769 8712
1.10	2.048 3910	28 0695	- 953	2.879 7027	29 6974	- 1340	1.779 7027
1.12	2.076 4605	27 9767	- 928	2.909 4001	29 5674	- 1300	1.789 4001
1.14	2.104 4372	27 8864	- 903	2.938 9676	29 4413	- 1261	1.798 9676
1.16	2.132 3236	27 7984	- 880	2.968 4088	29 3188	- 1225	1.808 4088
1.18	2.160 1220	27 7127	- 857	2.997 7276	29 1998	- 1190	1.817 7276
1.20	2.187 8347	27 6291	- 836	3.026 9274	29 0842	- 1156	1.826 9274
1.22	2.215 4638	27 5476	- 815	3.056 0116	28 9718	- 1124	1.836 0116
1.24	2.243 0114	27 4681	- 795	3.084 9834	28 8624	- 1094	1.844 9834
1.26	2.270 4794	27 3905	- 776	3.113 8458	28 7560	- 1064	1.853 8458
1.28	2.297 8699	27 3147	- 758	3.142 6018	28 6524	- 1036	1.862 6018
1.30	2.325 1846	27 2407	- 740	3.171 2542	28 5515	- 1009	1.871 2542
1.32	2.352 4254	27 1685	- 723	3.199 8056	28 4531	- 983	1.879 8056
1.34	2.379 5938	27 0978	- 706	3.228 2587	28 3573	- 958	1.888 2587
1.36	2.406 6916	27 0287	- 691	3.256 6160	28 2638	- 934	1.896 6160
1.38	2.433 7204	26 9612	- 675	3.284 8798	28 1727	- 912	1.904 8798
1.40	2.460 6816	26 8951	- 661	3.313 0525	28 0837	- 889	1.913 0525
1.42	2.487 5767	26 8305	- 646	3.341 1362	27 9969	- 868	1.921 1362
1.44	2.514 4072	26 7672	- 633	3.369 1331	27 9121	- 848	1.929 1331
1.46	2.541 1744	26 7053	- 620	3.397 0452	27 8293	- 828	1.937 0452
1.48	2.567 8797	26 6446	- 607	3.424 8745	27 7484	- 809	1.944 8745
1.50	2.594 5243	26 5853	- 594	3.452 6229	27 6694	- 791	1.952 6229

Ellipse:  $n=0$

$$10^{-13}u = U = E - \sin E$$

$$10^{-20}c_e = C_e(U) = 1 - \cos E$$

$$10^{-n} s_e = S_e(U) = \sin E$$

$$10^{-n} x_e = X_e(U) = E$$

$u$	$c_e$	$\delta$	$\delta^{2''}$	$s_e$	$\delta$	$\delta^{2''}$	$x_e$
1.14	1.447 2032		- 477	0.894 4324		- 295	2.034 4324
1.15	1.453 3599	6 1566	- 473	0.891 3276	- 3 1048	- 290	2.041 3276
1.16	1.459 4691	6 1093	- 469	0.888 1937	- 3 1338	- 286	2.048 1937
1.17	1.465 5315	6 0623	- 466	0.885 0313	- 3 1624	- 281	2.055 0313
1.18	1.471 5472	6 0158	- 462	0.881 8408	- 3 1905	- 277	2.061 8408
		5 9696			- 3 2182		
1.19	1.477 5168		- 458	0.878 6226		- 272	2.068 6226
1.20	1.483 4406	5 9238	- 454	0.875 3772	- 3 2454	- 268	2.075 3772
1.21	1.489 3189	5 8783	- 451	0.872 1049	- 3 2723	- 264	2.082 1049
1.22	1.495 1522	5 8332	- 447	0.868 8063	- 3 2987	- 260	2.088 8063
1.23	1.500 9407	5 7885	- 444	0.865 4816	- 3 3246	- 256	2.095 4816
		5 7441			- 3 3502		
1.24	1.506 6848		- 441	0.862 1314		- 252	2.102 1314
1.25	1.512 3849	5 7001	- 437	0.858 7559	- 3 3755	- 248	2.108 7559
1.26	1.518 0412	5 6564	- 434	0.855 3557	- 3 4003	- 245	2.115 3557
1.27	1.523 6542	5 6130	- 431	0.851 9309	- 3 4247	- 241	2.121 9309
1.28	1.529 2241	5 5699	- 428	0.848 4821	- 3 4488	- 237	2.128 4821
		5 5271			- 3 4725		
1.29	1.534 7512		- 425	0.845 0096		- 234	2.135 0096
1.30	1.540 2358	5 4847	- 422	0.841 5137	- 3 4959	- 230	2.141 5137
1.31	1.545 6783	5 4425	- 419	0.837 9947	- 3 5189	- 227	2.147 9947
1.32	1.551 0790	5 4007	- 416	0.834 4531	- 3 5416	- 224	2.154 4531
1.33	1.556 4381	5 3591	- 413	0.830 8891	- 3 5640	- 220	2.160 8891
		5 3178			- 3 5860		
1.34	1.561 7559		- 410	0.827 3030		- 217	2.167 3030
1.35	1.567 0327	5 2768	- 407	0.823 6953	- 3 6078	- 214	2.173 6953
1.36	1.572 2688	5 2361	- 405	0.820 0661	- 3 6292	- 211	2.180 0661
1.37	1.577 4644	5 1956	- 402	0.816 4159	- 3 6503	- 208	2.186 4159
1.38	1.582 6199	5 1554	- 399	0.812 7448	- 3 6711	- 205	2.192 7448
		5 1155			- 3 6916		
1.39	1.587 7354		- 397	0.809 0532		- 202	2.199 0532
1.40	1.592 8112	5 0759	- 394	0.805 3414	- 3 7118	- 199	2.205 3414
1.41	1.597 8477	5 0364	- 392	0.801 6097	- 3 7317	- 196	2.211 6097
1.42	1.602 8449	4 9973	- 389	0.797 8584	- 3 7514	- 194	2.217 8584
1.43	1.607 8033	4 9583	- 387	0.794 0876	- 3 7707	- 191	2.224 0876
		4 9197			- 3 7898		
1.44	1.612 7229		- 384	0.790 2978		- 188	2.230 2978
1.45	1.617 6041	4 8812	- 382	0.786 4891	- 3 8087	- 186	2.236 4891
1.46	1.622 4471	4 8430	- 380	0.782 6618	- 3 8273	- 183	2.242 6618
1.47	1.627 2521	4 8050	- 378	0.778 8163	- 3 8456	- 181	2.248 8163
1.48	1.632 0194	4 7672	- 375	0.774 9526	- 3 8637	- 178	2.254 9526
		4 7297			- 3 8815		
1.49	1.636 7491		- 373	0.771 0711		- 176	2.261 0711
1.50	1.641 4414	4 6924	- 371	0.767 1720	- 3 8991	- 173	2.267 1720
1.51	1.646 0967	4 6552	- 369	0.763 2556	- 3 9164	- 171	2.273 2556
1.52	1.650 7150	4 6183	- 367	0.759 3220	- 3 9335	- 169	2.279 3220
1.53	1.655 2967	4 5816	- 365	0.755 3716	- 3 9504	- 167	2.285 3716
		4 5451			- 3 9671		
1.54	1.659 8418		- 363	0.751 4045		- 164	2.291 4045

Hyperbola:  $n=0$

$$10^{-2n}u = U = \sinh F - F$$

$$10^{-2n}c_h = C_h(U) = \cosh F - 1$$

$$10^{-n} s_h = S_h(U) = \sinh F$$

$$10^{-n} x_h = X_h(U) = F$$

$u$	$c_h$	$\delta$	$\delta^2$	$s_h$	$\delta$	$\delta^2$	$x_h$
1.50	2.594 5243		- 3712	3.452 6229		- 4939	1.952 6229
1.55	2.660 8784	66 3542	- 3530	3.521 6517	69 0288	- 4671	1.971 6517
1.60	2.726 8793	66 0009	- 3361	3.590 2130	68 5613	- 4426	1.990 2130
1.65	2.792 5440	65 6646	- 3205	3.658 3315	68 1185	- 4199	2.008 3315
1.70	2.857 8879	65 3439	- 3060	3.726 0299	67 6984	- 3990	2.026 0299
		65 0378			67 2992		
1.75	2.922 9257		- 2925	3.793 3291		- 3797	2.043 3291
1.80	2.987 6707	64 7451	- 2800	3.860 2484	66 9193	- 3618	2.060 2484
1.85	3.052 1357	64 4650	- 2683	3.926 8058	66 5574	- 3452	2.076 8058
1.90	3.116 3322	64 1965	- 2574	3.993 0178	66 2120	- 3299	2.093 0178
1.95	3.180 2712	63 9390	- 2471	4.058 8998	65 8820	- 3154	2.108 8998
		63 6917			65 5664		
2.00	3.243 9629		- 2374	4.124 4662		- 3020	2.124 4662
2.05	3.307 4171	63 4542	- 2285	4.189 7305	65 2644	- 2895	2.139 7305
2.10	3.370 6427	63 2256	- 2200	4.254 7053	64 9748	- 2777	2.154 7053
2.15	3.433 6482	63 0055	- 2120	4.319 4023	64 6969	- 2667	2.169 4023
2.20	3.496 4416	62 7934	- 2044	4.383 8324	64 4302	- 2563	2.183 8324
		62 5889			64 1737		
2.25	3.559 0304		- 1973	4.448 0061		- 2467	2.198 0061
2.30	3.621 4219	62 3915	- 1906	4.511 9331	63 9270	- 2375	2.211 9331
2.35	3.683 6227	62 2008	- 1842	4.575 6226	63 6894	- 2288	2.225 6226
2.40	3.745 6393	62 0166	- 1782	4.639 0831	63 4606	- 2207	2.239 0831
2.45	3.807 4776	61 8383	- 1724	4.702 3229	63 2398	- 2130	2.252 3229
		61 6658			63 0268		
2.50	3.869 1434		- 1670	4.765 3497		- 2057	2.265 3497
2.55	3.930 6423	61 4988	- 1618	4.828 1708	62 8211	- 1987	2.278 1708
2.60	3.991 9793	61 3370	- 1568	4.890 7931	62 6223	- 1922	2.290 7931
2.65	4.053 1594	61 1801	- 1522	4.953 2231	62 4301	- 1859	2.303 2231
2.70	4.114 1873	61 0279	- 1477	5.015 4672	62 2441	- 1801	2.315 4672
		60 8802			62 0640		
2.75	4.175 0674		- 1434	5.077 5312		- 1744	2.327 5312
2.80	4.235 8042	60 7368	- 1393	5.139 4208	61 8896	- 1691	2.339 4208
2.85	4.296 4016	60 5974	- 1354	5.201 1412	61 7205	- 1640	2.351 1412
2.90	4.356 8636	60 4620	- 1317	5.262 6977	61 5565	- 1591	2.362 6977
2.95	4.417 1938	60 3302	- 1281	5.324 0951	61 3974	- 1544	2.374 0951
		60 2021			61 2429		
3.00	4.477 3959		- 1247	5.385 3380		- 1500	2.385 3380
3.05	4.537 4733	60 0774	- 1214	5.446 4309	61 0929	- 1457	2.396 4309
3.10	4.597 4292	59 9559	- 1183	5.507 3781	60 9472	- 1417	2.407 3781
3.15	4.657 2668	59 8376	- 1152	5.568 1836	60 8055	- 1378	2.418 1836
3.20	4.716 9892	59 7224	- 1124	5.628 8512	60 6676	- 1341	2.428 8512
		59 6100			60 5336		
3.25	4.776 5992		- 1096	5.689 3847		- 1305	2.439 3847
3.30	4.836 0997	59 5004	- 1069	5.749 7878	60 4030	- 1271	2.449 7878
3.35	4.895 4932	59 3935	- 1043	5.810 0637	60 2759	- 1238	2.460 0637
3.40	4.954 7824	59 2892	- 1018	5.870 2158	60 1521	- 1206	2.470 2158

Ellipse:  $n=0$

$$10^{-3n}u = U = E - \sin E$$

$$10^{-3n}c_e = C_e(U) = 1 - \cos E$$

$$10^{-n}s_e = S_e(U) = \sin E$$

$$10^{-n}x_e = X_e(U) = E$$

$u$	$c_e$	$\delta$	$\delta^{**}$	$s_e$	$\delta$	$\delta^{**}$	$x_e$
1.54	1.659 8418		- 363	0.751 4045		- 164	2.291 4045
1.55	1.664 3507	4 5088	- 361	0.747 4210	- 3 9835	- 162	2.297 4210
1.56	1.668 8234	4 4727	- 359	0.743 4213	- 3 9997	- 160	2.303 4213
1.57	1.673 2602	4 4368	- 357	0.739 4056	- 4 0157	- 158	2.309 4056
1.58	1.677 6614	4 4011	- 355	0.735 3741	- 4 0315	- 156	2.315 3741
		4 3656			- 4 0471		
1.59	1.682 0270		- 353	0.731 3270		- 154	2.321 3270
1.60	1.686 3572	4 3302	- 352	0.727 2646	- 4 0624	- 152	2.327 2646
1.61	1.690 6523	4 2951	- 350	0.723 1870	- 4 0776	- 150	2.333 1870
1.62	1.694 9124	4 2601	- 348	0.719 0944	- 4 0926	- 148	2.339 0944
1.63	1.699 1377	4 2253	- 346	0.714 9871	- 4 1073	- 146	2.344 9871
		4 1907			- 4 1219		
1.64	1.703 3283		- 345	0.710 8651		- 144	2.350 8651
1.65	1.707 4845	4 1562	- 343	0.706 7288	- 4 1363	- 142	2.356 7288
1.66	1.711 6064	4 1219	- 341	0.702 5783	- 4 1505	- 140	2.362 5783
1.67	1.715 6942	4 0877	- 340	0.698 4138	- 4 1645	- 138	2.368 4138
1.68	1.719 7479	4 0538	- 338	0.694 2355	- 4 1783	- 136	2.374 2355
		4 0200			- 4 1920		
1.69	1.723 7679		- 337	0.690 0435		- 135	2.380 0435
1.70	1.727 7542	3 9863	- 335	0.685 8380	- 4 2055	- 133	2.385 8380
1.71	1.731 7070	3 9528	- 333	0.681 6193	- 4 2188	- 131	2.391 6193
1.72	1.735 6265	3 9195	- 332	0.677 3874	- 4 2319	- 130	2.397 3874
1.73	1.739 5127	3 8863	- 330	0.673 1426	- 4 2448	- 128	2.403 1426
		3 8532			- 4 2576		
1.74	1.743 3660		- 329	0.668 8849		- 126	2.408 8849
1.75	1.747 1863	3 8203	- 328	0.664 6147	- 4 2703	- 125	2.414 6147
1.76	1.750 9738	3 7876	- 326	0.660 3320	- 4 2827	- 123	2.420 3320
1.77	1.754 7288	3 7549	- 325	0.656 0369	- 4 2950	- 121	2.426 0369
1.78	1.758 4513	3 7225	- 323	0.651 7298	- 4 3072	- 120	2.431 7298
		3 6901			- 4 3191		
1.79	1.762 1414		- 322	0.647 4106		- 118	2.437 4106
1.80	1.765 7993	3 6579	- 321	0.643 0797	- 4 3310	- 117	2.443 0797
1.81	1.769 4251	3 6258	- 319	0.638 7370	- 4 3427	- 115	2.448 7370
1.82	1.773 0190	3 5939	- 318	0.634 3828	- 4 3542	- 114	2.454 3828
1.83	1.776 5811	3 5621	- 317	0.630 0172	- 4 3656	- 112	2.460 0172
		3 5304			- 4 3768		
1.84	1.780 1116		- 316	0.625 6404		- 111	2.465 6404
1.85	1.783 6104	3 4989	- 314	0.621 2525	- 4 3879	- 109	2.471 2525
1.86	1.787 0778	3 4674	- 313	0.616 8537	- 4 3988	- 108	2.476 8537
1.87	1.790 5139	3 4361	- 312	0.612 4440	- 4 4097	- 107	2.482 4440
1.88	1.793 9189	3 4049	- 311	0.608 0237	- 4 4203	- 105	2.488 0237
		3 3738			- 4 4309		
1.89	1.797 2927		- 310	0.603 5929		- 104	2.493 5929
1.90	1.800 6356	3 3429	- 308	0.599 1516	- 4 4413	- 102	2.499 1516
1.91	1.803 9476	3 3120	- 307	0.594 7001	- 4 4515	- 101	2.504 7001
1.92	1.807 2289	3 2813	- 306	0.590 2385	- 4 4616	- 100	2.510 2385
1.93	1.810 4796	3 2507	- 305	0.585 7668	- 4 4716	- 99	2.515 7668
		3 2202			- 4 4815		
1.94	1.813 6998		- 304	0.581 2853		- 97	2.521 2853

Hyperbola:  $n=0$

$$10^{-3n}u = U = \sinh F - F$$

$$10^{-3n}c_h = C_h(U) = \cosh F - 1$$

$$10^{-n}s_h = S_h(U) = \sinh F$$

$$10^{-n}x_h = X_h(U) = F$$

$u$	$c_h$	$\delta$	$\delta^{2*}$	$s_h$	$\delta$	$\delta^{2*}$	$x_h$
3.4	4.954 782	118 275	- 407	5.870 216	119 945	- 482	2.470 216
3.5	5.073 058	117 887	- 388	5.990 161	119 486	- 459	2.490 161
3.6	5.190 944	117 515	- 371	6.109 647	119 049	- 437	2.509 647
3.7	5.308 460	117 160	- 355	6.228 697	118 633	- 416	2.528 697
3.8	5.425 620	116 821	- 340	6.347 330	118 235	- 397	2.547 330
3.9	5.542 441	116 495	- 325	6.465 565	117 856	- 380	2.565 565
4.0	5.658 936		- 312	6.583 421		- 363	2.583 421
4.0	5.658 936		- 1 248	6.583 421	234 636	- 1 452	2.583 421
4.2	5.891 001	232 066	- 1 151	6.818 057	233 301	- 1 333	2.618 057
4.4	6.121 913	230 912	- 1 066	7.051 358	232 071	- 1 229	2.651 358
4.6	6.351 757	229 844	- 991	7.283 429	232 071	- 1 136	2.683 429
4.8	6.580 609	228 852	- 923	7.514 362	230 933	- 1 054	2.714 362
		227 927			229 878		
5.0	6.808 536	227 064	- 862	7.744 239	228 895	- 981	2.744 239
5.2	7.035 600	226 256	- 808	7.973 135	227 979	- 915	2.773 135
5.4	7.261 856	225 497	- 758	8.201 114	227 122	- 856	2.801 114
5.6	7.487 353	224 783	- 713	8.428 236	226 318	- 803	2.828 236
5.8	7.712 135	224 110	- 672	8.654 554	225 563	- 754	2.854 554
6.0	7.936 245	223 475	- 635	8.880 117	224 852	- 710	2.880 117
6.2	8.159 720	222 878	- 601	9.104 970	224 182	- 670	2.904 970
6.4	8.382 594	222 304	- 569	9.329 151	223 548	- 633	2.929 151
6.6	8.604 898	221 764	- 540	9.552 699	222 948	- 600	2.952 699
6.8	8.826 662	221 250	- 513	9.775 647	222 379	- 568	2.975 647
7.0	9.047 912	220 761	- 488	9.998 027	221 839	- 540	2.998 027
7.2	9.268 673	220 296	- 465	10.219 866	221 326	- 513	3.019 866
7.4	9.488 969	219 851	- 444	10.441 191	220 837	- 489	3.041 191
7.6	9.708 820	219 427	- 424	10.662 028	220 370	- 466	3.062 028
7.8	9.928 247	219 021	- 406	10.882 398	219 925	- 445	3.082 398
8.0	10.147 268		- 388	11.102 324		- 425	3.102 324
8.0	10.147 268		- 2 423	11.102 324	547 994	- 2 651	3.102 324
8.5	10.693 156	543 698	- 2 183	11.650 317	545 608	- 2 378	3.150 317
9.0	11.236 854	541 716	- 1 977	12.195 926	543 457	- 2 146	3.195 926
9.5	11.778 570	539 912	- 1 799	12.739 382	541 505	- 1 946	3.239 382
10.0	12.318 482	538 263	- 1 646	13.280 888	539 727	- 1 774	3.280 888
10.5	12.856 745	536 749	- 1 511	13.820 615	538 100	- 1 624	3.320 615
11.0	13.393 495	535 354	- 1 392	14.358 715	536 604	- 1 493	3.358 715
11.5	13.928 849	534 065	- 1 287	14.895 319	535 225	- 1 377	3.395 319
12.0	14.462 914		- 1 194	15.430 544		- 1 274	3.430 544

Ellipse:  $n=0$

$$10^{-2\mu} u = U = E - \sin E$$

$$10^{-2\mu} c_e = C_e(U) = 1 - \cos E$$

$$10^{-\mu} s_e = S_e(U) = \sin E$$

$$10^{-\mu} x_e = X_e(U) = E$$

$u$	$c_e$	$\delta$	$\delta^{2'}$	$s_e$	$\delta$	$\delta^{2'}$	$x_e$
1.94	1.813 6998		- 304	0,581 2853		- 97	2,521 2853
1.95	1.816 8896	3 1898	- 303	0,576 7940	- 4 4913	- 96	2,526 7940
1.96	1.820 0491	3 1595	- 302	0,572 2932	- 4 5009	- 95	2,532 2932
1.97	1.823 1784	3 1293	- 301	0,567 7828	- 4 5104	- 94	2,537 7828
1.98	1.826 2776	3 0992	- 300	0,563 2630	- 4 5197	- 92	2,543 2630
		3 0692			- 4 5290		
1.99	1.829 3469		- 299	0,558 7341		- 91	2,548 7341
2.00	1.832 3862	3 0394	- 298	0,554 1960	- 4 5381	- 90	2,554 1960
2.01	1.835 3958	3 0096	- 297	0,549 6488	- 4 5471	- 89	2,559 6488
2.02	1.838 3757	2 9799	- 296	0,545 0928	- 4 5560	- 88	2,565 0928
2.03	1.841 3260	2 9503	- 295	0,540 5280	- 4 5648	- 87	2,570 5280
		2 9208			- 4 5734		
2.04	1.844 2468		- 294	0,535 9546		- 85	2,575 9546
2.05	1.847 1382	2 8914	- 293	0,531 3726	- 4 5820	- 84	2,581 3726
2.06	1.850 0003	2 8621	- 292	0,526 7822	- 4 5904	- 83	2,586 7822
2.07	1.852 8332	2 8329	- 291	0,522 1835	- 4 5987	- 82	2,592 1835
2.08	1.855 6369	2 8037	- 290	0,517 5765	- 4 6069	- 81	2,597 5765
		2 7747			- 4 6150		
2.09	1.858 4116		- 290	0,512 9615		- 80	2,602 9615
2.10	1.861 1574	2 7458	- 289	0,508 3384	- 4 6230	- 79	2,608 3384
2.11	1.863 8743	2 7169	- 288	0,503 7075	- 4 6309	- 78	2,613 7075
2.12	1.866 5624	2 6881	- 287	0,499 0688	- 4 6387	- 77	2,619 0688
2.13	1.869 2218	2 6594	- 286	0,494 4224	- 4 6464	- 76	2,624 4224
		2 6308			- 4 6539		
2.14	1.871 8525		- 285	0,489 7685		- 75	2,629 7685
2.15	1.874 4548	2 6022	- 285	0,485 1071	- 4 6614	- 74	2,635 1071
2.16	1.877 0285	2 5738	- 284	0,480 4383	- 4 6688	- 73	2,640 4383
2.17	1.879 5739	2 5454	- 283	0,475 7622	- 4 6760	- 72	2,645 7622
2.18	1.882 0910	2 5171	- 282	0,471 0790	- 4 6832	- 71	2,651 0790
		2 4889			- 4 6903		
2.19	1.884 5799		- 282	0,466 3887		- 70	2,656 3887
2.20	1.887 0406	2 4607	- 281	0,461 6915	- 4 6972	- 69	2,661 6915
2.21	1.889 4732	2 4326	- 280	0,456 9874	- 4 7041	- 68	2,666 9874
2.22	1.891 8778	2 4046	- 279	0,452 2765	- 4 7109	- 67	2,672 2765
2.23	1.894 2544	2 3767	- 279	0,447 5589	- 4 7176	- 66	2,677 5589
		2 3488			- 4 7242		
2.24	1.896 6032		- 278	0,442 8348		- 65	2,682 8348
2.25	1.898 9242	2 3210	- 277	0,438 1041	- 4 7306	- 64	2,688 1041
2.26	1.901 2175	2 2933	- 277	0,433 3671	- 4 7370	- 63	2,693 3671
2.27	1.903 4831	2 2656	- 276	0,428 6237	- 4 7434	- 62	2,698 6237
2.28	1.905 7211	2 2380	- 275	0,423 8742	- 4 7496	- 61	2,703 8742
		2 2105			- 4 7557		
2.29	1.907 9316		- 275	0,419 1185		- 60	2,709 1185
2.30	1.910 1145	2 1830	- 274	0,414 3567	- 4 7617	- 59	2,714 3567
2.31	1.912 2701	2 1556	- 273	0,409 5891	- 4 7677	- 59	2,719 5891
2.32	1.914 3984	2 1282	- 273	0,404 8155	- 4 7735	- 58	2,724 8155
2.33	1.916 4993	2 1010	- 272	0,400 0363	- 4 7793	- 57	2,730 0363
		2 0737			- 4 7850		
2.34	1.918 5730		- 272	0,395 2513		- 56	2,735 2513

Hyperbola:  $n=0$

$$10^{-2n}u = U = \sinh F - F$$

$$10^{-2n}c_h = C_h(U) = \cosh F - 1$$

$$10^{-n}x_h = S_h(U) = \sinh F$$

$$10^{-n}x_h = X_h(U) = F$$

$u$	$c_h$	$\delta$	$\delta^2$	$s_h$	$\delta$	$\delta^2$	$x_h$
12	14.462 914		- 4 764	15.430 544		- 5 086	3.430 544
13	15.527 539	1064 625	- 4 135	16.497 259	1066 714	- 4 396	3.497 259
14	16.588 007	1060 468	- 3 625	17.559 555	1062 297	- 3 839	3.559 555
15	17.644 833	1056 826	- 3 205	18.617 996	1058 441	- 3 383	3.617 996
16	18.698 441	1053 608	- 2 854	19.673 042	1055 045	- 3 004	3.673 042
		1050 743			1052 031		
17	19.749 184		- 2 559	20.725 073		- 2 686	3.725 073
18	20.797 360	1048 176	- 2 308	21.774 409	1049 337	- 2 417	3.774 409
19	21.843 221	1045 861	- 2 093	22.821 322	1046 913	- 2 187	3.821 322
20	22.886 984	1043 763	- 1 907	23.866 042	1044 720	- 1 988	3.866 042
20	22.886 984		- 7 596	23.866 042		- 7 919	3.866 042
22	24.968 938	2081 955	- 6 388	25.949 677	2083 635	- 6 637	3.949 677
24	27.044 455	2075 516	- 5 449	28.026 620	2076 943	- 5 664	4.026 620
26	29.114 486	2070 031	- 4 704	30.097 878	2071 258	- 4 864	4.097 878
28	31.179 786	2065 300	- 4 103	32.164 244	2066 366	- 4 234	4.164 244
		2061 176			2062 112		
30	33.240 962		- 3 611	34.226 357		- 3 719	4.226 357
32	35.298 511	2057 549	- 3 204	36.284 734	2058 378	- 3 294	4.284 734
34	37.352 845	2054 334	- 2 862	38.339 806	2055 072	- 2 938	4.339 806
36	39.404 307	2051 462	- 2 572	40.391 930	2052 125	- 2 637	4.391 930
38	41.453 190	2048 883	- 2 324	42.441 410	2049 480	- 2 380	4.441 410
		2046 552			2047 094		
40	43.499 742		- 2 111	44.488 504		- 2 159	4.488 504
42	45.544 177	2044 436	- 1 926	46.533 434	2044 929	- 1 968	4.533 434
44	47.586 683	2042 505	- 1 764	48.576 391	2042 957	- 1 801	4.576 391
46	49.627 420	2040 737	- 1 622	50.617 543	2041 152	- 1 655	4.617 543
48	51.666 532	2039 112	- 1 497	52.657 037	2039 494	- 1 526	4.657 037
		2037 612			2037 966		
50	53.704 144		- 1 386	54.695 003		- 1 411	4.695 003
52	55.740 368	2036 224	- 1 286	56.731 555	2036 552	- 1 309	4.731 555
54	57.775 304	2034 936	- 1 198	58.766 797	2035 241	- 1 218	4.766 797
56	59.809 041	2033 737	- 1 117	60.800 818	2034 021	- 1 136	4.800 818
58	61.841 659	2032 618	- 1 045	62.833 702	2032 884	- 1 062	4.833 702
		2031 572			2031 821		
60	63.873 231		- 980	64.865 523		- 995	4.865 523
62	65.903 821	2030 591	- 920	66.896 347	2030 825	- 934	4.896 347
64	67.933 491	2029 669	- 867	68.926 237	2029 989	- 879	4.926 237
66	69.962 293	2028 802	- 817	70.955 246	2029 009	- 828	4.955 246
68	71.990 277	2027 985	- 771	72.983 426	2028 180	- 782	4.983 426
		2027 212			2027 398		
70	74.017 489		- 730	75.010 824		- 740	5.010 824
72	76.043 972	2026 482	- 692	77.037 481	2026 657	- 701	5.037 481
74	78.069 762	2025 790	- 656	79.063 438	2025 956	- 664	5.063 438
76	80.094 895	2025 134	- 623	81.088 729	2025 291	- 631	5.088 729
78	82.119 405	2024 510	- 593	83.113 389	2024 660	- 600	5.113 389
		2023 916			2024 059		
80	84.143 321		- 565	85.137 449		- 571	5.137 449

Ellipse:  $n=0$

$$10^{-3n}u = U = E - \sin E$$

$$10^{-3n}c_e = C_e(U) = 1 - \cos E$$

$$10^{-n}s_e = S_e(U) = \sin E$$

$$10^{-n}x_e = X_e(U) = E$$

$u$	$c_e$	$\delta$	$\delta''$	$s_e$	$\delta$	$\delta''$	$x_e$
2.34	1.918 5730		- 272	0.395 2513		- 56	2.735 2513
2.35	1.920 6196	2 0466	- 271	0.390 4607	- 4 7906	- 55	2.740 4607
2.36	1.922 6390	2 0194	- 271	0.385 6646	- 4 7961	- 54	2.745 6646
2.37	1.924 6314	1 9924	- 270	0.380 8631	- 4 8015	- 53	2.750 8631
2.38	1.926 5968	1 9654	- 269	0.376 0562	- 4 8069	- 53	2.756 0562
		1 9385			- 4 8121		
2.39	1.928 5353		- 269	0.371 2441		- 52	2.761 2441
2.40	1.930 4469	1 9116	- 268	0.366 4268	- 4 8173	- 51	2.766 4268
2.41	1.932 3316	1 8847	- 268	0.361 6044	- 4 8224	- 50	2.771 6044
2.42	1.934 1896	1 8580	- 267	0.356 7770	- 4 8274	- 49	2.776 7770
2.43	1.936 0208	1 8312	- 267	0.351 9447	- 4 8323	- 48	2.781 9447
		1 8045			- 4 8372		
2.44	1.937 8253		- 266	0.347 1075		- 48	2.787 1075
2.45	1.939 6032	1 7779	- 266	0.342 2656	- 4 8419	- 47	2.792 2656
2.46	1.941 3546	1 7513	- 265	0.337 4190	- 4 8466	- 46	2.797 4190
2.47	1.943 0794	1 7248	- 265	0.332 5677	- 4 8513	- 45	2.802 5677
2.48	1.944 7777	1 6983	- 264	0.327 7119	- 4 8558	- 45	2.807 7119
		1 6719			- 4 8602		
2.49	1.946 4496		- 264	0.322 8517		- 44	2.812 8517
2.50	1.948 0951	1 6455	- 263	0.317 9871	- 4 8646	- 43	2.817 9871
2.51	1.949 7142	1 6191	- 263	0.313 1181	- 4 8689	- 42	2.823 1181
2.52	1.951 3070	1 5928	- 263	0.308 2450	- 4 8731	- 41	2.828 2450
2.53	1.952 8736	1 5666	- 262	0.303 3677	- 4 8773	- 41	2.833 3677
		1 5403			- 4 8814		
2.54	1.954 4139		- 262	0.298 4863		- 40	2.838 4863
2.55	1.955 9281	1 5142	- 261	0.293 6010	- 4 8854	- 39	2.843 6010
2.56	1.957 4161	1 4880	- 261	0.288 7117	- 4 8893	- 38	2.848 7117
2.57	1.958 8780	1 4619	- 261	0.283 8186	- 4 8931	- 38	2.853 8186
2.58	1.960 3139	1 4359	- 260	0.278 9216	- 4 8969	- 37	2.858 9216
		1 4098			- 4 9006		
2.59	1.961 7237		- 260	0.274 0210		- 36	2.864 0210
2.60	1.963 1076	1 3839	- 259	0.269 1168	- 4 9042	- 36	2.869 1168
2.61	1.964 4655	1 3579	- 259	0.264 2090	- 4 9078	- 35	2.874 2090
2.62	1.965 7974	1 3320	- 259	0.259 2977	- 4 9113	- 34	2.879 2977
2.63	1.967 1036	1 3061	- 258	0.254 3830	- 4 9147	- 33	2.884 3830
		1 2803			- 4 9180		
2.64	1.968 3838		- 258	0.249 4650		- 33	2.889 4650
2.65	1.969 6383	1 2545	- 258	0.244 5436	- 4 9213	- 32	2.894 5436
2.66	1.970 8670	1 2287	- 257	0.239 6191	- 4 9245	- 31	2.899 6191
2.67	1.972 0699	1 2029	- 257	0.234 6915	- 4 9276	- 31	2.904 6915
2.68	1.973 2471	1 1772	- 257	0.229 7608	- 4 9307	- 30	2.909 7608
		1 1515			- 4 9337		
2.69	1.974 3987		- 257	0.224 8271		- 29	2.914 8271
2.70	1.975 5246	1 1259	- 256	0.219 8905	- 4 9366	- 29	2.919 8905
2.71	1.976 6248	1 1003	- 256	0.214 9510	- 4 9395	- 28	2.924 9510
2.72	1.977 6995	1 0747	- 256	0.210 0087	- 4 9423	- 27	2.930 0087
2.73	1.978 7486	1 0491	- 255	0.205 0638	- 4 9450	- 26	2.935 0638
		1 0236			- 4 9476		
2.74	1.979 7722		- 255	0.200 1162		- 26	2.940 1162

Hyperbola:  $n=0$

$$10^{-3}u \approx U = \sinh F - F$$

$$10^{-2n}c_h \approx C_h(U) = \cosh F - 1$$

$$10^{-n}s_h \approx S_h(U) = \sinh F$$

$$10^{-n}x_h \approx X_h(U) = F$$

$u$	$c_h$	$\delta$	$\delta^2$	$s_h$	$\delta$	$\delta^2$	$x_h$
80	84.143 321			85.137 449			5.137 449
85	89.200 697	5057 376	- 3 523	90.195 154	5057 705	- 3 565	5.195 154
90	94.254 926	5054 229	- 3 136	95.249 676	5054 523	- 3 171	5.249 676
95	99.306 336	5051 410	- 2 809	100.301 351	5051 675	- 2 839	5.301 351
100	104.355 208	5048 872	- 2 531	105.350 462	5049 111	- 2 556	5.350 462
		5046 574	- 2 293		5046 791	- 2 314	
105	109.401 782			110.397 253			5.397 253
110	114.446 265	5044 483	- 2 086	115.441 934	5044 681	- 2 105	5.441 934
115	119.488 837	5042 572	- 1 906	120.484 687	5042 753	- 1 923	5.484 687
120	124.529 656	5040 820	- 1 749	125.525 673	5040 986	- 1 764	5.525 673
125	129.568 863	5039 206	- 1 610	130.565 033	5039 360	- 1 623	5.565 033
		5037 716	- 1 488		5037 858	- 1 499	
130	134.606 579			135.602 891			5.602 891
135	139.642 914	5036 335	- 1 379	140.639 359	5036 467	- 1 389	5.639 359
140	144.677 966	5035 052	- 1 281	145.674 534	5035 175	- 1 290	5.674 534
145	149.711 823	5033 857	- 1 193	150.708 506	5033 972	- 1 202	5.708 506
150	154.744 565	5032 741	- 1 115	155.741 354	5032 848	- 1 122	5.741 354
		5031 697	- 1 043		5031 797	- 1 050	
155	159.776 261			160.773 151			5.773 151
160	164.806 978	5030 717	- 979	165.803 962	5030 811	- 985	5.803 962
165	169.836 774	5029 796	- 920	170.833 847	5029 885	- 925	5.833 847
170	174.865 703	5028 929	- 866	175.862 860	5029 013	- 871	5.862 860
			- 817			- 822	
175	179.894 666			180.891 873			5.891 873
180	184.921 152	10055 449	- 3 263	185.918 463	10055 603	- 3 282	5.918 463
185	189.946 066	10052 520	- 2 919	190.941 053	10052 658	- 2 935	5.941 053
190	194.973 672	10049 886	- 2 626	195.971 121	10050 011	- 2 640	5.971 121
195	199.999 309	10047 504	- 2 376	200.999 689	10047 617	- 2 387	6.000 309
200	205.023 559	10045 340	- 2 159	206.021 132	10045 443	- 2 169	6.021 132
205	210.046 332			211.041 145			6.041 145
210	215.071 063			216.068 749			6.068 749
215	220.093 876			221.093 802			6.093 802
220	225.116 403	10043 365	- 1 971	226.114 192	10043 459	- 1 980	6.114 192
225	230.137 956	10041 555	- 1 806	231.134 605	10041 641	- 1 814	6.134 605
230	235.159 768	10039 891	- 1 661	236.154 934	10039 970	- 1 668	6.154 934
235	240.180 851	10038 354	- 1 535	241.184 289	10038 428	- 1 540	6.180 289
240	245.201 323	10036 932	- 1 419	246.199 293	10037 000	- 1 425	6.199 293
245	250.221 295			251.213 863			6.213 863
250	255.241 214			256.227 690			6.227 690
255	260.259 968			261.240 873			6.240 873
260	265.279 568			266.253 506			6.253 506
265	270.298 026			271.265 189			6.265 189
270	275.316 500	10035 612	- 1 318	276.314 691	10035 675	- 1 323	6.314 691
275	280.333 991	10034 383	- 1 227	281.333 366	10034 442	- 1 231	6.333 366
280	285.351 112	10033 236	- 1 145	286.350 366	10033 297	- 1 149	6.350 366
285	290.368 496			291.362 809			6.362 809
290	295.386 496			296.384 809			6.384 809
295	300.404 119			301.406 809			6.404 809
300	305.419 732			306.418 100			6.418 100

Ellipse:  $n=0$

$$10^{-10}u = U = E - \sin E$$

$$10^{-10}c_r = C_r(U) = 1 - \cos E$$

$$10^{-10}s_r = S_r(U) = \sin E$$

$$10^{-10}x_r = X_r(U) = E$$

$u$	$c_r$	$\delta$	$\delta^{2'}$	$s_r$	$\delta$	$\delta^{2'}$	$x_r$
2.74	1.979 7722	9981	-255	0.200 1162	-4 9502	-26	2.940 1162
2.75	1.980 7702	9726	-255	0.195 1660	-4 9527	-25	2.945 1660
2.76	1.981 7428	9471	-255	0.190 2133	-4 9551	-24	2.950 2133
2.77	1.982 6899	9217	-254	0.185 2581	-4 9575	-24	2.955 2581
2.78	1.983 6116	8962	-254	0.180 3006	-4 9598	-23	2.960 3006
2.79	1.984 5078	8709	-254	0.175 3408	-4 9621	-22	2.965 3408
2.80	1.985 3787	8455	-254	0.170 3787	-4 9643	-22	2.970 3787
2.81	1.986 2241	8201	-253	0.165 4144	-4 9664	-21	2.975 4144
2.82	1.987 0443	7948	-253	0.160 4481	-4 9684	-20	2.980 4481
2.83	1.987 8391	7695	-253	0.155 4797	-4 9704	-20	2.985 4797
2.84	1.988 6086	7442	-253	0.150 5093	-4 9723	-19	2.990 5093
2.85	1.989 3528	7189	-253	0.145 5370	-4 9742	-18	2.995 5370
2.86	1.990 0718	6937	-252	0.140 5628	-4 9759	-18	3.000 5628
2.87	1.990 7655	6685	-252	0.135 5869	-4 9777	-17	3.005 5869
2.88	1.991 4339	6433	-252	0.130 6092	-4 9793	-17	3.010 6092
2.89	1.992 0772	6181	-252	0.125 6299	-4 9809	-16	3.015 6299
2.90	1.992 6952	5929	-252	0.120 6490	-4 9824	-15	3.020 6490
2.91	1.993 2881	5677	-252	0.115 6666	-4 9839	-15	3.025 6666
2.92	1.993 8558	5425	-252	0.110 6827	-4 9853	-14	3.030 6827
2.93	1.994 3983	5174	-251	0.105 6974	-4 9866	-13	3.035 6974
2.94	1.994 9157	4923	-251	0.100 7108	-4 9879	-13	3.040 7108
2.95	1.995 4080	4672	-251	0.095 7229	-4 9891	-12	3.045 7229
2.96	1.995 8752	4421	-251	0.090 7338	-4 9902	-11	3.050 7338
2.97	1.996 3172	4170	-251	0.085 7436	-4 9913	-11	3.055 7436
2.98	1.996 7342	3919	-251	0.080 7523	-4 9923	-10	3.060 7523
2.99	1.997 1261	3668	-251	0.075 7600	-4 9933	-10	3.065 7600
3.00	1.997 4929	3417	-251	0.070 7667	-4 9942	-9	3.070 7667
3.01	1.997 8346	3167	-251	0.065 7726	-4 9950	-8	3.075 7726
3.02	1.998 1513	2916	-250	0.060 7776	-4 9957	-8	3.080 7776
3.03	1.998 4430	2666	-250	0.055 7818	-4 9964	-7	3.085 7818
3.04	1.998 7096	2416	-250	0.050 7854	-4 9971	-6	3.090 7854
3.05	1.998 9512	2165	-250	0.045 7883	-4 9977	-6	3.095 7883
3.06	1.999 1677	1915	-250	0.040 7907	-4 9982	-5	3.100 7907
3.07	1.999 3592	1665	-250	0.035 7925	-4 9986	-4	3.105 7925
3.08	1.999 5258	1415	-250	0.030 7939	-4 9990	-4	3.110 7939
3.09	1.999 6673	1165	-250	0.025 7949	-4 9993	-3	3.115 7949
3.10	1.999 7837	915	-250	0.020 7956	-4 9996	-3	3.120 7956
3.11	1.999 8752	665	-250	0.015 7960	-4 9998	-2	3.125 7960
3.12	1.999 9417	415	-250	0.010 7962	-4 9999	-1	3.130 7962
3.13	1.999 9832	+ 165	-250	0.005 7963	-5 0000	-1	3.135 7963
3.14	1.999 9997	- 85	-250	+ 0.000 7963	-5 0000	0	3.140 7963
3.15	1.999 9912	- 85	-250	- 0.004 2037	-5 0000	-1	3.145 7963

Everett interpolation coefficients

(from "Interpolation and Allied Tables", London, H. M. Stationery Office, 1936)

$p$	$E_n^2$	$-\delta$	$E_n^2$	$-\delta$	
0 00	- 0 00000	328	0 00000	167	1 00
01	- 00328	319	00167	166	0 99
02	- 00647	308	- 00333	167	98
03	- 00955	299	00500	166	97
04	- 01254	290	00666	165	96
0 05	-0 01544	280	-0 00831	165	0 95
06	- 01821	270	- 00996	165	94
07	- 02094	261	- 01161	164	93
08	- 02355	252	- 01325	163	92
09	02607	243	01488	162	91
0 10	0 02850	234	-0 01650	161	0 90
11	- 03084	225	01811	160	89
12	- 03309	216	01971	159	88
13	- 03525	207	- 02130	158	87
14	- 03732	199	- 02288	156	86
0 15	0 03931	191	0 02144	154	0 85
16	01122	182	02598	153	84
17	04304	173	- 02751	152	83
18	- 04477	166	02903	149	82
19	- 04643	157	03052	148	81
0 20	-0 04800	149	-0 03200	146	0 80
21	- 04949	142	03346	143	79
22	05091	133	03489	142	78
23	- 05224	126	03631	139	77
24	- 05350	119	- 03770	136	76
0 25	0 05469	111	-0 03906	134	0 75
26	- 05580	103	04040	132	74
27	- 05683	96	- 04172	129	73
28	05779	89	04301	126	72
29	- 05868	82	04427	123	71
0 30	- 0 05950	75	0 04550	120	0 70
31	06025	68	04670	117	69
32	- 06093	61	04787	114	68
33	- 06154	54	04901	111	67
34	- 06208	48	- 05012	107	66
			$E_n^2$		$p$

Everett interpolation coefficients—Continued

$p$	$E_0'$	$-\delta$	$E_1'$	$-\delta$	
0 35	- 0 06256	42	- 0 05119	103	0 65
36	- .06298	35	- .05222	100	. 64
37	- .06333	28	- .05322	97	. 63
38	- .06361	23	- .05419	92	. 62
39	- .06381	16	- .05511	89	. 61
0 40	-0 06100	10	-0 05600	85	0 60
. 41	06110	5	.05685	80	. 59
. 42	06115	2	.05765	77	. 58
. 43	06113	7	.05842	72	. 57
. 44	06106	12	.05914	67	. 56
0 45	0 06394	18	-- 0 05981	63	0 55
. 46	- .06376	24	-- .06011	59	. 54
. 47	06352	29	- .06103	54	. 53
. 48	06323	34	06157	49	. 52
. 49	- .06289	39	- .06206	44	. 51
0 50	-0 06250		--0 06250		0 50
	$E_1'$		$E_0'$		$p$

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