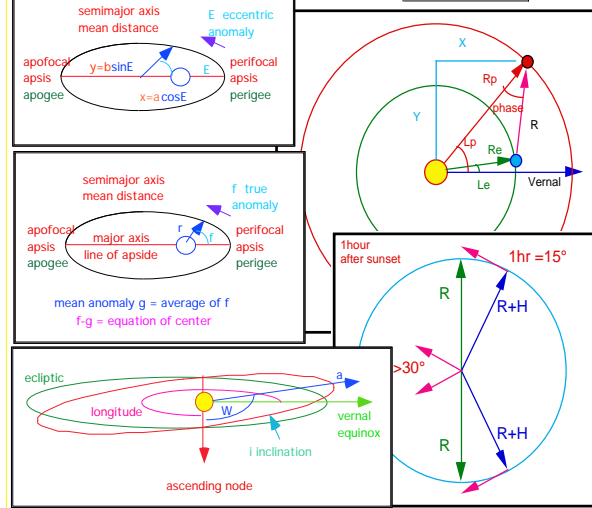
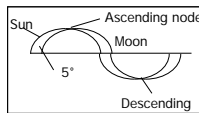


$P_{period\_sec} = 2\pi(O)^{1.5}/\sqrt{k^2\mu}$	k constant of grav
$g = g_0 + n^*(t-t_0) = \mu d^*(t-T) = \text{mean daily}^*(\text{time since per})$	$k^2_{cm^3/gsec^2} = 6.6623E-08$
g0 and t0 at some epoch	$\mu_{sum\_mass} = 1.99E+30$
$e = \text{eccentric} = \sqrt{1 - (b^2/a^2)}$	M_sun_kgm = 1.9910E+30
Kepler 3d law	m_earth_kgm = 5.9790E+24
$n^2 a^3 = k^2 \mu$	a_earth_km = 1.4957E+08
Kepler equation	P_period_sec = 31557088.1
$g = E - e^* \sin(E)$	P_period_days = 365.2440752
find true anomaly f ...and radius r	Day_'' = 0.985642272
$r^* \cos(f) = a^*(\cos(E) - e)$	Day_''' = 3548.312178
$r^* \sin(f) = a^* \sqrt{1 - e^2} \sin(E)$	n_radians = mean motion
where $g^* a^{1.5} = k = 3548.31 \text{second}$	a_semimajor axis = 2*Pi(O)_rad = 360
a in astronomical units	24hr_'' = 360
find heliocentric coordinates	1hr_'' = 15
w=distance from ascending node to perhelion	1min_'' = 15
= longitude of ascending node	1sec_'' = 15
$\mu d = \text{mean daily motion}$	
e= eccentricity	
i=incline to ecliptic	
$y = r^*(\sin(\ )^* \cos(f+w) + \cos(\ )^* \sin(f+w) \cos(i))$	
$x = r^*(\cos(\ )^* \cos(f+w) - \sin(\ )^* \sin(f+w) \cos(i))$	
$z = r^* \sin(f+w) \sin(i)$	
find geocentric coordinates	
Re=radius earth	
Le=long earth	
Ae=atlitude earth	
R =radius earth to planet	
Lp=long planet	
Ap=atlitude planet	
$R \cos(Ap) \cos(Lp) = x + Re \cos(-Ae) \cos(-Le)$	
$R \cos(Ap) \sin(Lp) = y + Re \cos(-Ae) \sin(-Le)$	
$R \sin(Ap) = z + Re \sin(-Ae)$	

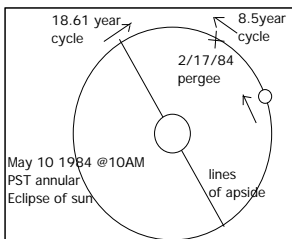


**MOON**  
 SIDREAL PERIOD 27days 7hours 43.2minutes  
 New Moon 29days 12hours 44.05minutes  
 INCLINE OF ORBIT 5°8'  
 5°18' to 4°59' due to external  
 Regression of Nodes 18.6 years  
 Advance of perogee 8.85 years

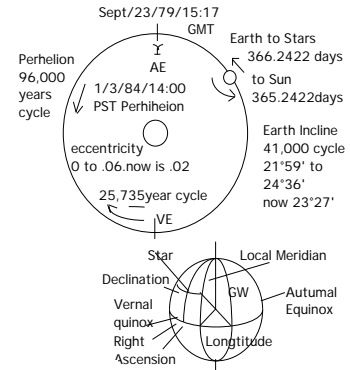


**TIDES**  
 NEW OR FULL MOON-SUN + MOON =SPRING TIDES  
 QUARTER MOON TIDES CANCEL OUT= HEAP TIDES

**ECLIPSES**  
 Eclipse year=346.6 days  
 recurrent eclipse=saros  
 223 synalic months=18 years 11+1/3 days  
 Feb 26 1975 Eclipse  
 Begin 16h 9.2m GMT  
 Aparent noon 17h 21.4m  
 End 17h 39.0  
 Max duration 2m 49s  
 Portland Oregon Lat(45°31'06'')Lo(122°40'35'')  
 San Jose Lat(37°20'16'')Lo(121°53'24'')



**EARTH**  
 1 TROPICAL YEAR 1900  
 31 556 926.9747 SEC  
 Decreases .53 secs per year  
 Days increase 1 millisecc per century  
 due to tidal friction  
 ±5 millisecc 5 to 10 year cycle  
 due to internal of earth  
 Earth late 30msec in June  
 Earth ahead 30 msec in Oct  
 North Pole remains in a 40ft radius  
 around postion of pole  
 Magnetic Pole 1970  
 north 76.2N 101W  
 south 66S 139.1E  
 Precession of 23.5° due to moon  
 cause Vernal Equinox to move 50''  
 of an arc per year .25735 year  
 cycle move northpole in clockwise  
 direction



Navigation diagrams showing Earth, Sun, and Moon with labels like GW, Sun, Mon, La1, Lo1, La2, Lo2, D in degrees.

**NAVIGATION**  
 $\cos D = \sin La1 \sin La2 + \cos La1 \cos La2 \cos(Lo1 - Lo2)$   
**ECLIPSE**  
 $x^2/a^2 + y^2/b^2 = 1$   
 FocI=ae  
 $e = \{(a^2 - b^2)/a\}^{1/2}$

$F = ma = Gmm/R^2$   
 $G = 6.670E-11 Nm^2/Kgm^2$   
 acceleration in circle= $v^2/R$   
 Energy= $1/2mv^2$   
 Impulse= $f \cdot t$   
 momentum= $mv$

	LONGITUDE ASCENDING NODE DEG	RADIUS Km	MASSdiff between noon and Kgm expected noon	EQUATION OF TIME due to ecliptic orbit	SOLAR DAY
SUN	695950	1.99E+30	Feb 1, 1.3m, 2.6s slow	JAN 24H 0M 29S	
MERC	47.667	2433	3.18E+23 March 1, 1.2m, 3s slow	APRIL 23H 59M 42S	
VEN	76.183	6053	4.88E+24 April 1, 4m, 8s slow	JULY 24H 0M 12S	
EARTH	6371.315	AV	5.98E+24 May 1, 2m, 5.3s fast	OCT 23H 59M 41S	
MOON	1738.3	7.35E+22	July 1, 3.31s slow	UT=24 HOUR GMT	
MARS	49.133	3380	6.42E+23 Aug 1, 6m 14s slow	PST =UT-8 Pacific Std	
JUP	99.883	69758	1.90E+30 Sept 1, 0m 11s slow	EST=UT-5 Eastern	
SAT	113.167	58219	5.68E+26 Oct 1, 10m 5s fast	MST=UT-7 Mountain	
URAN	73.717	23470	8.68E+25 Nov 16m 19s fast	CST=UT-6 Central	
NEP	131.167	22716	1.03E+26 Dec 1, 11m 9s fast	PDT=UT-7 Pacific Daylit	
PLUTO	131.278	5700	1.08E+24	(April 24 to Oct 29)	
HALLEY	58				

	REVOLUTION TO ORBIT	EQUATOR TO ORBIT	ORBIT TO ECLIPTIC	ECCENT	LONGITUDE PERHELION DEG (a-x)	PERHELION
SUN	Solar Sec	DEGREES	DEG			
MERC						
VEN	7.60E+06	0	7.0028	5.80E+07	0.2056	76.583 4.60E+07
EARTH	1.94E+07	R179.0	3.4	1.08E+08	0.0068	130.783
MOON	3.16E+07	23.45	0	1.50E+08	0.0167	101.983 1.47E+08
MARS	2.36E+09	6.683	5.12	3.84E+05	0.0549	3.63E+05
JUP	5.94E+07	25.2	1.85	2.28E+08	0.0934	335.033
SAT	3.74E+08	3.117	1.309	7.78E+08	0.0484	13.417
URAN	9.30E+08	26.75	2.493	1.43E+09	0.0543	91.95
NEP	2.65E+09	R97.983	0.0773	2.87E+09	0.046	169.75
PLUTO	5.20E+09	29	1.779	4.50E+09	0.008	44.117
HALLEY	7.84E+09	297	17.146	5.91E+09	0.2481	270.059 4.4439 306? 8.82E+06

**SEASON & CLOCK DATES**  
 Spring Equinox (Spring begins & day and night equal length) March 20  
 Daylight saving time starts. move 1 hr ahead. 2a.m. on first Sunday in April  
 Summer Solstice (summer begin & sun is farthest north of the equator) June 20  
 Autumn Equinox (Fall begins & day and night equal length) September 22  
 Daylight saving time End, move 1 hr back 2 a.m. on last Sunday in October  
 mnt Solstice (winter begin & sun is farthest south of the equator) December 21

**SIGNS OF THE ZODIAC**

Name	Symbol	Dates	
Aries	Ram	March 21-April 19	1900 88°46'
Taurus	Bull	April 20-May 20	1910 88°50'
Gemini	Twins	May 21-June 20	1920 88°53'
Cancer	Crab	June 21-July 22	1930 88°56'
Leo	Lion	July 23-Aug 22	1940 88°59'
Virgo	Virgin	Aug 23-Sept 22	1950 89°02'
Libra	Balance	Sept 23-Oct 22	1970 89°05'
Scorpio	Scorpion	Oct 23-Nov 21	1980 89°08'
Sagittarius	Archer	Nov 22-Dec 21	1990 89°11'
Capricorn	Goat	Dec 22- Jan 19	2000 89°14'
Aquarius	WaterBearer	Jan 20-Feb 18	2010 89°20'
Pisces	Fish	Feb 19- March 20	

**POLARIS MUST BE OBSERVE 12 HOURS APART TO SET POLE DECLINATION OF POLARIS**