An Easy Introduction to

PRIMARY DIRECTIONS

By Deborah Houlding

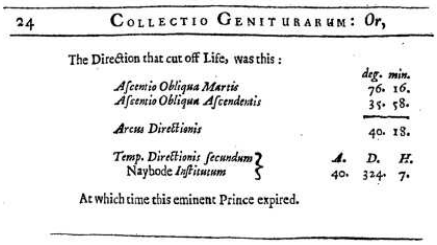
2009 Update:

In 2005, before we had Martin Gansten's new book on Primary Directions, I circulated this tutorial to my students as an introduction to what primary directions are, and how they can be calculated using a system tool built into a computer running Windows. I am not an expert on the subject of primary directions myself and struggle along with the mathematics, getting very nervous around words like tan, sin and cosine. It was as much for my benefit as anyone else's that I created a visual, step-by-step reminder of how to manually perform the calculation. Experts need not read further, but new students and astrologers who fear mathematical terms will hopefully find this tutorial to be of value. If you take your time, follow the reasoning, and recreate the example as you go along, any astrologer should be able to reproduce the extremely interesting example direction from the chart of King Henry II of France, which John Gadbury claimed was the cause of his death.

[*N.B.* This tutorial was designed to accompany a presentation I gave regarding that particular direction, so if you have not already read my article Gauricus and the Warning of Death given to King Henry II of France, you should read that first and then return to this document].

In this tutorial:

Our working example:


24 COLLECTIO GENITURARUM: Or,

The Direction that cut off Life, was this :

	deg. min.
Ascensio Obliqua Martis	76. 16.
Ascensio Obliqua Ascendentis	35. 58.
Arcus Directionis	40. 18.
Temp. Directionis secundum Naybode *Institutum*	*A.* 40. *D.* 324. *H.* 7.

At which time this eminent Prince expired.

From John Gadbury's *Collection of Nativities*, 1661*

"...if any shall question how Gauricus could hit so right to the exercise this prince should lose his life by...

The direction which cut off his life was this:

The Oblique Ascension of Mars	76.16	
The Oblique Ascension of the Ascendant	35.58	
The Arc of Direction	40.18	[*deg. mins*]
Time of Direction according to Naibod's Instruction:	40. 324.7	[*years. days. hours*]

At which time this eminent prince expired"

* A digital reproduction, hosted by Paulo Alexandre Silva of Portugal, is available as a free download from his Medieval Astrology blog: http://www.astrologiamedieval.com/e-Books.htm

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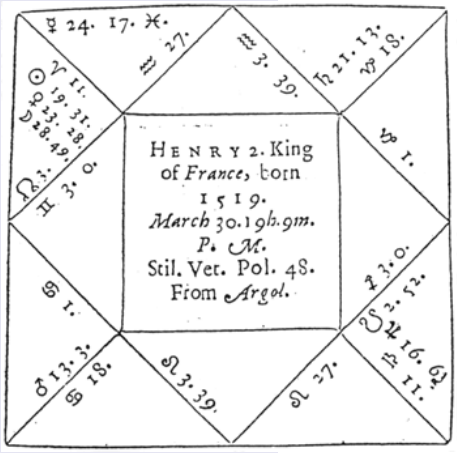
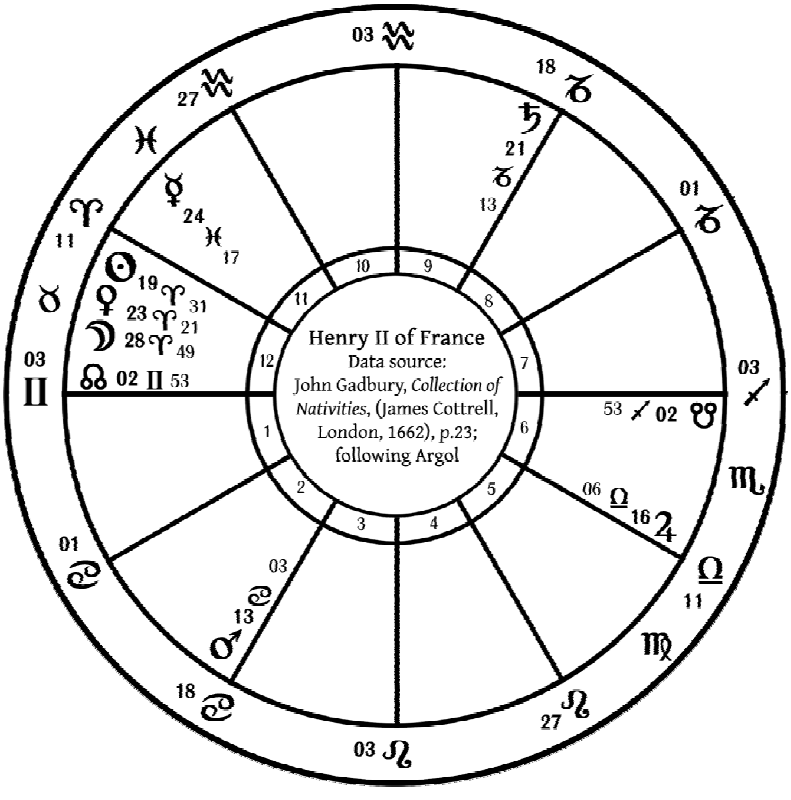
This tutorial will work towards manually calculating this primary direction using given tables and the calculator that is built into Windows software. To understand the importance of the direction, read the story about the warning of mortal injury given to Henry II by the astrologer Lucas Gauricus (at www.skyscript.co.uk/gauricus.html).





From the top:

Lucas Gauricus

King Henry II of France

John Gadbury

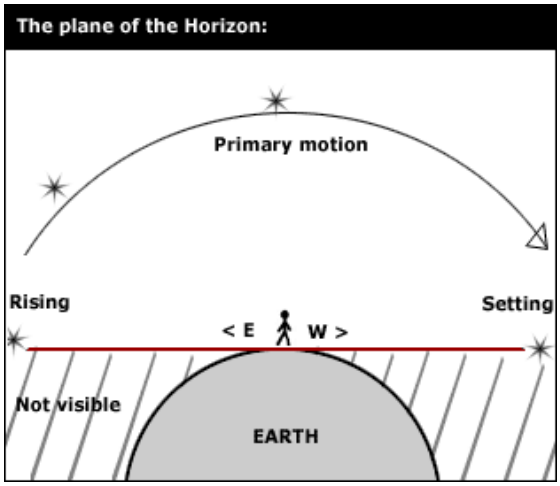
Henry's chart as published by Gadbury in the 17th century

Modern reproduction based on Gadbury's chart details

Primary Directions – What are they?

Today's popular predictive techniques - transits, solar returns and progressions – are based upon actual movements of planets. However, traditional authors placed the greatest emphasis upon mundane directions, or *primary directions*

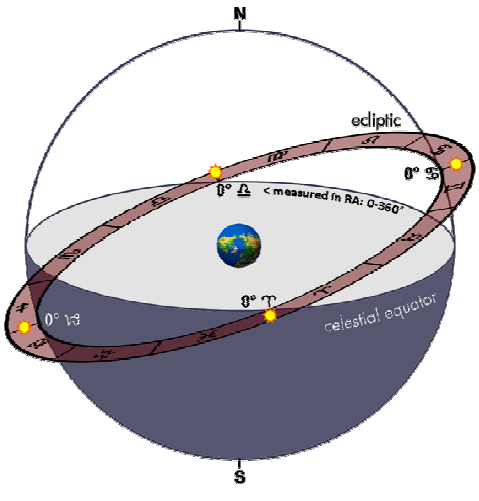
> – so named because they direct the angles and planets to new positions using only diurnal motion, (known as *primum mobile* or 'primary motion'). This is the apparent daily revolution of the sky which sees the heavenly sphere rise in the east, culminate on the midheaven and set in the west.



Primary motion is a constant and its frame of reference is right ascension, which is used in the recording of time.

> – Hence primary directions are time-based projections, used to reveal the time when the expected promise of aspects in the birth chart come to maximum expression. So first we identify the planets in the birth chart that signify danger or advancement; then we use their direction by primary motion to discover the age(s) in life when they become significant by exact contact with angles or other planets.

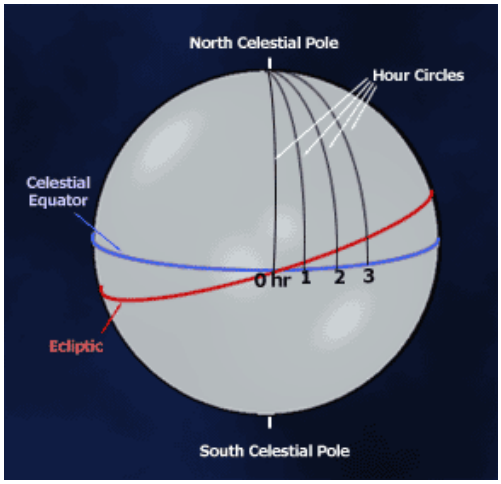
To understand primary directions you first need to have an understanding of what right ascension is.



Unless otherwise stated, images are created by the author

Understanding Right Ascension (RA)

Right ascension (RA) measures the easterly distance of an object from the vernal point (0°♈) along the plane of the celestial equator. In this, it is the celestial equivalent of terrestrial longitude (measuring positions east or west of the equator). It is partnered with declination, which is the celestial equivalent of terrestrial latitude (measuring positions north or south of the equator).



Right ascension makes it easy to use the apparent diurnal rotation of the celestial sphere as a means of telling time. In 24 hours a fixed point in the celestial sphere will move 360° in right ascension, which equates to a movement of 15° per hour.

Right ascension can therefore be measured in degrees and minutes of arc, or hours and minutes of time. In astrology we measure the distance in degrees of arc and then convert the result into time to obtain the age of the expected effect.

15° of right ascension crosses the sky in 1 hour of time

therefore **5° of R.A = 20 minutes of time**

1° of R.A. = 4 minutes of time

Whereas terrestrial longitude uses meridians of longitude, right ascension uses hour circles which run between the north and south celestial poles.

- Any object on the same hour circle will have the same degree of right ascension, just as any place on earth on the same meridian of longitude has the same celestial longitude.

- As a very rough and ready measure, hour circles cover about half a zodiac sign. But this varies: measuring in RA allows us to be more precise.

However, because of the flattening of the Earth's sphere in the polar regions, and the way the lines of RA converge towards the pole, it is only on the equator that one hour of RA corresponds *exactly* to 15° of arc. At other latitudes one hour of RA may correspond to a greater or lesser distance than 15°.

So it is only on the equator that all positions on the celestial sphere, rise and set with a true alignment to right ascension. When we use the term 'right ascension' we mean right as in 'correct', 'true', or 'properly aligned', meaning that at the equator the direction east is perfectly perpendicular to the horizon.

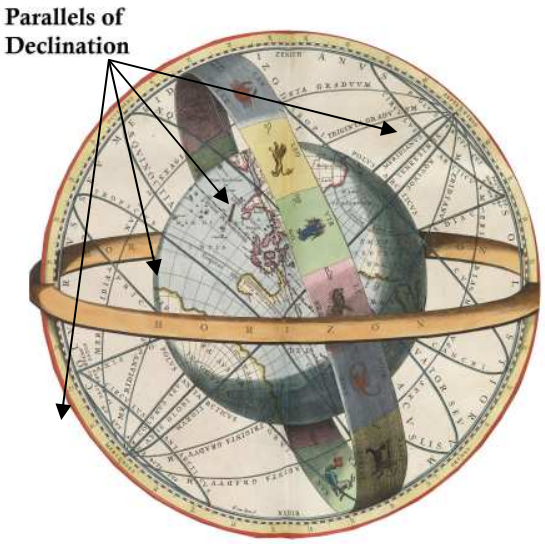


Image detail taken from plate 17 of *Harmonia Macrocosmica* by Andreas Cellarius, 1661.

With thanks to R.H. van Gent for permission to reproduce

(*Parallels of declination correspond to terrestrial latitude in the same way that right ascension corresponds to terrestrial longitude*)

Where a planet rises in latitudes north or the south of the equator, it forms an angle with that part of the equator which is rising at the same time. This angle represents the **Ascensional Difference (AD)** between the time that the planet rises at that latitude, to when it would have risen on the equator.

When we factor the ascensional difference into RA we obtain what is called the measure of **Oblique Ascension (OA).** It is this that is used to calculate the contacts in primary directions.

The midheaven, because it represents the point where the ecliptic cuts the equator due south, is always perpendicular to the cardinal directions east and west. Therefore we don't have to worry about the factor of oblique ascension when directing the midheaven. We need only measure the movement of the midheaven by right ascension.

However the ascendant is only due east at locations on the equator, so when we are directing planets beneath the horizon to the ascendant, we do need to factor in their oblique ascension, which recognises the effect of latitude.

TO FIND THE ASCENSIONAL DIFFERENCE & OBLIQUE ASCENSION OF A PLANET

For charts drawn in the northern hemisphere, **Oblique Ascension** (OA) is found by subtracting the Ascensional Difference (AD) from the Right Ascension (RA).

That is: **OA = RA – AD**

For charts drawn in the southern hemisphere, reverse the procedure so that **OA = RA + AD**

We can refer to the table at the end to get the Right Ascension, so the main part of the procedure is to obtain the Ascensional Difference.

Calculating Ascensional Difference (AD)

Remember: the Ascensional Difference is the difference between the Right Ascension of any body and its Oblique Ascension: used chiefly as a way to express the difference in time between the rising or setting of a celestial body, and six o'clock; or, six hours from the meridian passage.

[*When you look at the next piece of text, please do not panic – any term that you need to understand will be explained!*]

To find the Ascensional Difference we use the formula:

AD = ArcSin (Tan *declination of degree* x Tan *geographical latitude*)

The geographical latitude is simply the latitude of birth. However, this formula requires calculation of the declination of the degree (DD), for which we also need to know the formula:

DD = ArcSin(Sin *oe* x Sin *ablong*)

Where ***oe*** = *obliquity of the ecliptic (23°30)*

ablong = *absolute longitude of the planet*

NB: In mathematical formulas involving tan, cosine or sin, a point denotes multiplication. So more properly you would find the formula above written as: **Arcsin = (Sin *oe* . Sin *ablong*)**. This is simply telling us that the sin value of the obliquity of the ecliptic is multiplied by the sin value of the absolute longitude of the planet. However, some people use 'x' to avoid confusion, as I have here.

Do not despair if you have never made calculations using tan, sin or cosine. They are based on laws that allow us to calculate angles and replace the need for complex tables of logarithms. We will step through the procedure using the example of Henry II of France. Note that in Gadbury's account of this chart we are told:

The direction which cut off his life was this:

Oblique ascension of Mars	76.16	
Oblique ascension of ascendant	35.58	
The arc of direction:	40.18	[deg.mins]
The time of the direction according to Naibod	40. 324.7	[years.days.hours]

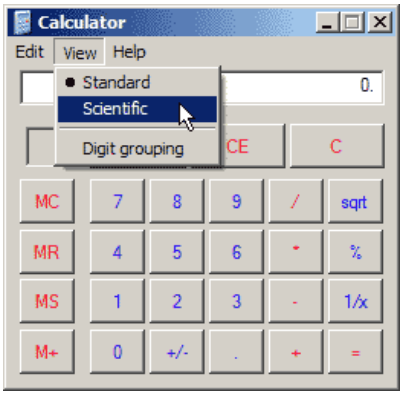
At which time this eminent prince expired.

STEP-BY-STEP PROCEDURE FOR CALCULATING PRIMARY DIRECTIONS

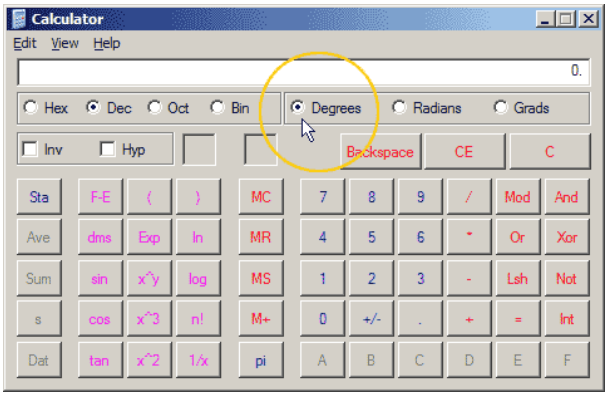
ON THE CALCULATOR BUILT INTO MICROSOFT WINDOWS

Open up your system calculator by going to **`Start > Programs > Accessories > Calculator`**

First change the calculator from **`Standard`** to **`Scientific`** mode under the **`View`** menu.

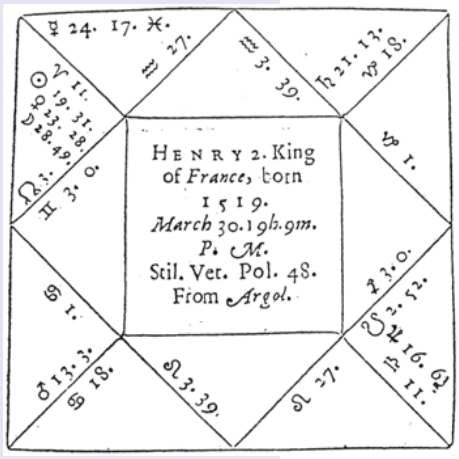


The calculator should look like this:



Make sure that the right-hand option is set to Degrees as circled in the diagram

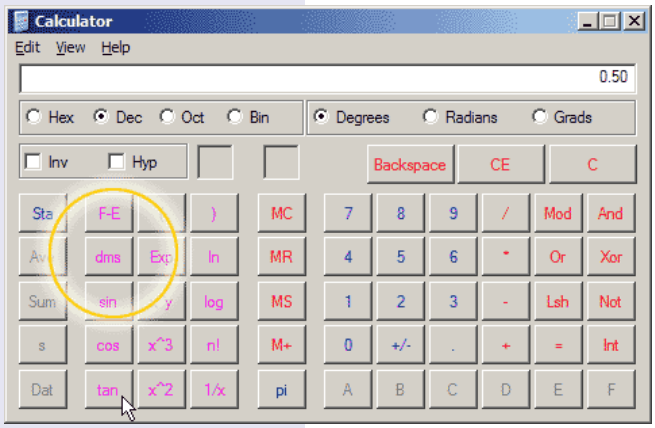
In order to follow Gadbury's example we need to know the longitude of the planets or points we are directing (3° Gemini for the ascendant; 13° 03 Cancer for Mars). The only other thing we need to know is the latitude of the place of birth.



▪ Henry was born at St Germaine on Laye in France. Gadbury used 48°N for the latitude and even though it is 'rounded up' we'll stick to that, because the purpose of this exercise is to demonstrate Gadbury's calculation.

In order to perform the calculation, you should realise that when we are working in degrees and minutes of arc, our figures are in *sexagisimal*, not *decimal* format. We need to be able to convert between sexagisimal and decimal format. It's easy enough to work out that 0° 30′ in sexagisimal is 0.5 as a decimal fraction; but where the calculation is not that simple, it may help to use the calculator. First we'll see how to convert half a degree from 0.5 as a decimal fraction to 0.30′ in sexagisimal.

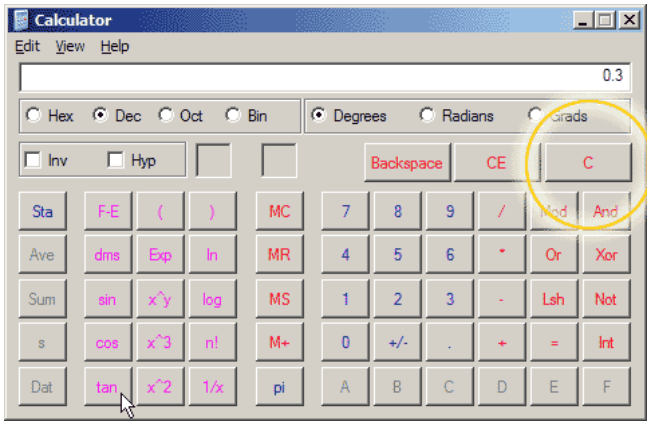
First enter **`0.50`** into your calculator and then click the **`dms`** [deg, min, sec] button:



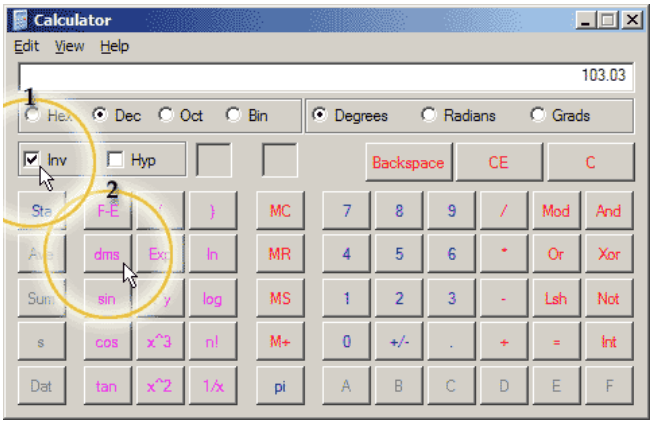
The result will be **`0.3`** – the equivalent of half a degree in sexagisimal. Of course we are used to seeing it as 0° 30′, but the calculator loses the trailing zero.

Next we will enter a new figure in degrees and minutes and use the calculator to obtain the decimal equivalent. We'll enter **`103° 03′`** – which will be required later as part of our example.

Remember to first press clear 'C' on your calculator to clear the screen for the next calculation.



First enter **103.03** into your calculator; then [1] tick the **inv** (inverse) box; and then [2] click the **dms** button:



By clicking the **inv** button we tell the calculator to perform the opposite of its normal function. Its normal function is to convert whole degrees and fractions into whole degrees and minutes, so its inverse function is to convert from degrees and minutes to decimal fractions. The result is **103.05**. You can understand what is happening when you consider that 3 minutes is 5% of a degree.

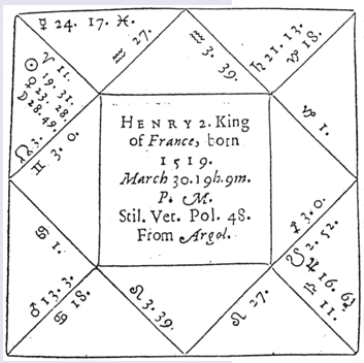
That's the hard part! Nothing you do next is more complicated than what you have already done; so relax – calculating oblique ascension is easy with sin, tan, a scientific calculator and the tables included.

Example 1. Calculation for the oblique ascension of Henry II's Mars:

Longitude of Mars:	13°03 Cancer (absolute longitude: 103°03)
Right Ascension of Mars:	104°11 (read from table of RA)
Latitude of birth place:	48°N

a) First calculate the declination of the degree (DD):

DD = ArcSin (Sin oe x Sin ablong)



- We'll do the easy bit first and fill in all the parts of the equation that we can easily establish. We know that **oe** is the obliquity of the ecliptic, which is 23½°. This can vary slightly through the ages, but at Henry II's time it was exactly 23°30' and this figure will meet the needs of current calculations until the end of the next century. We also know the absolute longitude of Mars from its zodiacal position. So:

DD = ArcSin (Sin 23°30' x Sin 103°03')

- Next we need to convert any figures that are in degrees of arc to decimal fractions. We demonstrated these two examples above so we can simply insert the answers here. Our equation now reads:

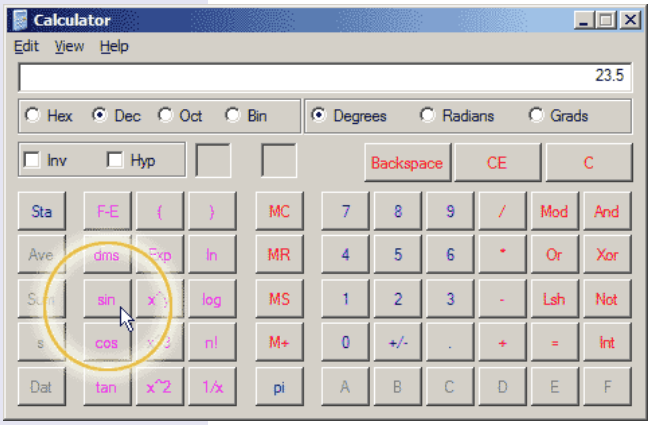
```
DD    = ArcSin (Sin 23.5 x Sin 103.05)
```

- As per usual, we perform the calculation inside the brackets before the calculation outside of it. So the next step is to find the sin of **23.5** and **103.05**. Follow the steps as demonstrated below:

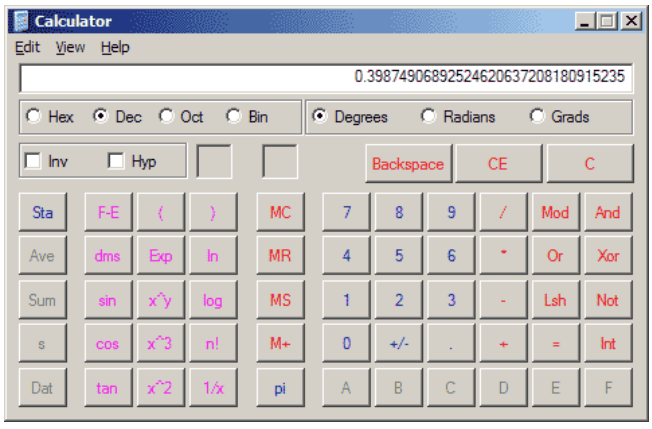
To obtain Sin 23.5:

First press **C** to clear the screen.

Enter **23.5** into the calculator, then press the **sin** button:



The result is a huge number:



Round the result to the first 4 figures after the decimal point.

Our answer is **0.3987**.

Now clear the screen and repeat the procedure for **103.05**

The result, rounded to 4 figures after the decimal point will be **0.9741**

- Our equation was:

DD = ArcSin (Sin 23.5 x Sin 103.05)

- Entering our calculated figures into the equation it now reads:

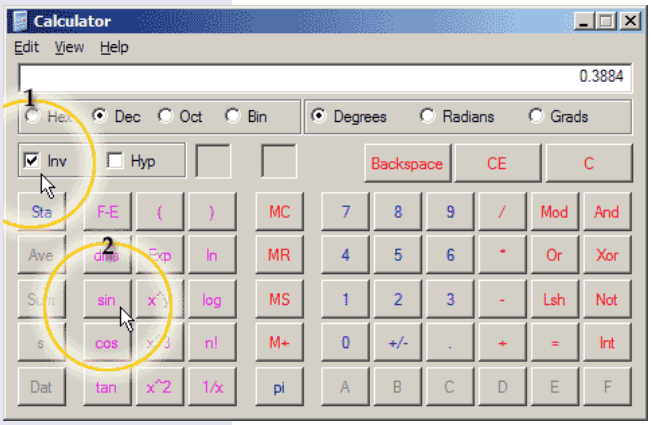
DD = ArcSin (0.3987 x 0.9741)

- We perform the calculation inside the brackets (simple multiplication) to simplify our equation to:

DD = ArcSin 0.3884

- **ArcSin** is also known as **inverse sin**. This is another example of telling the calculator to reverse its normal function so that we can obtain the decimal fraction that is equivalent to **Sin 0.3884**

To obtain the ArcSin of 0.3884:



First press **C** to clear the screen.

Enter **0.3884** into the calculator input area.

Next click the **inv** button.

Now press the **sin** button:

The answer is **22.85** (rounded to 2 figures after the decimal point)

The result of our calculation then, to find the declination of the degree of Mars is **22.85 as a decimal fraction**. Converted to degrees and minutes of arc this would be **22°51'** but it's the decimal fraction that we need for the next part of the calculation (to find the ascensional difference) so we only need to calculate that.

That may seem a lot of work the first time you do this, but it's actually a very quick and simple procedure once you get familiar with it!

b) Now that we know the declination of the degree, we can calculate the Ascensional Difference (AD) of Mars:

As previously noted, the calculation to obtain the AD is:

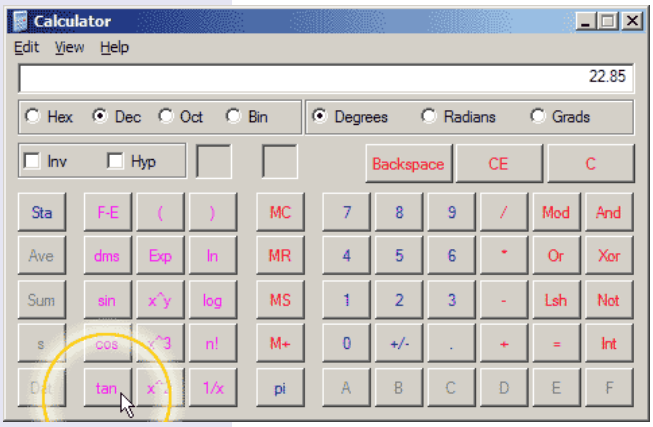
AD = ArcSin (Tan declination of degree x Tan geographical latitude)

- We already know the declination of the degree and the latitude of the place of birth so we can enter them straight into the equation:

AD = ArcSin (Tan 22.85 x Tan 48)

- Finding Tan is as easy as finding Sin:
-

To obtain the Tan of 22.85:



First press **C** to clear the screen.

Enter **22.85** into the calculator input area.

Now press the **tan** button:

The answer, rounded to 4 figures after the decimal point is **0.4213**.

Now clear the screen and repeat the procedure to obtain **Tan 48**.

The answer is **1.1106**

- We can now simplify the equation and complete it as per the previous instruction:

AD = ArcSin (0.4213 x 1.1106)

= ArcSin 0.4679

= 27.90 [as a fraction, rounded to 2 figures after the decimal point]

= 27°54' [converted to degrees and minutes]

(* For southern hemisphere charts the formula is reversed to **OA = RA + AD**)

c) Now that we have the ascensional difference we can complete the calculation of the oblique ascension of Mars in King Henry's chart:

Remember, the formula to calculate oblique ascension is

OA = Right ascension – Ascensional Difference*

RA has been established as **104°11′**

AD has been established as **27°54′**

Result of AD subtracted from RA = **76°17**

Gadbury calculates the oblique ascension of Mars as 76°16. Since he used tables instead of a calculator this minor difference need not trouble us.

Example 2. Calculation for the oblique ascension of Henry II's ascendant:

Longitude of asc: 3° Gemini (absolute longitude: 63°)
Right Ascension of Asc: 60°57 (read from table of RA)
Latitude of birth place: 48°N

a) Calculate the declination of the degree of the asc:

DD = ArcSin (Sin oe x Sin ablong)
= ArcSin (Sin 23.50 x Sin 63)* *converted to decimal*
= ArcSin (0.3987 x 0.8910)
= ArcSin 0.3552
= 20.80 **as a decimal fraction*

b) Now calculate the Ascensional Difference of the asc:

AD = ArcSin (Tan DD x Tan latitude)
= ArcSin (Tan 20.80 x Tan 48)
= ArcSin (0.3799 x 1.1106)
= ArcSin 0.4219
= 24.95 * *as a decimal fraction*
= 24°57′

c) Now calculate the Oblique Ascension of the asc:

OA = RA - AD
= 60°57′ – 24°57′
= 36°

Gadbury calculates the oblique ascension of the ascendant as 35°58.

All we now need to do is work out how many degrees separate the oblique ascension of the ascendant and Mars to work out the arc of direction between them:

Oblique ascension of Mars	= 76°17	
Oblique ascension of Asc	= 36°00	
Arc of direction	**= 40° 17**	[Gadbury obtains 40° 18]

USING THE ARC OF DIRECTION TO FIND THE AGE WHEN THE DIRECTION BECOMES EXACT:

Underneath the calculation of his arc of direction Gadbury writes *"Temp Directionis Secundum Naybode Institutum"* - meaning 'The Time of Direction according to Naibod's Instruction'

The philosophy of primary directions recognises a symbolic link between the Sun's movement in a day and a year of life. Since there are 365 days in the year, and the Sun travels through 360° in a year, a rough measure would be to say that 1° of movement along the equator relates to one year of life.

However, this is not an exact rate of direction. The 16th century astrologer Valentine Naibod argued that to get the correct mean measure for the Sun's daily movement we must divide the day into as many parts as there are days in the year. The solar day is 24hr, 03 min and 57 seconds in sidereal time – dividing that by 365.24 gives an angular measure of 0°59′08″ (equivalent to 0.985 as a decimal fraction). Thus to find the age when the direction becomes exact we must divide the arc of direction by the Sun's mean motion of 0°59′08″.

Astrologers such as Lilly and Gadbury simply referred to Naibod's Table of the Measure of Time. This is generally no longer available but a copy of the table is preserved in Alan Leo's *Progressed Horoscope* (1905)

A larger copy of Naibod's table can be found on the final page (p.16)

Note – the first two columns convert degrees of arc; the last two columns convert minutes of arc into time

NAIBOD'S TABLE OF THE MEASURE OF TIME.

Measure of Time for Degrees.						Measure of Time for Minutes.					
°	Yrs.	Days.	°	Yrs.	Days	′	Days.	Hrs.	′	Days.	Hrs.
0	0	0	30	30	160	0	0	0	30	185	7
1	1	5	31	31	166	1	6	4	31	191	11
2	2	10	32	32	171	2	12	8	32	197	16
3	3	16	33	33	177	3	18	13	33	203	20
4	4	21	34	34	181	4	24	17	34	209	0
5	5	26	35	35	186	5	30	21	35	216	4
6	6	32	36	36	192	6	37	1	36	222	9
7	7	37	37	37	197	7	43	6	37	228	13
8	8	43	38	38	202	8	49	10	38	234	17
9	9	48	39	39	208	9	55	14	39	240	21
10	10	53	40	40	213	10	61	18	40	247	2
11	11	59	41	41	218	11	68	23	41	253	6
12	12	64	42	42	224	12	74	3	42	259	10
13	13	69	43	43	229	13	80	7	43	265	14
14	14	74	44	44	234	14	86	11	44	271	18
15	15	80	45	45	240	15	92	16	45	277	23
16	16	85	46	46	245	16	98	20	46	284	3
17	17	90	47	47	250	17	105	0	47	290	7
18	18	96	48	48	256	18	111	4	48	296	11
19	19	101	49	49	261	19	117	9	49	302	16
20	20	106	50	50	266	20	123	13	50	308	20
21	21	112	51	51	272	21	129	17	51	315	0
22	22	117	52	52	277	22	135	21	52	321	4
23	23	122	53	53	282	23	142	1	53	327	9
24	24	128	54	54	288	24	148	6	54	333	13
25	25	133	55	55	293	25	154	10	55	339	17
26	26	138	56	56	298	26	160	14	56	345	21
27	27	144	57	57	304	27	166	18	57	352	2
28	28	149	58	58	309	28	172	23	58	358	6
29	29	154	59	59	314	29	179	3	59	364	10
30	30	160	60	60	320	30	185	7	60	370	14

Gadbury's arc of direction between the ascendant and Mars in King Henry's chart was 40°18′

40° = 40 yrs + 213 days
18′ =111 days + 4 hrs

The total gives:
40 yrs 324 days + 4hrs

Gadbury worked it out as:
40 yrs 324 days + 7hrs

We need not worry about the 3hrs difference!

For Gadbury's account of King Henry's chart see: A Collection of Nativities, *1662; pp.23-24; available online on Paulo Alexandre Silva of Portugal's 'Medieval Astrology' blog:*

www.astrologiamedieval.com/e-Books.htm

Tables to convert degrees of zodiacal longitude to their equivalent right ascension

TABLES OF RIGHT ASCENSION

	♈	♉	♊	♋	♌	♍
Deg.	Deg. Min.	Deg. Min.	Deg. Min.	Deg. Min.	Deg. Min.	Deg. Min.
0	0 00	27 54	57 48	90 00	122 12	152 06
1	0 55	28 51	58 51	91 05	123 14	153 06
2	1 50	29 49	59 54	92 12	124 16	154 00
3	2 45	30 46	60 57	93 17	125 18	154 57
4	3 40	31 44	62 00	94 22	126 20	155 54
5	4 35	32 42	63 03	95 27	127 23	156 51
6	5 30	33 40	64 06	96 33	128 24	157 48
7	6 25	34 39	65 09	97 38	129 25	158 45
8	7 20	35 37	66 13	98 43	130 26	159 41
9	8 15	36 36	67 17	99 48	131 27	160 37
10	9 11	37 35	68 21	100 53	132 27	161 33
11	10 06	38 34	69 25	101 58	133 28	162 39
12	11 01	39 33	70 29	103 03	134 29	163 25
13	11 57	40 32	71 33	104 08	135 29	164 21
14	12 52	41 31	72 38	105 13	136 29	165 17
15	13 48	42 31	73 43	106 17	137 29	166 12
16	14 43	43 31	74 47	107 22	138 29	167 08
17	15 39	44 31	75 52	108 27	139 28	168 03
18	16 35	45 31	76 57	109 31	140 27	168 59
19	17 31	46 32	78 02	110 35	141 26	169 54
20	18 27	47 33	79 07	111 39	142 25	170 49
21	19 23	48 33	80 12	112 43	143 24	171 45
22	20 19	49 34	81 17	113 47	144 23	172 40
23	21 15	50 35	82 22	114 51	145 21	173 35
24	22 12	51 36	83 27	115 54	146 20	174 30
25	23 09	52 38	84 33	116 57	147 18	175 25
26	24 06	53 40	85 38	118 00	148 16	176 20
27	25 03	54 42	86 43	119 03	149 14	177 15
28	26 00	55 44	87 48	120 06	150 11	178 10
29	26 55	56 46	88 53	121 09	151 09	179 05
30	27 54	57 48	90 00	122 12	152 06	180 00

	♎	♏	♐	♑	♒	♓
Deg.	Deg. Min	Deg. Min	Deg. Min	Deg. Min	Deg. Min	Deg. Min
0	180 00	207 54	237 48	270 00	302 12	332 06
1	180 55	208 51	238 51	271 06	303 14	333 03
2	181 50	209 49	239 54	272 12	304 16	334 00
3	182 45	210 46	240 57	273 17	305 18	334 57
4	183 40	211 44	242 00	274 22	306 20	335 54
5	184 35	212 42	243 03	275 27	307 22	336 51
6	185 30	213 40	244 06	276 33	308 24	337 48
7	186 25	214 39	245 09	277 38	309 25	338 45
8	187 20	215 37	246 13	278 43	310 26	339 41
9	188 15	216 36	247 17	279 48	311 27	340 37
10	189 11	217 35	248 21	280 53	312 27	341 33
11	190 06	218 34	249 25	281 58	313 28	342 29
12	191 01	219 33	250 29	283 03	314 29	343 25
13	191 57	220 32	251 33	284 08	315 29	344 21
14	192 52	221 31	252 38	285 13	316 29	345 17
15	193 48	222 31	253 43	286 17	317 29	346 12
16	194 43	223 31	254 47	287 22	318 29	347 08
17	195 39	224 31	255 52	288 27	319 28	348 03
18	196 35	225 31	256 57	289 31	320 27	348 59
19	197 31	226 32	258 02	290 35	321 26	349 54
20	198 27	227 33	259 07	291 39	322 25	350 50
21	199 23	228 33	260 12	292 43	323 24	351 45
22	200 19	229 34	261 17	293 45	324 23	352 45
23	201 15	230 35	262 22	294 51	325 21	353 35
24	202 12	231 36	263 27	295 54	326 20	354 30
25	203 09	232 38	264 33	296 57	327 18	355 25
26	204 06	233 40	265 38	298 00	328 16	356 20
27	205 03	234 42	266 44	299 03	329 14	357 15
28	206 00	235 44	267 49	300 06	330 11	358 10
29	206 57	236 46	268 54	301 09	331 08	359 05
30	207 54	237 48	270 00	302 12	332 06	360 00

Reproduced from Alan Leo's *Progressed Horoscope* (1905)

Note – the first two columns convert degrees of arc; the last two columns convert minutes of arc into time (see example on p.14)

NAIBOD'S TABLE OF THE MEASURE OF TIME.

Measure of Time for DEGREES. *Measure of Time for* MINUTES.

°	Yrs.	Days.	°	Yrs.	Days	′	Days.	Hrs.	′	Days.	Hrs.
0	0	0	30	30	160	0	0	0	30	185	7
1	1	5	31	31	166	1	6	4	31	191	11
2	2	10	32	32	171	2	12	8	32	197	16
3	3	16	33	33	177	3	18	13	33	203	20
4	4	21	34	34	181	4	24	17	34	209	0
5	5	26	35	35	186	5	30	21	35	216	4
6	6	32	36	36	192	6	37	1	36	222	9
7	7	37	37	37	197	7	43	6	37	228	13
8	8	43	38	38	202	8	49	10	38	234	17
9	9	48	39	39	208	9	55	14	39	240	21
10	10	53	40	40	213	10	61	18	40	247	2
11	11	59	41	41	218	11	68	23	41	253	6
12	12	64	42	42	224	12	74	3	42	259	10
13	13	69	43	43	229	13	80	7	43	265	14
14	14	74	44	44	234	14	86	11	44	271	18
15	15	80	45	45	240	15	92	16	45	277	23
16	16	85	46	46	245	16	98	20	46	284	3
17	17	90	47	47	250	17	105	0	47	290	7
18	18	96	48	48	256	18	111	4	48	296	11
19	19	101	49	49	261	19	117	9	49	302	16
20	20	106	50	50	266	20	123	13	50	308	20
21	21	112	51	51	272	21	129	17	51	315	0
22	22	117	52	52	277	22	135	21	52	321	4
23	23	122	53	53	282	23	142	1	53	327	9
24	24	128	54	54	288	24	148	6	54	333	13
25	25	133	55	55	293	25	154	10	55	339	17
26	26	138	56	56	298	26	160	14	56	345	21
27	27	144	57	57	304	27	166	18	57	352	2
28	28	149	58	58	309	28	172	23	58	358	6
29	29	154	59	59	314	29	179	3	59	364	10
30	30	160	60	60	320	30	185	7	60	370	14