Section 1.3 – Measurement of Rotation – Day 2

Instead of using decimals for subdivisions of a degree, we may also use the notion of minutes and seconds.

One minute, denoted by $1'$, is defined as $\dfrac{1}{60}$ degree.

One second, denoted $1''$, is defined as $\dfrac{1}{60}$ minute $= \dfrac{1}{3600}$ degree.

So, $1^\circ = 60' \quad \Rightarrow$ 1 degree is 60 minutes
$1' = 60'' \quad \Rightarrow$ 1 minute is 60 seconds

$35^\circ\, 10'\, 20''$ is an angle of 35 degrees, 10 minutes, 20 seconds. It is said to be written in $D^\circ\, M'\, S''$ form.

Example 6: a) Convert $40^\circ\, 7'\, 16''$ to a decimal in degrees.

Know $1' = \left(\dfrac{1}{60}\right)^\circ$ and $1'' = \left(\dfrac{1}{60}\right)' = \left(\dfrac{1}{3600}\right)^\circ$

$$40^\circ\, 7'\, 16'' = \left(40 + 7\left(\frac{1}{60}\right) + 16\left(\frac{1}{3600}\right)\right)^\circ$$
$$\approx (40 + 0.116667 + 0.004444)^\circ$$
$$\approx 40.121111^\circ$$
$$\approx 40.12^\circ$$

b) Convert 32.345° to the $D^\circ\, M'\, S''$ form.

Change 0.345° to minutes: $0.345^\circ = 0.345(1^\circ)$
$= 0.345\,(60')$
$= 20.7'$

Change $0.7'$ to seconds: $0.7' = 0.7(1')$
$= 0.7(60'')$
$= 42''$

$\Rightarrow 32.345^\circ = 32^\circ + 20.7'$
$= 32^\circ + 20' + 42''$
$= 32^\circ\, 20'\, 42''$

$D^\circ\, M'\, S''$ form is often used in finding the location of a boat at sea or the exact location of a star.

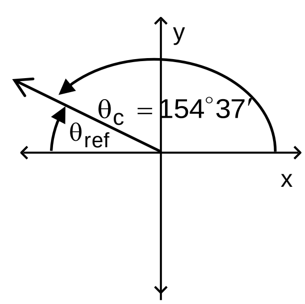
To solve problems 21 – 26 on page 15, do the following:
For the given angle, find the reference angle, then draw the angle in standard position.

21) $\theta = 154^\circ\ 37'$

Since the given angle θ is already coterminal, $\theta_c = 154^\circ\ 37'$.

θ_c is in Quadrant II,

so $\theta_{ref} = 180^\circ - \theta_c$
$= 180^\circ - 154^\circ 37'$
$= 179^\circ 60' - 154^\circ 37'$ ← Notice how I have rewritten 180° as 179 degrees and 60 minutes, i.e. $179^\circ 60'$
$= 25^\circ 23'$



Section 1.3 – Measurement of Rotation – Day 2 (continued)

Solve problems 31 – 34 on page 15, similarly to 21 – 26:

For the given angle, find the reference angle, then draw the angle in standard position.

Given $\theta = 295^\circ\ 17'\ 24''$

Since the given angle θ is already coterminal, $\theta_c = 295^\circ\ 17'\ 24''$.

θ_c is in Quadrant IV,

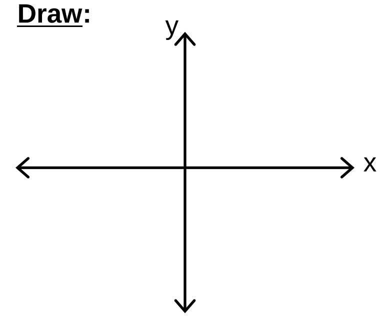
so $\theta_{ref} = 360^\circ - \theta_c$

$= 360^\circ - 295^\circ 17'\ 24''$

$= 359^\circ 59'\ 60'' - 295^\circ 17'\ 24''$ ← Notice how I have rewritten 360° as 359 degrees, 59 minutes, and 60 seconds, i.e. $359^\circ 59'\ 60''$

$= 64^\circ 42'\ 36''$

Draw:



For problems 27 – 30 on page 15, first find the coterminal angle θ_c.

For the given angle, find the reference angle, then draw the angle in standard position.

27) $\theta = 1066^\circ\ 9'$

Coterminal $\theta_c = \theta - 2(360^\circ)$

$= 1066^\circ 9' - 2(360^\circ)$

$= 1066^\circ 9' - 720^\circ$

$= 346^\circ 9'$

$\theta_c = 346^\circ 9'$ is in Quadrant IV,

so $\theta_{ref} = 360^\circ - \theta_c$

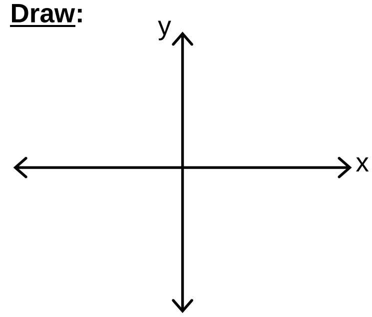
$=$

Complete

$=$

$=$

Draw:



All material has been taken from *Trigonometry,* by P. Foerster, 3rd Edition