Math 1030 #18a

Problem Solving with Geometry

Angles

Degrees, Minutes, Seconds

$1^{o} = 60'$ There are sixty minutes in a degree.

$1' = 60''$ There are sixty seconds in a minute.

$3600'' = 1^{\circ}$

EX 1: Convert 47.67º to degree-minutes-seconds.

$47.67^{\circ} = 47^{\circ} +$ some minutes & seconds

$0.67^{\cancel{\circ}}\left(\frac{60'}{1^{\cancel{\circ}}}\right) = 40.2' = 40' +$ some number of seconds

$0.2^{\cancel{\prime}}\left(\frac{60''}{1^{\cancel{\prime}}}\right) = 12'' \Rightarrow 47.67^{\circ} = \boxed{47^{\circ}\,40'\,12''}$

EX 2: Convert 150º 15' 27" to decimal degrees.

$15^{\cancel{\prime}}\left(\frac{1^{\circ}}{60^{\cancel{\prime}}}\right) = 0.25^{\circ}$

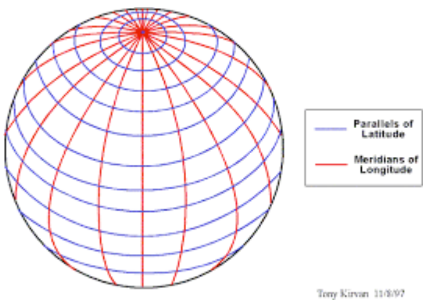
$27^{\cancel{\prime\prime}}\left(\frac{1^{\circ}}{3600^{\cancel{\prime\prime}}}\right) = 0.0075^{\circ}$

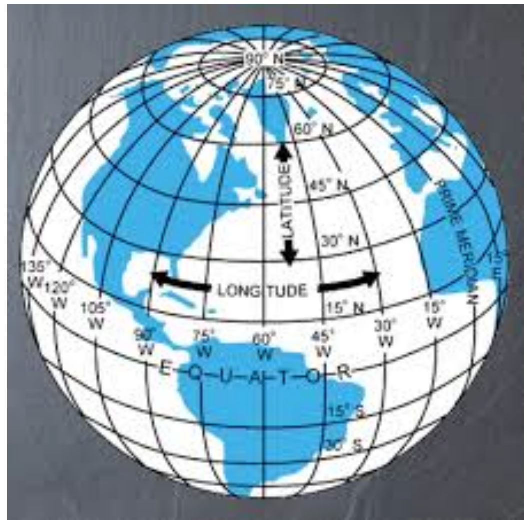
$150^{\circ}\,15'\,27''$

$= 150^{\circ} + 0.25^{\circ} + 0.0075^{\circ}$

$= 150.2575^{\circ}$

<u>Latitude and Longitude</u>





Latitude measures positions north or south of the equator. It will be a number between 0º and 90º.

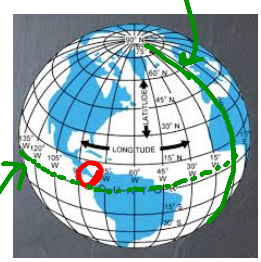
Longitude measures east-west position from the prime meridian. It will be a number between 0º and 180º.

EX 3: Determine the approximate latitude and longitude of the following places.

prime meridian

a) The Panama Canal

~ 9°N 80°W

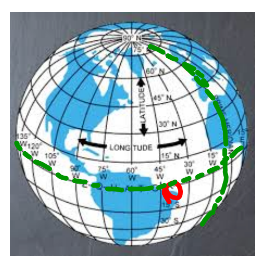


equator

b) The eastern most point in South America

(in Brazil)

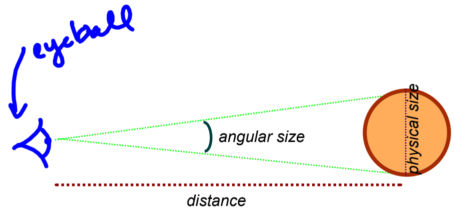
~ 20.5° S 29° W



c) The western most point in Alaska.

51°N 179°W

Angular Size and Distance



$$\frac{\text{angular size}}{360^\circ} = \frac{\text{physical size}}{2\pi \text{distance}}$$

EX 4: The moon has an angular size of 30 minutes (0.5º) and its distance from the earth is about 240,000 miles.

$$\frac{\text{angular size}}{360^\circ} = \frac{\text{physical size}}{2\pi \text{distance}}$$

a) What is the diameter of the moon? (actual diameter $\simeq 2159$ miles)

$$\frac{0.5^\circ}{360^\circ} = \frac{\text{phys. size}}{2\pi\,(240{,}000\text{ mi})} \Rightarrow \text{phys size} = 666.\overline{6}\pi \text{ miles} \simeq 2094.4 \text{ mi.}$$

b) At what distance would a tennis ball (2.5 " diameter) have to be so it would have the same angular size as the moon?

$$\frac{0.5^\circ}{360^\circ} = \frac{2.5\text{ in}}{2\pi(\text{dist})} \Leftrightarrow \text{dist}\left(\frac{0.5}{360}\right) = \frac{2.5\text{ in}}{2\pi}$$

$$\text{dist} = \frac{2.5\text{ in}}{2\pi}\left(\frac{360}{0.5}\right) \simeq 286.5 \text{ in} \simeq 24 \text{ ft}$$

c) What is the angular size of the tennis ball when held at arm's length from the eye (about 25")?

$$\frac{\text{ang. size}}{360^\circ} = \frac{2.5\,\cancel{\text{in}}}{2\pi(25\,\cancel{\text{in}})} \Rightarrow \text{ang size} = \frac{2.5(360^\circ)}{50\pi} \simeq 5.73^\circ$$

d) How far from Washington's face (60 ft in diameter) would you have to stand to have the tennis ball, held at arm's length, barely cover the face?

angular size $\simeq 6^\circ$

phys. size $= 60$ ft

dist = ?

$$\frac{6^\circ}{360^\circ} = \frac{60\text{ ft}}{2\pi\,(\text{dist})}$$

$$\text{dist} = \frac{60\text{ ft}}{2\pi}\left(\frac{360}{6}\right) \simeq 573 \text{ ft}$$

(a little less than 2 football fields away)