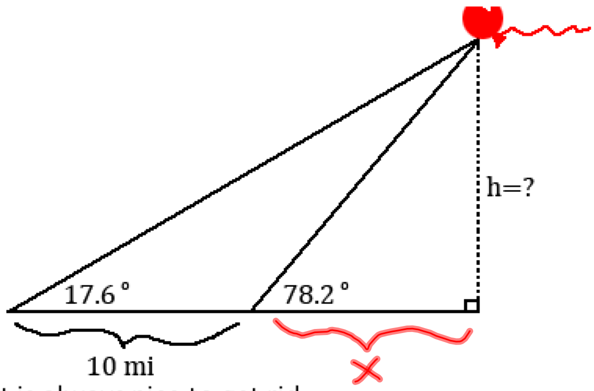
5.2 #24 - The balloon problem:



$\tan 78.2° = \frac{h}{x}$ $\quad$ $\tan 17.6° = \frac{h}{x+10}$

$x \tan 78.2° = h$

$x = \dfrac{h}{\tan 78.2°}$

Substitution yields:

$$\tan 17.6° = \frac{h}{\frac{h}{\tan 78.2°} + 10}$$

When confronted by an equation involving fractions, it is always nice to get rid of the fractions by multiplying both sides by the least common denominator.

$$\left(\frac{h}{\tan 78.2°} + 10\right) \cdot \tan 17.6° = \frac{h}{\frac{h}{\tan 78.2°} + 10} \cdot \left(\frac{h}{\tan 78.2°} + 10\right)$$

Distribution yields: $h\frac{\tan 17.6°}{\tan 78.2°} + 10 \tan 17.6° = h$

When more than one instance of your variable appears, try to get all instances of the variable on one side and everything else on the other side.

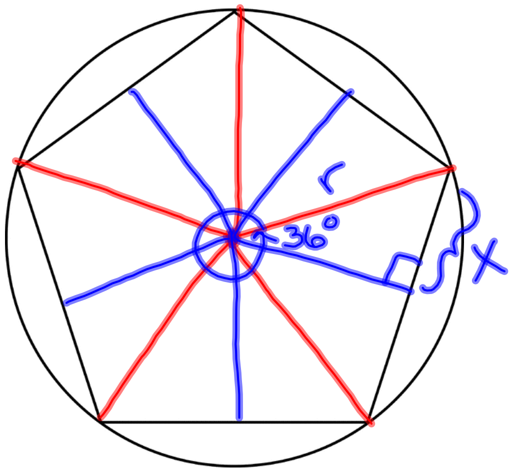
$$10 \tan 17.6° = h - \frac{h \tan 17.6°}{\tan 78.2°}$$

To get h by itself, factor and then divide.

$$10 \tan 17.6° = h\left(1 - \frac{\tan 17.6°}{\tan 78.2°}\right)$$

$$\boxed{h = \frac{10 \tan 17.6°}{1 - \frac{\tan 17.6°}{\tan 78.2°}} \approx 3.4 \text{ miles}}$$

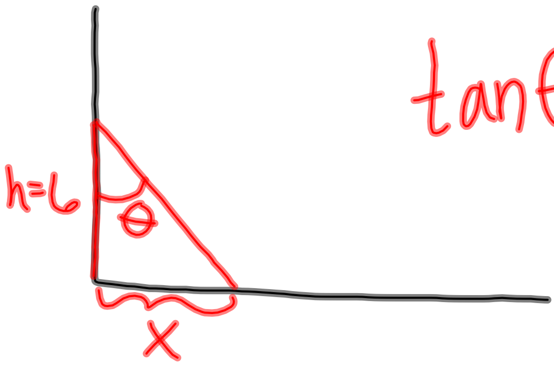
5.2 #23 - Inscribed Pentagon



$\sin 36° = \frac{x}{r}$

perimeter $= 10x$

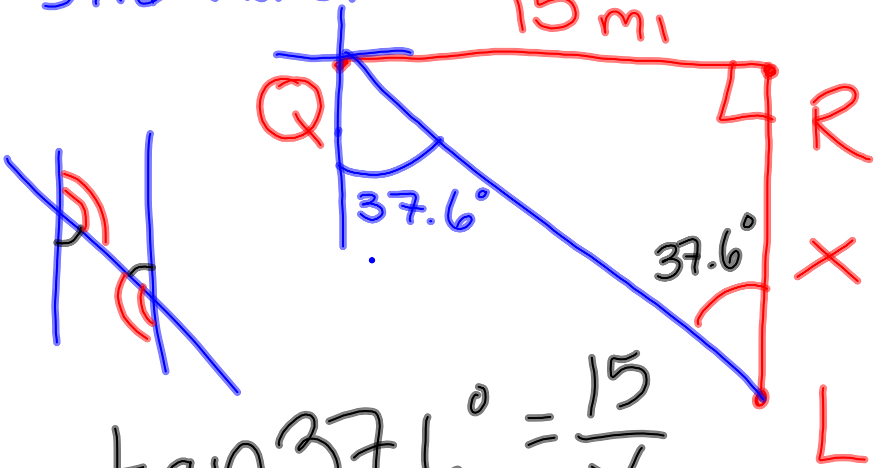
#19 - easel



$\tan\theta = \frac{x}{6}$

<u>5.2 #30 - Lightning Detection</u>: A detector at point Q is situated 15 mi west of a central fire station at point R. The bearing from Q to where lightning hits due south of R is S37.6°E. How far is the hit from point R?

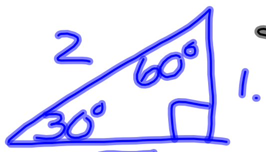
37.6° east of south

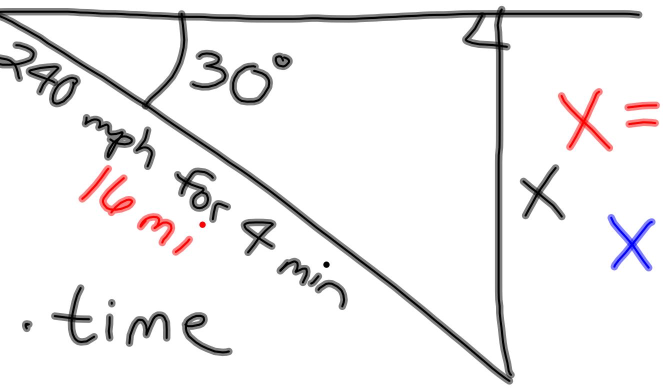


$$\tan 37.6^\circ = \frac{15}{x}$$

$$x = \boxed{\frac{15}{\tan 37.6^\circ}\text{ mi}} \approx 19.5\text{ mi}$$

An airplane traveling 240 miles per hour is descending at an angle of 30°. Through how many vertical miles will the plane descend in 4 minutes?





$$\sin 30^\circ = \frac{x}{16}$$

$$x = 16\sin 30^\circ$$

$$x = 16 \cdot \frac{1}{2}$$

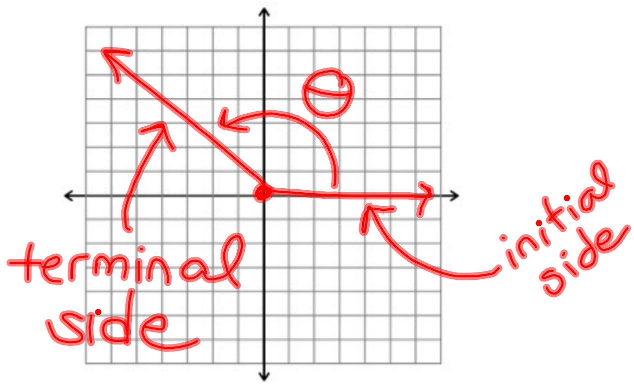
$$= \boxed{8\text{ mi}}$$

distance = rate · time

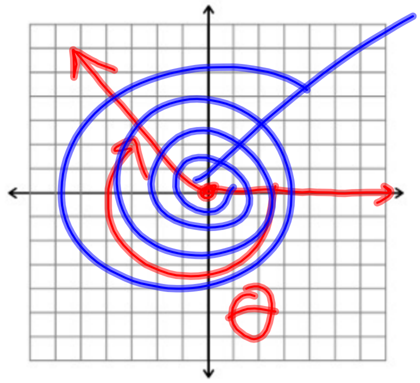
$$= \frac{\overset{4}{\cancel{240}}\text{ miles}}{\cancel{\text{hour}}} \cdot \frac{4\ \cancel{\text{min}}}{1} \cdot \frac{1\ \cancel{\text{hour}}}{\cancel{60}\ \cancel{\text{min}}} = 16\text{ mi}$$

5.3 Trigonometric Functions of Any Angle

An angle in standard position has its vertex at the origin and initial side on the positive x-axis, and is measured counter-clockwise.

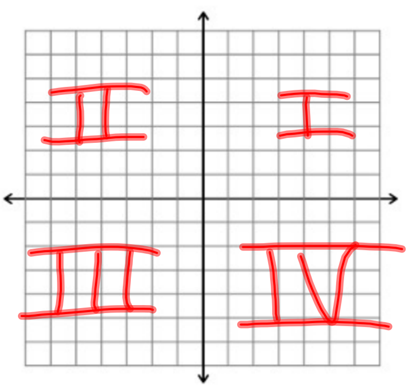


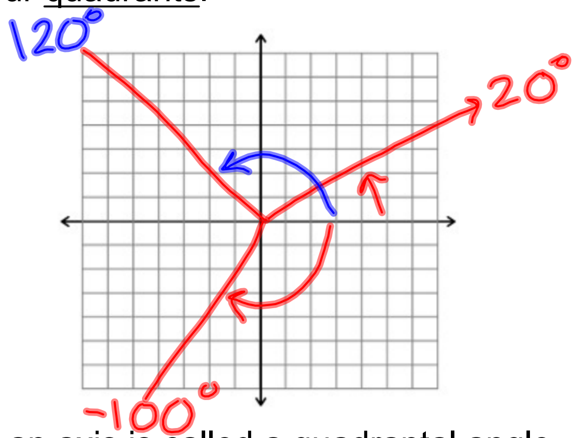
positive angle



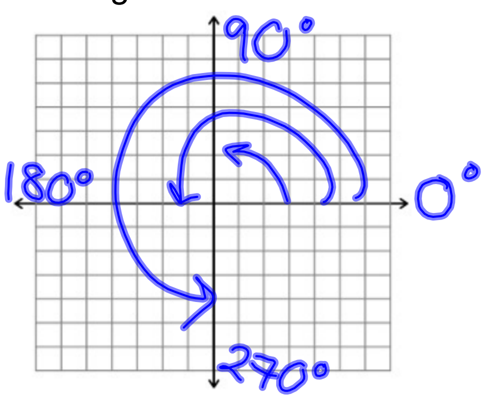
negative angle

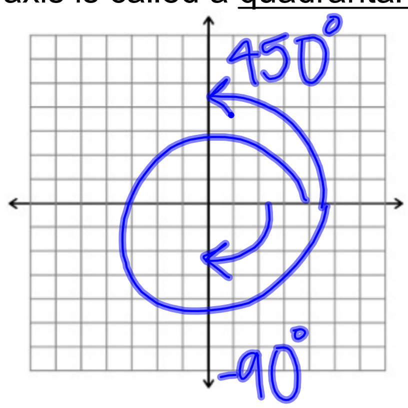
The coordinate plane is divided into four quadrants.



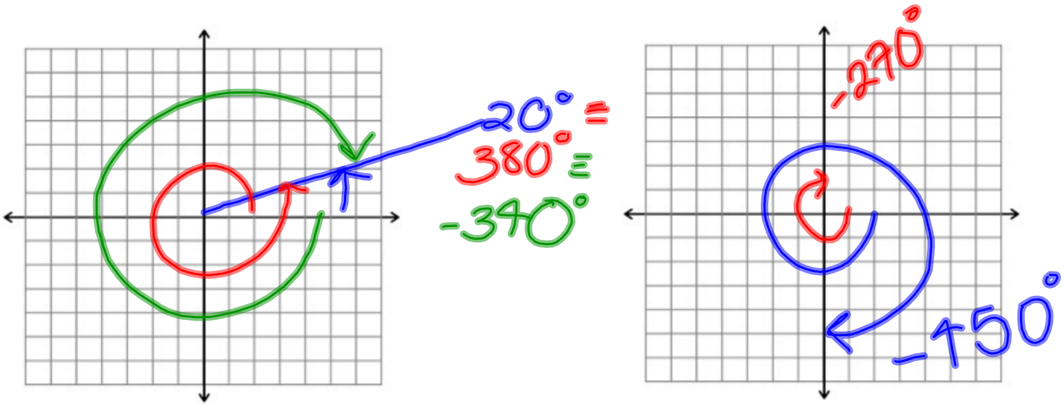


An angle whose terminal side falls on an axis is called a quadrantal angle.





Two angles sharing a terminal side are called <u>coterminal</u> and differ by integer multiples of 360°.



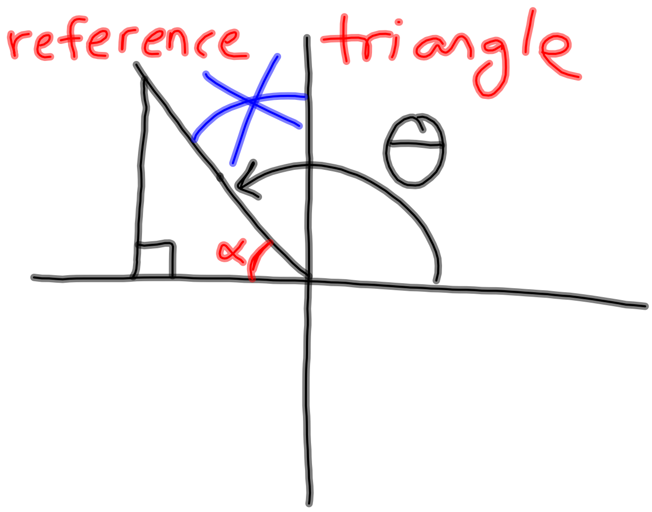
Find two positive and two negative angles that are coterminal with 89°.

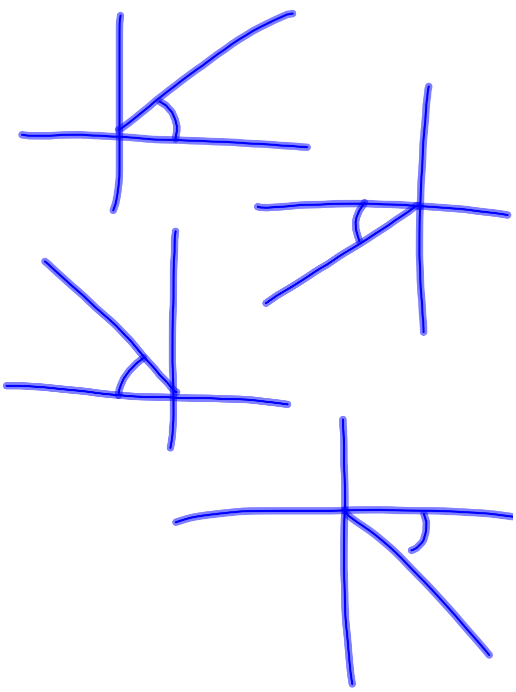
$$89^\circ + 360^\circ = \boxed{449^\circ} + 360^\circ = \boxed{809^\circ}$$

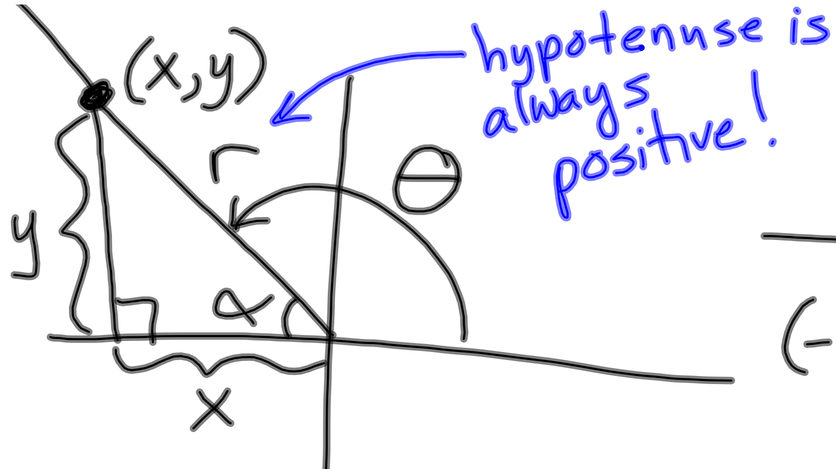
$$89^\circ - 360^\circ = \boxed{-271^\circ} - 360^\circ = \boxed{-631^\circ}$$

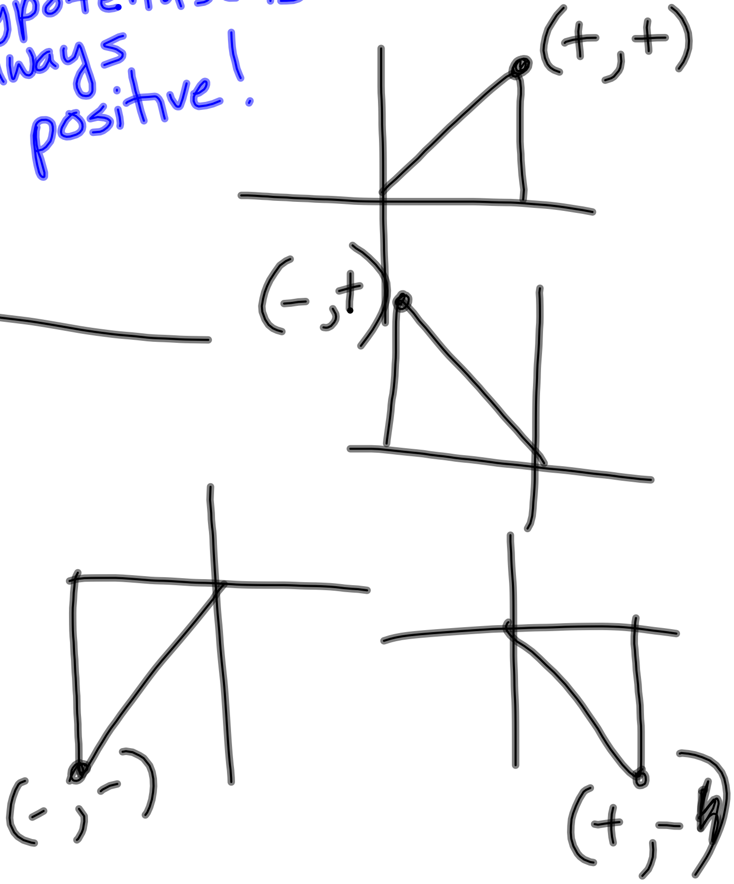
α

For an angle in standard position, the reference angle is the acute angle between the terminal side of the angle and the x-axis.







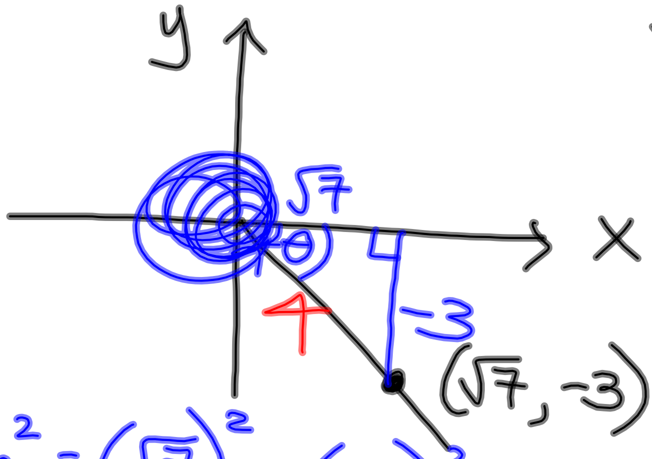


$$\sin\theta = \frac{y}{r}$$

$$\cos\theta = \frac{x}{r}$$

$$\tan\theta = \frac{y}{x}$$

5.3 #26



$$h^2 = (\sqrt{7})^2 + (-3)^2$$

$$= 7 + 9 = 16$$

$$h = 4$$

$$\sec\theta = \frac{4}{\sqrt{7}}$$

$$\cot\theta = -\frac{\sqrt{7}}{3}$$

$$\cos\theta = \frac{\sqrt{7}}{4}$$

$$\csc\theta = -\frac{4}{3}$$

5.2 #31,

53 #1-27 odd