33) $\dfrac{17\pi}{9}$

$+$ coterminal

$-$ coterminal $-\dfrac{\pi}{9}$

$\dfrac{17\pi}{9} - \dfrac{2\pi \cdot 9}{9} = \dfrac{-\pi}{9}$

$\dfrac{17\pi}{9} + \dfrac{2\pi \cdot 9}{9} = \dfrac{35\pi}{9}$

Reference angles

acute ∠
positive measure
vertex origin
1 ray terminal side
1 ray x-axis

ref ∠
45°

135°

-40° ref ∠
40°
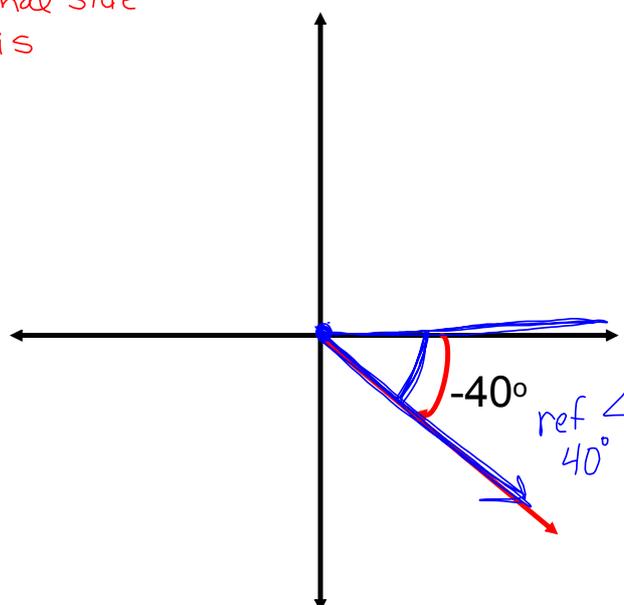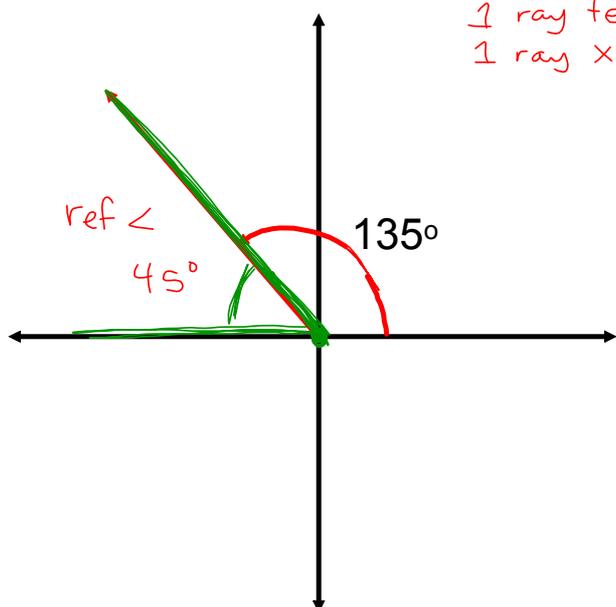
Use the given point on the terminal side of an angle θ in standard position to evaluate the six trigonometric functions of θ.

(-3, 4)

$\sin\theta = \dfrac{4}{5}$ $\csc\theta = \dfrac{5}{4}$

$\cos\theta = \dfrac{-3}{5}$ $\sec\theta = \dfrac{5}{-3} = \dfrac{-5}{3}$

$\tan\theta = \dfrac{4}{-3} = \dfrac{-4}{3}$ $\cot\theta = \dfrac{-3}{4}$

$h^2 = 3^2 + 5^2$

$h = \sqrt{34}$

(3, -5)

$\sin\theta = \dfrac{-5}{\sqrt{34}} = \dfrac{-5\sqrt{34}}{34}$ $\csc\theta = \dfrac{-\sqrt{34}}{5}$

$\cos\theta = \dfrac{3}{\sqrt{34}} = \dfrac{3\sqrt{34}}{34}$ $\sec\theta = \dfrac{\sqrt{34}}{3}$

$\tan\theta = \dfrac{-5}{3}$ $\cot\theta = \dfrac{-3}{5}$
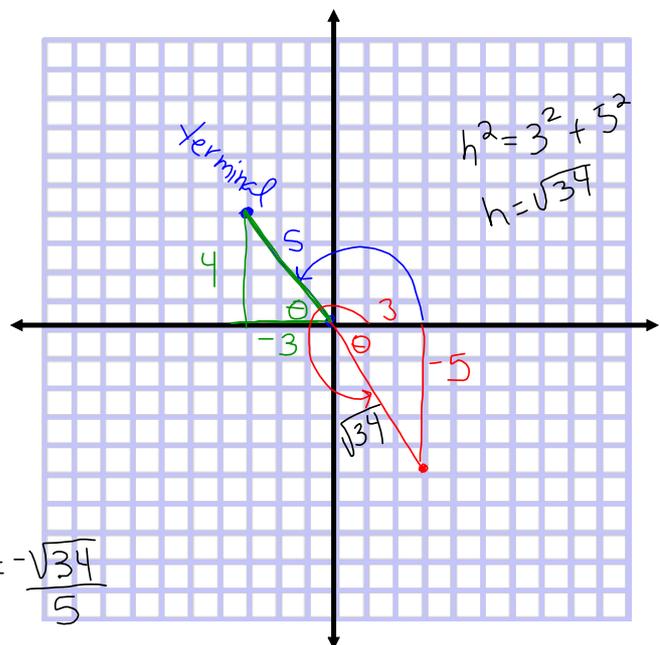
How do you find the measure of an angle?

$$\tan \theta = \frac{10}{8}$$

$$\tan^{-1}\left(\frac{10}{8}\right) = \theta$$

$$\theta = 51.3°$$

Find θ

$\sin\theta = \dfrac{7}{12}$

$\sin^{-1}\left(\dfrac{7}{12}\right) = \theta$

$\theta = 35.7°$

13

θ

12
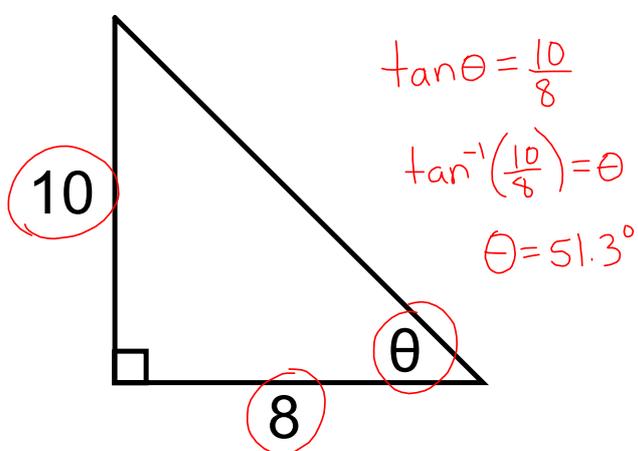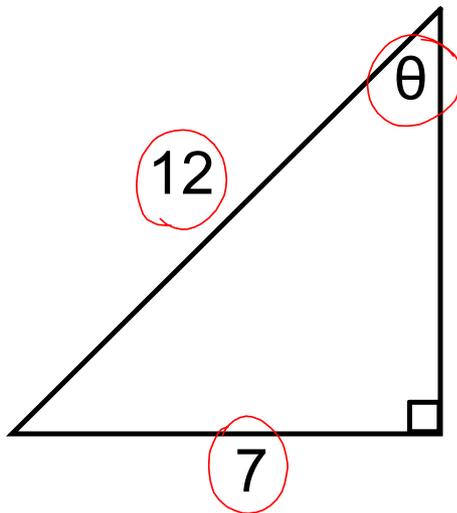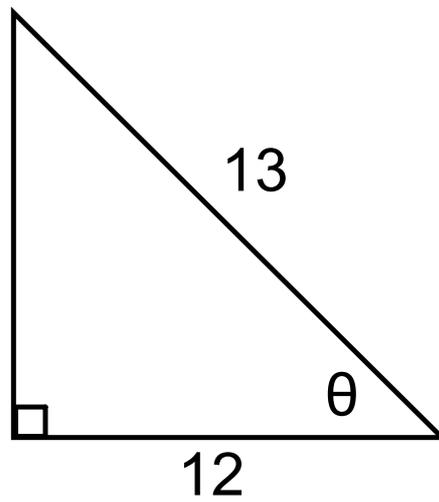
$$\cos\theta = \frac{12}{13}$$

$$\cos^{-1}\left(\frac{12}{13}\right) = \theta$$

$$\theta = 22.6°$$

Calculator issues:

$\sin 126° \approx .8090$ $\cot 43°$

$\csc \dfrac{2\pi}{3} = \dfrac{1}{\sin \frac{2\pi}{3}} \approx 1.157$ $\sec 24°$

$\cos 2.67 \approx -.8908$ $\cot \dfrac{\pi}{4}$

$\csc 237°$ $\dfrac{1}{\sin 237°} = -1.192$ $\sec 1.58$

Arc length

Circumference of a Circle
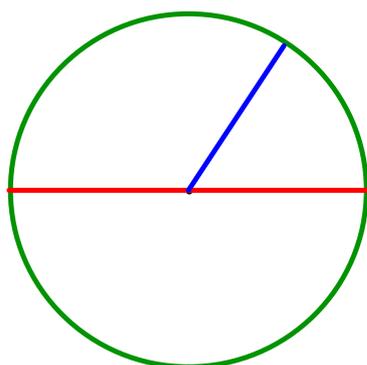
$$C = \pi d \quad \text{or} \quad C = 2\pi r$$
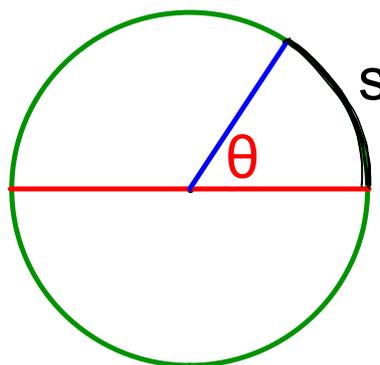
radius

central angle in radians

$$s = r\theta$$

arc length

Find the arc length with the given information.

A circle with a diameter of 12 in. and a central angle of π/12.
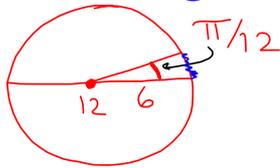
$S = r\theta$

$S = 6\left(\dfrac{\pi}{12}\right)$

$S = 1.57 \text{ in.}$

A circle with a radius of 8 cm and a central angle of 140°.

$\theta = 140°\left(\dfrac{\pi}{180}\right)$

$\dfrac{7\pi}{9}$

$140°$

$S = 8\left(\dfrac{7\pi}{9}\right)$

$S \approx 19.5 \text{ cm}$

C   4 in.
$\overset{}{B}$

$\dfrac{5\pi}{6}$

A
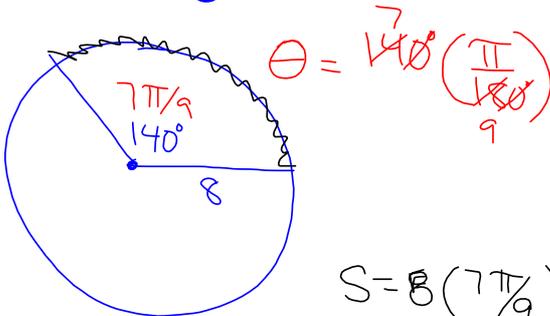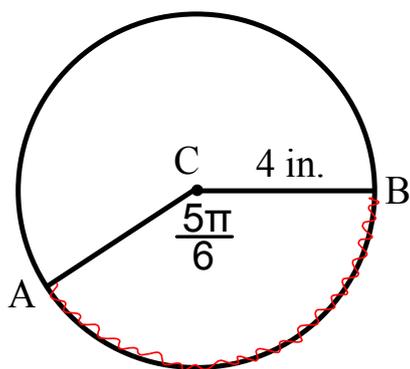
$\overset{\frown}{ADB}$

Find the length of $\overset{\frown}{AB}$

$S = r\theta$

$S = 4\left(5\pi/6\right)$

$S \approx 10.5 \text{ in}$

B

6 cm

$60°$ C

A $300°$
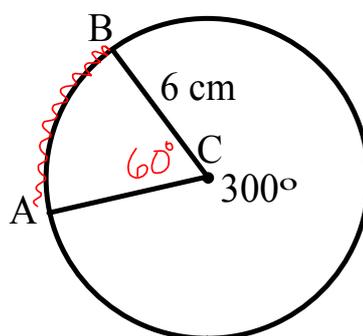
$60°\left(\dfrac{\pi}{180°}\right) = \dfrac{\pi}{3}$

Find the length of $\overset{\frown}{AB}$

$S = 6\left(\dfrac{\pi}{3}\right)$

$S = 6.28 \text{ cm}$

# Area of a sector

Area of a Circle:

Area of a Sector:

$$A = \pi r^2$$
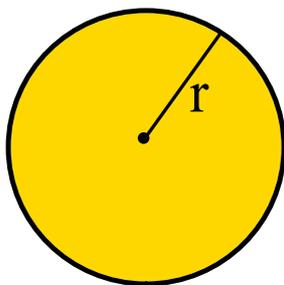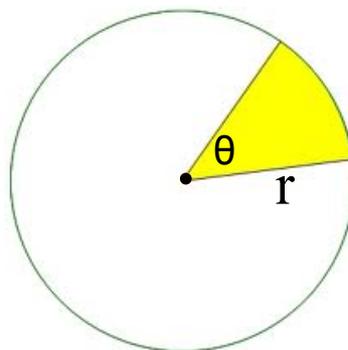
$$\text{Area of sector} = \tfrac{1}{2} r^2 \theta$$

central angle in radians

13 mi $\frac{2\pi}{3}$

$\frac{\pi}{3}$
7 mi
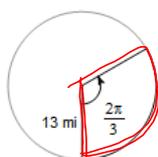
$A = \frac{1}{2}r^2\theta$

$A = \frac{1}{2}(13)^2\left(\frac{2\pi}{3}\right)$

$A = 177 \text{ mi}^2$

$\underset{5}{\cancel{150}^{\circ}}\left(\frac{\pi}{\cancel{180}^{\circ}}\right)$

5 mi 150° $5\pi/6$

90°
2 ft
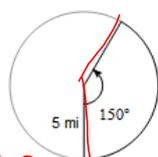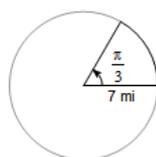
$A = \frac{1}{2}(5)^2\left(\frac{5\pi}{6}\right)$

$A \approx 32.7 \text{ mi}^2$
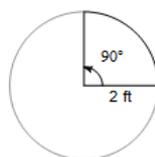
$r = 13 \text{ yd}, \ \theta = \dfrac{\pi}{6}$

$r = 17 \text{ ft}, \ \theta = \dfrac{4\pi}{3}$

$r = 9 \text{ cm}, \ \theta = 270°$

$r = 10 \text{ ft}, \ \theta = 90°$