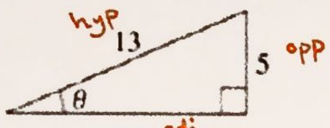
STATION 1

Find the exact values of the six trigonometric functions of the angle θ shown in the figure.

1.



$(5, 12, 13)$

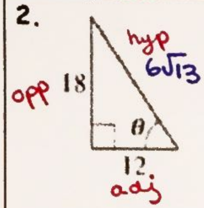
$a^2 + 5^2 = 13^2$
$a^2 + 25 = 169$
$a^2 = 144$
$a = 12$

$\sin\theta = \frac{5}{13}$ $\qquad \csc\theta = \frac{13}{5}$

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

$\tan\theta = \frac{5}{12}$ $\qquad \cot\theta = \frac{12}{5}$

2.



$12^2 + 18^2 = c^2$
$144 + 324 = c^2$
$468 = c^2$
$\sqrt{468} = c$
$6\sqrt{13} = c$

$\sin\theta = \frac{18}{6\sqrt{13}} = \frac{3}{\sqrt{13}}$ $\qquad \csc\theta = \frac{\sqrt{13}}{3}$

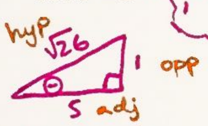
$\cos\theta = \frac{12}{6\sqrt{13}} = \frac{2}{\sqrt{13}}$ $\qquad \sec\theta = \frac{\sqrt{13}}{2}$

$\tan\theta = \frac{18}{12} = \frac{3}{2}$ $\qquad \cot\theta = \frac{2}{3}$

STATION 2

Sketch a right triangle corresponding to the trigonometric function of the acute angle θ. Then find the other five trigonometric functions of θ.

3. $\cot\theta = 5 = \frac{5}{1} \frac{\text{adj}}{\text{opp}}$



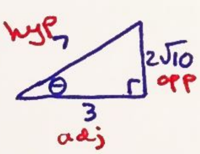
$5^2 + 1^2 = c^2$
$26 = c^2$
$\sqrt{26} = c$

$\sin\theta = \frac{1}{\sqrt{26}}$ $\qquad \csc\theta = \sqrt{26}$

$\cos\theta = \frac{5}{\sqrt{26}}$ $\qquad \sec\theta = \frac{\sqrt{26}}{5}$

$\tan\theta = \frac{1}{5}$

4. $\cos\theta = \frac{3}{7} = \frac{\text{adj}}{\text{hyp}}$



$a^2 + 3^2 = 7^2$
$a^2 + 9 = 49$
$a^2 = 40$
$a = 2\sqrt{10}$

$\sin\theta = \frac{2\sqrt{10}}{7}$ $\qquad \csc\theta = \frac{7}{2\sqrt{10}}$

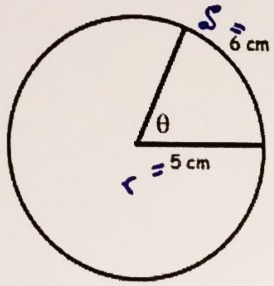
$\qquad \sec\theta = \frac{7}{3}$

$\tan\theta = \frac{2\sqrt{10}}{3}$ $\qquad \cot\theta = \frac{3}{2\sqrt{10}}$

STATION 3

Find the angle in radians.

1.



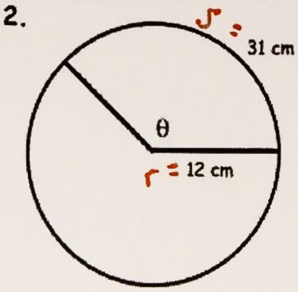
$S = r\theta$

$6 = 5\theta$

$6/5 = \theta$

$\boxed{\theta = 1.2 \text{ radians}}$

2.



$S = r\theta$

$31 = 12\theta$

$\frac{31}{12} = \theta$

$\boxed{\theta = 2.583 \text{ radians}}$

3. r = radius is 7 meters

S = arc length is 32 meters

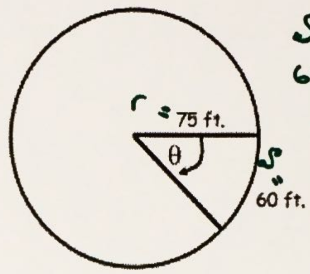
$S = r\theta$

$32 = 7\theta$

$\frac{32}{7} = \theta$

$\boxed{\theta = 4.571 \text{ radians}}$

4.



$S = r\theta$

$60 = 75\theta$

$\frac{60}{75} = \theta$

$\boxed{\theta = 0.8 \text{ rads}}$

STATION 4

Find the length of the arc.

5. r = radius is 14 inches

θ = central angle θ is 180°

$\theta = (180°)\left(\frac{\pi}{180°}\right) = \pi \text{ radians}$

$S = r\theta$

$S = 14(\pi)$

$\boxed{S = 14\pi \text{ inches}}$

or $\boxed{43.982 \text{ inches}}$

6. r = radius is 12 centimeters

θ = central angle θ is $\frac{3\pi}{4}$

$S = r\theta$

$S = 12\left(\frac{3\pi}{4}\right)$

$\boxed{S = 9\pi \text{ cm}}$

or $\boxed{28.274 \text{ cm}}$

Find the radius.

7. S = arc length is 36 feet

θ = central angle θ is $\frac{\pi}{2}$

$S = r\theta$

$\frac{2}{\pi} \cdot 36 = r\left(\frac{\pi}{2}\right) \cdot \frac{2}{\pi}$

$\frac{72}{\pi} = r$

$\boxed{r = 22.918 \text{ ft}}$

8. S = arc length is 82 miles

θ = central angle θ is 135°

$\theta = 135°\left(\frac{\pi}{180°}\right) = \frac{3\pi}{4} \text{ radians}$

$S = r\theta$

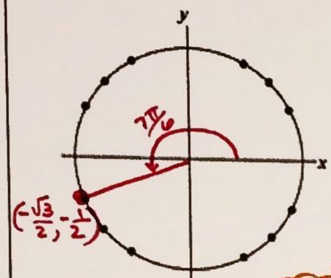
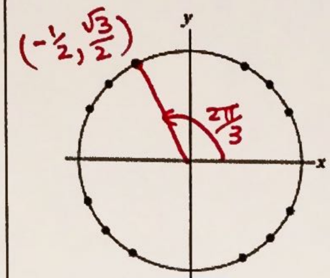
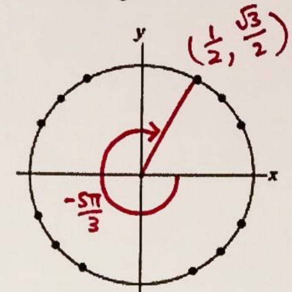
$\frac{4}{3\pi} \cdot 82 = r\left(\frac{3\pi}{4}\right) \cdot \frac{4}{3\pi}$

$\frac{328}{3\pi} = r$

$\boxed{r = 34.802 \text{ miles}}$

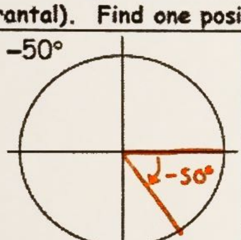
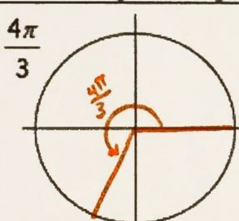
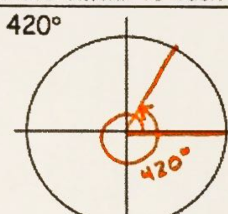
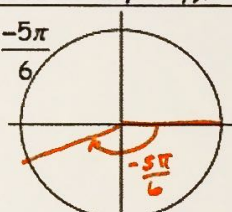
STATION 5

Use the blank unit circle to mark the angle and then label the point. Then evaluate (if possible) the sine, cosine, and tangent of the real number *t*.

7. $t = \frac{7\pi}{6}$	8. $t = \frac{2\pi}{3}$	9. $t = -\frac{5\pi}{3}$
		
$\boxed{\sin t = -\frac{1}{2}}$ $\sin\theta = y$	$\boxed{\sin t = \sqrt{3}/2}$	$\boxed{\sin t = \sqrt{3}/2}$
$\boxed{\cos t = -\frac{\sqrt{3}}{2}}$ $\cos\theta = x$	$\boxed{\cos t = -1/2}$	$\boxed{\cos t = 1/2}$
$\tan t = \frac{-1/2}{-\sqrt{3}/2}$ $\tan\theta = \frac{y}{x}$	$\tan t = \frac{\sqrt{3}/2}{-1/2}$	$\tan t = \frac{\sqrt{3}/2}{1/2}$
$\boxed{\tan t = \frac{1}{\sqrt{3}}}$ or $\frac{\sqrt{3}}{3}$	$\boxed{\tan t = -\sqrt{3}}$	$\boxed{\tan t = \sqrt{3}}$

STATION 6

Draw each angle in standard position (initial & terminal sides). Determine the reference angle (if it's not quadrantal). Find one positive and one negative angle that is coterminal to each angle (answers may vary).

1. $-50°$	2. $\frac{4\pi}{3}$	3. $420°$	4. $\frac{-5\pi}{6}$
			
Ref. ∠ = $50°$	Ref. ∠ = $\pi/3$	Ref. ∠ = $60°$	Ref. ∠ = $\pi/6$
Coterminal ∠s:	Coterminal ∠s:	Coterminal ∠s:	Coterminal ∠s:
$310°$, $-410°$	$-\frac{2\pi}{3}$, $\frac{10\pi}{3}$	$60°$, $-300°$	$\frac{7\pi}{6}$, $-\frac{17\pi}{6}$

$360° - 50° = 310°$

$-50° - 360° = -410°$

$= \frac{4\pi}{3} - 2\pi = \frac{4\pi}{3} - \frac{6\pi}{3} = -\frac{2\pi}{3}$

$= \frac{4\pi}{3} + 2\pi = \frac{4\pi}{3} + \frac{6\pi}{3} = \frac{10\pi}{3}$

$= 420° - 360° = 60°$

$= 420° - 360° - 360° = -300°$

$= -\frac{5\pi}{6} + 2\pi = -\frac{5\pi}{6} + \frac{12\pi}{6} = \frac{7\pi}{6}$

$= -\frac{5\pi}{6} - 2\pi = -\frac{5\pi}{6} - \frac{12\pi}{6} = -\frac{17\pi}{6}$

STATION 7

CALCULATOR

Rewrite each angle in radian measure in the following ways:
- **a) in terms of π**
- **b) the rounded decimal equivalent (round three decimal places)**

34. 145°	35. −80°	36. −350°	37. 58°
a) $145°\left(\frac{\pi}{180°}\right) = \boxed{\frac{29}{36}\pi}$	a) $-80°\left(\frac{\pi}{180°}\right) = \boxed{-\frac{4}{9}\pi}$	a) $-350°\left(\frac{\pi}{180°}\right) = \boxed{-\frac{35}{18}\pi}$	a) $58°\left(\frac{\pi}{180°}\right) = \boxed{\frac{29}{90}\pi}$
b) $\boxed{2.531}$	b) $\boxed{-1.396}$	b) $\boxed{-6.109}$	b) $\boxed{1.012}$

Rewrite each angle in degree measure. Round three decimal places when needed.

38. $\frac{6\pi}{5}$	39. $-\frac{4\pi}{3}$	40. 5π	41. 5
$\left(\frac{6\pi}{5}\right)\left(\frac{180°}{\pi}\right) = \boxed{216°}$	$-\frac{4\pi}{3}\left(\frac{180°}{\pi}\right) = \boxed{-240°}$	$5\pi\left(\frac{180°}{\pi}\right) = \boxed{900°}$	$5\left(\frac{180°}{\pi}\right) = \boxed{286.479°}$

STATION 8

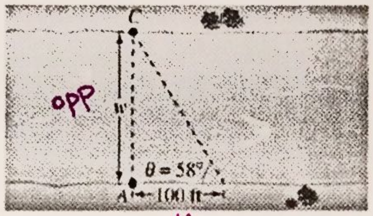
Answer the following. Provide an exact value (in terms of π) and decimal value (rounded to three places).

50. An arc of a circle has a central angle measure of 330° and a length of 15 feet. Find the length of a radius of the circle.	51. Find the length of an arc of a circle with a radius of 25 cm and a central angle measure of $\frac{3\pi}{7}$	52. Find the measure of a central angle of an arc if its length is 10 meters and the radius is 2 meters.
θ → central angle; S → length $\theta = 330° \rightarrow 330°\left(\frac{\pi}{180°}\right) = \frac{11\pi}{6}$ $S = 15ft$ $r = ?$ $S = r\theta$ $\frac{6}{11\pi} \cdot 15 = r\left(\frac{11\pi}{6}\right) \cdot \frac{6}{11\pi}$ $\boxed{\frac{90}{11\pi} ft = r}$ $\boxed{r = 0.074 ft}$	r ; θ $r = 25cm$ $\theta = \frac{3\pi}{7}$ $S = ?$ $S = r\theta$ $S = 25\left(\frac{3\pi}{7}\right)$ $\boxed{S = \frac{75}{7}\pi \text{ cm}}$ $\boxed{S = 33.660 \text{ cm}}$	S ; r $S = 10m$ $r = 2m$ $\theta = ?$ $S = r\theta$ $10 = 2\theta$ $5 = \theta$ $\boxed{\theta = 5 \text{ radians}}$

STATION 9

21. A biologist wants to know the width w of a river (see figure) in order to properly set instruments for studying the pollutants in the water. From point A, the biologist walks downstream 100 feet and sights to point C. From the sighting, it is determined that $\theta = 58°$. How wide is the river? Round your answer to three decimal places.

opp



adj

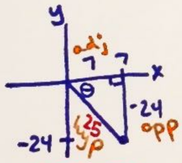
$\tan 58° = \dfrac{w}{100}$

$w = 100 \tan 58°$

$\boxed{w = 160.033 \text{ ft}}$

STATION 10

24. Find the 6 trigonometric function values for the point $(7, -24)$ on the terminal side of angle θ.



☺ 7, 24, 25

$7^2 + (-24)^2 = c^2$

$49 + 576 = c^2$

$625 = c^2$

$25 = c$

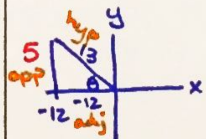
$\sin\theta = \dfrac{-24}{25}$ $\quad \csc\theta = \dfrac{-25}{24}$

$\cos\theta = \dfrac{7}{25}$ $\quad \sec\theta = \dfrac{25}{7}$

$\tan\theta = \dfrac{-24}{7}$ $\quad \cot\theta = \dfrac{-7}{24}$

Quadrant II, $\cos\theta < 0$, $\sin\theta > 0$ ($x < 0$, $y > 0$) ☺

25. Given that $\cos\theta = -\dfrac{12}{13}$ and $\sin\theta > 0$, find the exact values of the other five trig. functions.



☺ 5, 12, 13

$a^2 + (-12)^2 = 13^2$

$a^2 + 144 = 169$

$a^2 = 25$

$a = 5$

$\sin\theta = \dfrac{5}{13}$ $\quad \csc\theta = \dfrac{13}{5}$

$\cos\theta = -\dfrac{12}{13}$ $\quad \sec\theta = -\dfrac{13}{12}$

$\tan\theta = \dfrac{5}{-12}$ $\quad \cot\theta = -\dfrac{12}{5}$