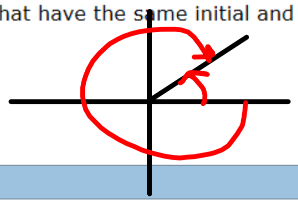
1. –/1 points LarTrig9 1.1.001.

Fill in the blank.

Two angles that have the same initial and terminal sides are ---Select--- .



coterminal

2. –/1 points LarTrig9 1.1.002.

Fill in the blank.

One ---Select--- is the measure of a central angle that intercepts an arc equal in length to the radius of the circle.

radian

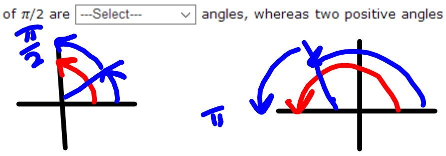
$\theta = \frac{s}{r} = \frac{\text{arc length}}{\text{radius}} = \text{radian measure.}$

3. –/2 points LarTrig9 1.1.003.

Fill in the blanks.

Two positive angles that have a sum of $\pi/2$ are ---Select--- angles, whereas two positive angles that have a sum of π are ---Select--- angles.

complementary



Supplementary

4. –/1 points LarTrig9 1.1.004.

Fill in the blank.

The angle measure that is equivalent to a rotation of $\frac{1}{360}$ of a complete revolution about an angle's vertex is one ---Select--- .

degree.

5. –/2 points LarTrig9 1.1.005.

Fill in the blanks.

The ---Select--- speed of a particle is the ratio of the arc length to the time traveled, and the ---Select--- speed of a particle is the ratio of the central angle to the time traveled.

$\frac{s}{t}$ = Linear speed

Linear distance when you flatten the arc.

$\frac{\theta}{t}$ = angular speed.

6. –/1 points LarTrig9 1.1.006.

Fill in the blank.

The area A of a sector of a circle with radius r and central angle θ, where θ is measured in radians, is given by the formula ________.

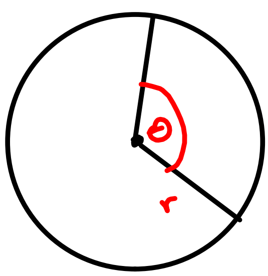
- $A = \frac{1}{2}\pi r^2\theta$
- $A = r^2\theta$
- $A = \frac{1}{2}r^2\theta$
- $A = \pi r^2$
- $A = \frac{1}{2}\pi r^2$

$A = \frac{1}{2}r^2\theta$

$\theta = 2\pi$ all way around, so

Area $= \pi r^2$ from past.

$A = \frac{1}{2}r^2(2\pi) = \pi r^2$



Area $= \frac{1}{2}r^2\theta$

7. –/1 points LarTrig9 1.1.007.

Estimate the angle to the nearest one-half radian.

rad

1 rad

$\approx 57^\circ$

8. –/1 points LarTrig9 1.1.008.

Estimate the angle to the nearest one-half radian.

radians

5 rad

9. –/1 points LarTrig9 1.1.010.

Estimate the angle to the nearest one-half radian.

radians

10. –/2 points LarTrig9 1.1.011.

Determine the quadrant in which each angle lies. (The angle measure is given in radians.)

(a) $\frac{\pi}{4}$

- I
- II
- III
- IV

II I

III IV

$\left(\frac{\pi}{4}\right)\left(\frac{180^\circ}{\pi \text{ rad}}\right) = 45^\circ$

(b) $\frac{5\pi}{4}$

- I
- II
- III
- IV

III

$\frac{5\pi}{4} = \frac{4\pi}{4} + \frac{1\pi}{4} = \pi + \frac{\pi}{4}$

Reference Angle

11. –/2 points LarTrig9 1.1.01

QIII (a) $-\frac{6\pi}{7}$

QII (b) $-\frac{11\pi}{9}$

$\frac{6\pi}{7} = \frac{7\pi}{7} - \frac{1\pi}{7} = \pi - \frac{\pi}{7}$

$-\frac{6\pi}{7} = -\pi + \frac{\pi}{7}$

$-\frac{9\pi}{9} - \frac{2\pi}{9} = -\pi - \frac{2\pi}{9}$

Check:

$\frac{2\pi}{9} < \frac{\pi}{2}$

$\frac{4}{18} = \frac{2}{9} < \frac{1}{2} = \frac{9}{18}$

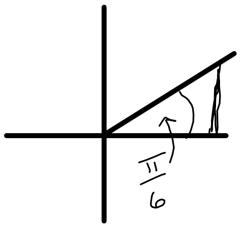
II I

III IV

12. –/2 points LarTrig9 1.1.013.

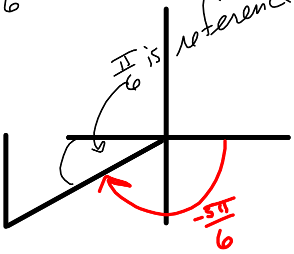
Sketch each angle in standard position.

(a) $\frac{\pi}{6}$



(b) $-\frac{5\pi}{6}$

$\frac{5\pi}{6} = \pi - \frac{\pi}{6}$



Reference (xi)- Angle

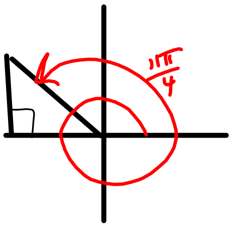
13. –/2 points LarTrig9 1.1.014.

Sketch each angle in standard position.

(a) $\frac{11\pi}{4} = 2\pi + \frac{3\pi}{4}$

$\frac{11}{4} = 2 + \frac{3}{4}$

$$\begin{array}{r} 2\ r3 \\ 4\overline{)11} \\ \underline{-8} \\ 3 \end{array}$$



(b) 4

$\left(4 \text{ rad}\right)\left(\frac{360^\circ}{2\pi \text{ rad}}\right)$

$\left(4 \text{ rad}\right)\left(\frac{180^\circ}{\pi \text{ rad}}\right)$

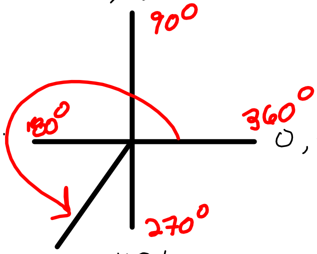
=

$\frac{3.14}{2} = 1.57$

1.57 . . .

$\frac{\pi}{2}, \frac{5\pi}{2}, \ldots$

3.14
1.57
4.71



14. –/2 points LarTrig9 1.1.016.

Determine two coterminal angles (one positive and one negative) for each angle.

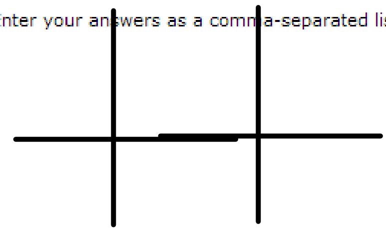
Give your answers in radians. (Enter your answers as a comma-separated list.)

(a) $\frac{5\pi}{6}$

$\frac{5\pi}{6}+\frac{2\pi}{1}\cdot\frac{6}{6}=\boxed{\frac{17\pi}{6}}$

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

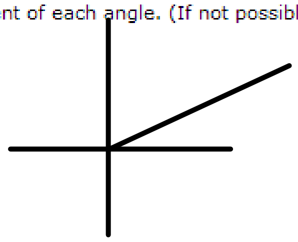
(b) $-\frac{13\pi}{6}$



15. –/4 points LarTrig9 1.1.017.

Find (if possible) the complement and the supplement of each angle. (If not possible, enter IMPOSSIBLE.)

(a) $\frac{\pi}{4}$ $\frac{\pi}{2}-\frac{\pi}{4}=\frac{\pi}{4}$

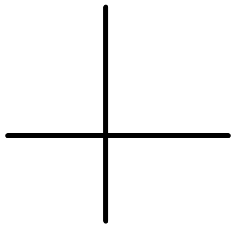


complement $\frac{\pi}{4}$ radians

supplement $\frac{3\pi}{4}$ radians

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

(b) $\frac{\pi}{3}$ $\frac{\pi}{2}-\frac{\pi}{3}=\frac{\pi}{6}$



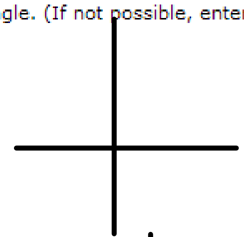
complement $\frac{\pi}{6}$ radians

supplement $\frac{2\pi}{3}$ radians

16. –/4 points LarTrig9 1.1.018.MI.

Find (if possible) the complement and the supplement of each angle. (If not possible, enter IMPOSSIBLE.)

(a) $\frac{\pi}{10}$

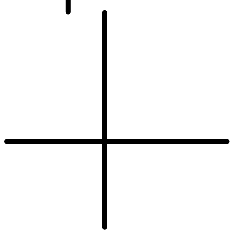


complement radians

supplement radians

$\frac{\pi}{2}<\frac{9\pi}{10}$, so No complement

(b) $\frac{9\pi}{10}$



complement Unpossible radians

supplement $\frac{1}{10}\pi$ radians

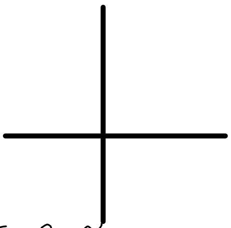
17. –/4 points LarTrig9 1.1.019.

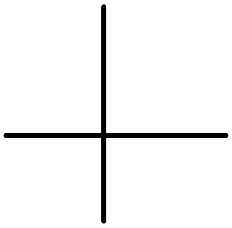
Find (if possible) the complement and the supplement of each angle.

(a) 1 (Round your answers to two decimal places. If not possible, enter IMPOSSIBLE.)

complement .57 radians

supplement 2.14 radians





(b) 2

complement Impossible radians

$\pi - 2 \approx$

supplement 1.14159265358979323846264338327950288419716939937510582 radians

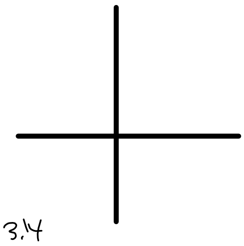
18. –/4 points LarTrig9 1.1.020.

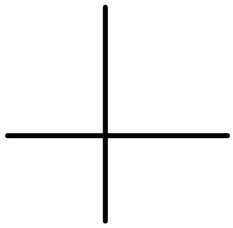
Find (if possible) the complement and supplement of each angle. (Round your answers to two decimal places. If not possible, enter IMPOSSIBLE.)

(a) 3

complement No radians

supplement .14 radians





(b) 1.5

complement .07 radians

supplement 1.64 radians

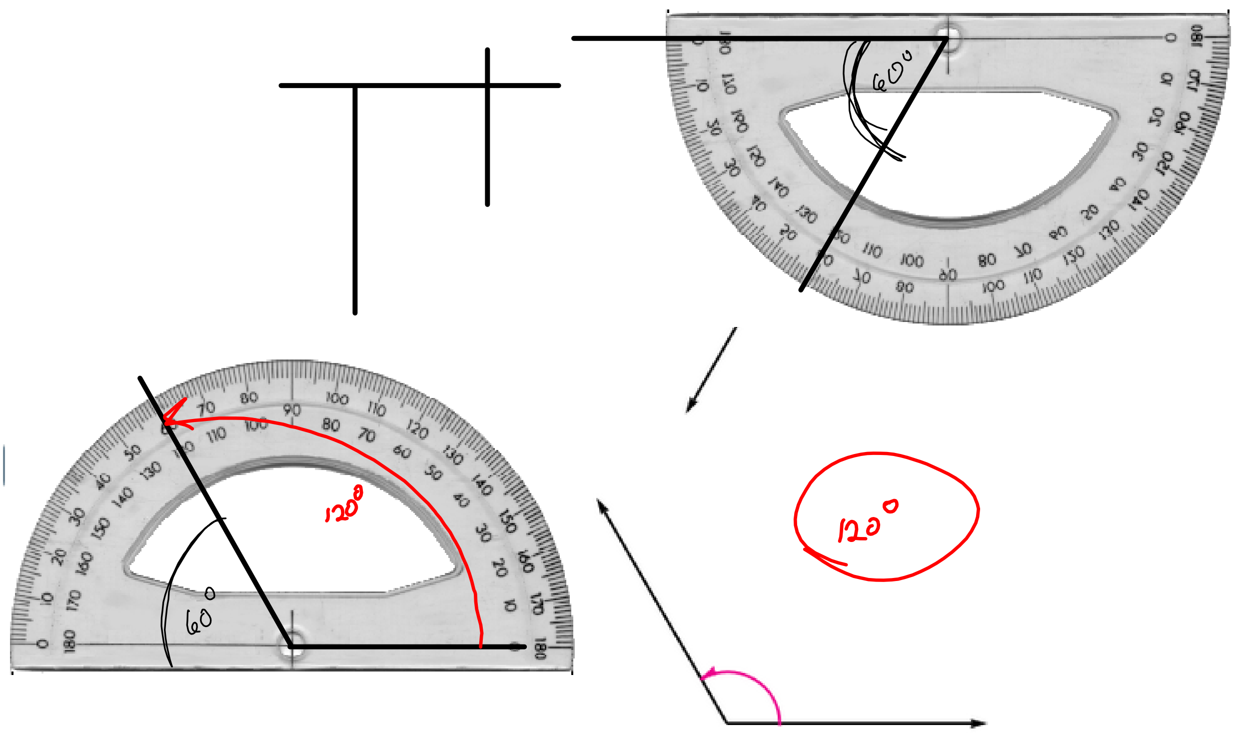
$$\begin{array}{r} 3.14 \\ -\ 1.50 \\ \hline 1.64 \end{array}$$

19. + –/1 points LarTrig9 1.1.021.

Estimate the number of degrees in the angle.

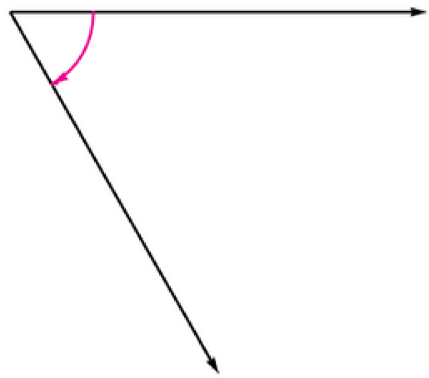
Guess $180^\circ + 60^\circ = 240^\circ$

$\pi + \frac{\pi}{3}$



21. + –/1 points LarTrig9 1.1.023.

Estimate the number of degrees in the angle.



22. –/1 points LarTrig9 1.1.043.

Convert the angle measure from radians to degrees. Round to three decimal places.

$\left(\frac{5\pi}{14}\text{ rad}\right)\left(\frac{180^\circ}{\pi\text{ rad}}\right) \approx 64.286^\circ$ $\quad \frac{\pi\text{ rad}}{180^\circ}$

$(390^\circ)\left(\frac{\pi\text{ rad}}{180^\circ}\right) = \frac{39\pi}{18} \approx 6.807$

23. –/1 points LarTrig9 1.1.042.

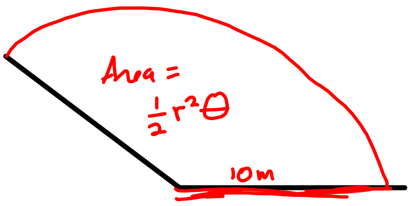
Convert the angle measure from degrees to radians. Round to three decimal places.

390°

24. –/1 points LarTrig9 1.1.502.XP.

A sprinkler on a golf green is set to spray water over a distance of 10 meters and to rotate through an angle of 140°. Draw a diagram that shows the region that can be irrigated with the sprinkler. Find the area of the region.

(Round your answer to two decimal places.)



θ MUST be given in radians!

$(140^\circ)\left(\frac{\pi\text{ rad}}{180^\circ}\right) = \frac{7\pi}{9}$ rad

$\frac{1}{2}r^2\theta = \frac{1}{2}(10^2)\left(\frac{7\pi}{9}\right) = \frac{(50)(7)(\pi)}{9} \approx \boxed{122.17\text{ m}^2}$

$\left.\begin{array}{l}2\pi r\\ \pi r^2\end{array}\right\}$ Associated with $\theta = 2\pi$

25. –/3 points LarTrig9 1.1.501.XP.

A two-inch-diameter pulley on an electric motor that runs at 1700 revolutions per minute is connected by a belt to a four-inch-diameter pulley on a saw arbor.

(a) Find the angular speed (in radians per minute) of each pulley.

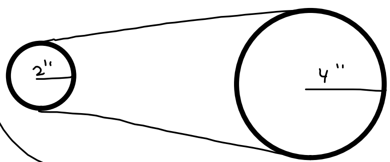
(i) motor pulley ______ radians per minute

(ii) saw arbor ______ radians per minute

(b) Find the revolutions per minute of the saw.

______ revolutions per minute

$\frac{1700\text{ rev}}{\text{min}}$ on small pulley.



$\theta = \frac{s}{r}$

$s = r\theta$

(a)(i) $\left(\frac{1700\text{ rev}}{\text{min}}\right)\left(\frac{2\pi\text{ rad}}{1\text{ rev}}\right) = \frac{3400\pi\text{ radians}}{\text{min}}$ Ans. to (a)(i)

(ii) $\left(\frac{3400\pi\text{ rad}}{\text{min}}\right)(2'') = \frac{6800''\pi}{\text{min}}$

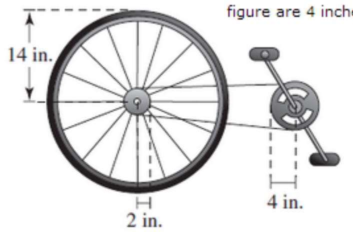
$\left(\frac{6800\pi\text{ in}}{\text{min}}\right)\left(\frac{1}{4''\text{ radius}}\right) = \frac{1700\pi\text{ rad}}{\text{min}}$ Ans to (a)(ii)

(b) $\left(\frac{1700\pi\text{ rad}}{\text{min}}\right)\left(\frac{1\text{ rev}}{2\pi\text{ rad}}\right) = \boxed{\frac{8500\text{ rev}}{\text{min}}}$

Here's an old way I worked this. See next page for what I did, more recently.

–/6 points LarTrig9 1.1.068.

The radii of the pedal sprocket, the wheel sprocket, and the wheel of the bicycle in the figure are 4 inches, 2 inches, and 14 inches, respectively. A cyclist is pedaling at a rate of 1 revolution per second.



rev per minute to angular speed to linear speed of chain to angular speed of rear sprocket to linear speed of the rear wheel.

(a) Find the speed of the bicycle in feet per second and miles per hour.

$$\left(\frac{1\ \cancel{\text{rev}}}{\text{sec}}\right)\left(\frac{2\pi\ \text{rad}}{1\ \cancel{\text{rev}}}\right)(4\,\text{in}) = 8\pi\ \frac{\text{in}\text{-rad}}{s}\ \text{front sprocket.}$$

[ ] feet per second

[ ] mph

$$\theta = \frac{s}{r} \Rightarrow r\theta = s = \text{arc length}$$

$$\frac{8\pi\ \frac{\text{in-rad}}{s}}{2\,\text{in}} = \frac{8\pi\ \text{rad}}{s}$$

(b) Use your result from part (a) to write a function for the distance *d* (in miles) a cyclist travels in terms of the number *n* of revolutions of the pedal sprocket.

d = [ ] mi

$$\text{Finally}\ \left(\frac{8\pi\ \text{rad}}{s}\right)(14) = \frac{112\,\text{in}}{s}$$

(c) Write a function for the distance *d* (in miles) a cyclist travels in terms of the time *t* (in seconds).

d = [ ] mi

$$= \left(\frac{112\,\text{in}}{s}\right)\left(\frac{1\,\text{ft}}{12\,\text{in}}\right)$$

$$= \frac{56}{6} = \frac{28}{3}$$

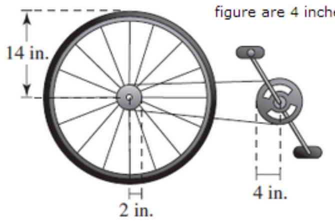
Compare this function with the function from part (b).

The function from (b) is [---Select---].

The function from (c) is [---Select---].

–/6 points LarTrig9 1.1.068.

The radii of the pedal sprocket, the wheel sprocket, and the wheel of the bicycle in the figure are 4 inches, 2 inches, and 14 inches, respectively. A cyclist is pedaling at a rate of 1 revolution per second.



Cool thing is arc length is proportional to radius. This means the rate at which the sprockets turn works really slick:

front: $\frac{1 \text{ rev}}{\text{sec}} \Rightarrow$ Rear: $\frac{4}{2} = 2$ times faster if they're linked by the chain

(a) Find the speed of the bicycle in feet per second and miles per hour.

[ ] feet per second

[ ] mph

(b) Use your result from part (a) to write a function for the distance d (in miles) a cyclist travels in terms of the number n of revolutions of the pedal sprocket.

$d =$ [ ] mi

$$S = r\theta$$

$$\left(\frac{1 \cancel{\text{rev front}}}{\text{sec}}\right)\left(\frac{2 \cancel{\text{rev rear}}}{1 \cancel{\text{rev front}}}\right)\left(\frac{2\pi \cdot 14 \cancel{\text{inches}}}{1 \cancel{\text{rev rear}}}\right)\left(\frac{1 \text{ ft}}{12 \cancel{\text{inches}}}\right)$$

(a)

$$\frac{56\pi}{12} \frac{\text{ft}}{\text{sec}} = \boxed{\frac{14\pi}{3} \frac{\text{ft}}{\text{sec}}}$$

$$= \left(\frac{14\pi}{3} \frac{\text{ft}}{\text{sec}}\right)\left(\frac{60 \frac{\text{mi}}{\text{hr}}}{88 \frac{\text{ft}}{\text{sec}}}\right) = \boxed{\frac{35\pi}{11} \frac{\text{mi}}{\text{hr}}}$$

$$\frac{(\cancel{14})(\cancel{60})}{(\cancel{3})(\cancel{88})} \quad 7,\ 5,\ \cancel{10},\ \cancel{20},\ 1,\ \cancel{44},\ \cancel{22},\ 11$$

$$\frac{56}{12}: \quad 14,\ \cancel{28},\ \cancel{56},\ \cancel{12},\ \cancel{6},\ 3 \qquad = \frac{14}{3}$$

(b) write distance as a function sprocket revolutions.

Lexicon:

d = distance (in miles) as function of...

... n = the # of revs on front sprocket.

$$\underbrace{\left(1 \text{ rev front}\right)\left(\frac{2 \text{ rev back}}{1 \text{ rev front}}\right)\left(\frac{2\pi \cdot 14 \text{ in}}{1 \text{ rev back}}\right)\left(\frac{1 \text{ ft}}{12 \text{ in}}\right)\left(\frac{1 \text{ mi}}{5280 \text{ ft}}\right)}_{\text{miles traveled / 1 rev front}} \underbrace{n \text{ revs}}_{\text{revs front}}$$

$(7\pi)/7920\, n \approx 0.0027766601736273425\, n$ mi → OK

$$d = d(n) = \frac{56\pi}{(12)(5280)}\, n$$

$\frac{7\pi}{7920} n$ mi → OK

$7\pi/7920n$ → Not OK. Is 'n' upstairs or downstairs?

$$\frac{4 \text{ in. front}}{2 \text{ in. back}} = 2$$

27. –/2 points LarTrig9 1.1.066.MI.

$\rightarrow r = 1.2\text{ ft}$

A car is moving at a rate of 55 miles per hour, and the diameter of its wheels is 2.4 feet. (Round your answers to three decimal places.)

(a) Find the number of revolutions per minute the wheels are rotating.

_____ revolutions per minute

641.925

(b) Find the angular speed of the wheels in radians per minute.

_____ radians per minute

$\boxed{4033.333}$

a

$$\frac{s}{t} = \frac{55\text{ mi}}{1\text{ hr}}$$

$$\frac{\theta}{t} = \frac{\frac{s}{r}}{t} = \left(\frac{55\text{ mi}}{1\text{ hr}}\right)\left(\frac{1}{1.2\text{ ft}}\right)\left(\frac{5280\text{ ft}}{1\text{ mi}}\right)$$

$$= \left(\frac{(55)(5280)}{1.2}\ \frac{\text{rad}}{\text{hr}}\right)\left(\frac{1\text{ rev}}{2\pi\text{ rad}}\right)\left(\frac{1\text{ hr}}{60\text{ min}}\right)$$

$$= \frac{(55)(5280)}{(1.2)(2\pi)(60)} \approx 641.925\ \frac{\text{rev}}{\text{min}}$$

b rev to radians via 2π:

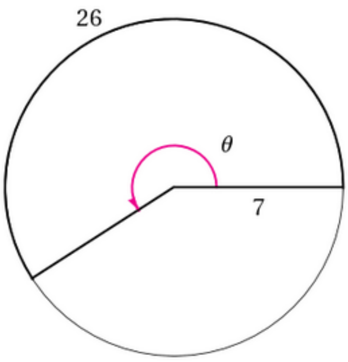
$$\left(\frac{(55)(5280)}{(1.2)(\cancel{2\pi})(60)}\ \frac{\text{rev}}{\text{min}}\right)\left(\frac{\cancel{2\pi}\text{ rad}}{1\text{ rev}}\right) = 4033 + \frac{1}{3}$$

$$= 4033.\overline{3}$$

28. –/1 points LarTrig9 1.1.055.

Use the given arc length and radius to find the angle θ (in radians).

θ = _____ radians



$s = r\theta$

29. –/1 points LarTrig9 1.1.054.

Find the radian measure of the central angle of a circle of radius r that intercepts an arc of length s.

Radius r	**Arc Length s**
11 feet	8 feet

30. –/1 points LarTrig9 1.1.053.MI.

Find the radian measure of the central angle of a circle of radius r that intercepts an arc of length s.

Radius r	**Arc Length s**
40 kilometers	85 kilometers

30. –/1 points LarTrig9 1.1.053.MI.

Find the radian measure of the central angle of a circle of radius r that intercepts an arc of length s.

Radius r	Arc Length s
40 kilometers	85 kilometers

31. –/1 points LarTrig9 1.1.052.

Find the length of the arc on a circle of radius r intercepted by a central angle θ. (Round your answer to two decimal places.)

Radius r	Central Angle θ
9 meters	150°

32. –/1 points LarTrig9 1.1.051.

Find the length of the arc on a circle of radius r intercepted by a central angle θ. (Round your answer to two decimal places.)

Radius r	Central Angle θ
17 inches	240°

33. –/1 points LarTrig9 1.1.045.

Convert the angle measure from radians to degrees. Round to three decimal places.

-3.6π

34. –/1 points LarTrig9 1.1.044.

Convert the angle measure from radians to degrees. Round to three decimal places.

$17\pi/8$

35. –/1 points LarTrig9 1.1.041.

Convert the angle measure from degrees to radians. Round to three decimal places.

0.76°

36. –/2 points LarTrig9 1.1.038.

Rewrite each angle in degree measure. (Do not use a calculator.)

(a) $-\frac{11\pi}{12}$

°

(b) $\frac{7\pi}{4}$

°

37. –/2 points LarTrig9 1.1.037.

Rewrite each angle in degree measure. (Do not use a calculator.)

(a) $\frac{3\pi}{2}$

______ °

(b) $\frac{7\pi}{6}$

______ °

38. –/2 points LarTrig9 1.1.038.

Rewrite each angle in radian measure as a multiple of π. (Do not use a calculator.)

(a) $-30°$

______ radians

(b) $72°$

______ radians

39. –/2 points LarTrig9 1.1.035.

Rewrite each angle in radian measure as a multiple of π. (Do not use a calculator.)

(a) $60°$

______ radians

(b) $-20°$

______ radians