

Warm up

What quadrant am I in?

1. $\frac{3\pi}{8}$

2. $\frac{5\pi}{4}$

3. -295°

4. 460°

5. $-\frac{11\pi}{3}$


6. 5.5

Find one positive and one negative coterminal angle for the following:

7. $\frac{2\pi}{9}$

8. -400°


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GO COUGARS! 


Homework Questions


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In Exercises 71-74, find the angle in radians.


71. 

72. 


73. 

74. 

75. Find each angle (in radians) shown on the unit circle.



76. Find each angle (in degrees) shown on the unit circle.



In Exercises 77-80, 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
77. 15 inches	8 inches
78. 22 feet	10 feet
79. 14.5 centimeters	35 centimeters
80. 80 kilometers	100 kilometers

In Exercises 81-84, find the length of the arc on a circle of radius r intercepted by a central angle θ .

Radius r	Central Angle θ
81. 14 inches	180°
82. 9 feet	60°
83. 27 meters	$\frac{2\pi}{3}$ radians
84. 12 centimeters	$\frac{3\pi}{4}$ radians


In Exercises 85-88, find the radius r of a circle with an arc length s and a central angle θ .

Arc Length s	Central Angle θ
85. 36 feet	$\frac{\pi}{2}$ radians
86. 3 meters	$\frac{4\pi}{3}$ radians
87. 82 miles	135°

Distance In Exercises 89 and 90, find the distance between the cities. Assume that Earth is a sphere of radius 4000 miles and the cities are on the same longitude (YES they are north of the equator).

City	Latitude
89. Miami	$25^\circ 46' 32'' N$
Erie	$42^\circ 7' 33'' N$
90. Johannesburg, South Africa	$26^\circ 18' S$
Jerusalem, Israel	$31^\circ 46' N$

91. **Difference in Latitudes** Assuming that Earth is a sphere of radius 6378 kilometers, what is the difference in the latitudes of Syracuse, New York and Annapolis, Maryland, where Syracuse is 400 kilometers due north of Annapolis?



$AL = \text{radians} \cdot \text{radius}$
 $450 \text{ km} = \theta \cdot 6378 \text{ km}$
 → the difference between latitudes

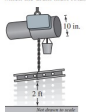
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GO COUGARS!

p 267 **Homework Questions**


92. **Difference in Latitudes** Assuming that Earth is a sphere of radius 6378 kilometers, what is the difference in the latitudes of Lynchburg, Virginia and Myrtle Beach, South Carolina, where Lynchburg is 400 kilometers due north of Myrtle Beach?

94. **Electric Hoist** An electric hoist is used to lift a piece of equipment 2 feet (see figure). The diameter of the drum on the hoist is 10 inches. Find the number of degrees through which the drum must rotate.



$AL = 2 \text{ ft}$ $AL = \text{radians} \cdot \text{radius}$
 $r = 5$ $2 \text{ ft} = \theta \cdot 5 \text{ in}$
 $24 \text{ in} = \theta \cdot 5 \text{ in} \rightarrow \theta = 4.8 \text{ rad.}$
 $4.8 \cdot \frac{180}{\pi}$

96. **Linear Speed** A satellite in a circular orbit 1250 kilometers above Earth makes one complete revolution every 110 minutes. What is its linear speed? Assume that Earth is a sphere of radius 6400 kilometers.



$AS = \frac{1 \text{ rev}}{110 \text{ min}} \cdot 2\pi$
 $LS = \frac{\pi \text{ road}}{55 \text{ min}} \cdot 7650 \text{ km}$

98. **Construction** The circular blade on a saw has a diameter of 7.25 inches and rotates at 4800 revolutions per minute.

(a) Find the angular speed of the blade in radians per second.
 $AS = 1 \text{ rev} \cdot 2\pi$
 $4800 \frac{\text{rev}}{\text{min}} \cdot \frac{2\pi}{1 \text{ rev}}$


(b) Find the linear speed of the saw tooth (in feet per second) as they contact the wood being cut.
 $AS = 9600 \pi \frac{\text{rad}}{\text{min}} \cdot \frac{1 \text{ min}}{60 \text{ sec}} = 502.65 \frac{\text{rad}}{\text{sec}}$
 $LS = 502.65 \frac{\text{rad}}{\text{sec}} \cdot 3.625 \text{ in} \cdot \frac{1 \text{ ft}}{12 \text{ in}}$

100. **Angular Speed** A DVD is approximately 12 centimeters in diameter. The drive motor of the DVD player is controlled to rotate precisely between 200 and 500 revolutions per minute, depending on what track is being read.

(a) Find an interval for the angular speed of a disc as it rotates.
 $AS = 200 \frac{\text{rev}}{\text{min}} \cdot 2\pi = 1600\pi \frac{\text{rad}}{\text{min}}$
 $LS = 1600\pi \frac{\text{rad}}{\text{min}} \cdot 11 \text{ in} \cdot \frac{1 \text{ min}}{60 \text{ sec}} \cdot \frac{1 \text{ m}}{1000 \text{ mm}}$

(b) Find the linear speed of a point on the outermost track as the disc rotates.
 $AS = 500 \frac{\text{rev}}{\text{min}} \cdot 2\pi = 1000\pi \frac{\text{rad}}{\text{min}}$
 $LS = 1000\pi \frac{\text{rad}}{\text{min}} \cdot 12 \text{ cm} \cdot \frac{1 \text{ m}}{100 \text{ mm}} \cdot \frac{1 \text{ min}}{60 \text{ sec}}$


1. The wheel (including the tire) of a sports car under development by one of the Big Three auto companies has an 18-inch radius. What would be the car's speed in miles per hour if its wheels are turning 800 rpm?



$AS = 800 \frac{\text{rev}}{\text{min}} \cdot 2\pi = 1600\pi \frac{\text{rad}}{\text{min}}$
 $LS = 1600\pi \frac{\text{rad}}{\text{min}} \cdot 18 \text{ in} \cdot \frac{1 \text{ min}}{60 \text{ sec}} \cdot \frac{1 \text{ mi}}{5280 \text{ ft}}$

2. Cathy Nguyen runs on a bicycle with 13-inch radius wheels. When she is traveling at a speed of 44 ft/sec, how many revolutions per minute are her wheels making?

3. A radial arm saw has a circular cutting blade with a diameter of 10 inches. It spins at 2000 rpm. If there are 12 cutting teeth per inch on the cutting blade, how many teeth cross the surface each second?



$AS = 2000 \frac{\text{rev}}{\text{min}} \cdot 2\pi = 4000\pi \frac{\text{rad}}{\text{min}}$
 $LS = 4000\pi \frac{\text{rad}}{\text{min}} \cdot 5 \text{ in} \cdot \frac{1 \text{ min}}{60 \text{ sec}} \cdot \frac{12 \text{ teeth}}{1 \text{ in}}$

4. The propellers of the *Aviation Paradise* have a radius of 1.2 m. At full throttle the propellers turn at 135 rpm.

a. What is angular speed of the propeller blade in radians per second?
 $AS = 135 \frac{\text{rev}}{\text{min}} \cdot 2\pi = 270\pi \frac{\text{rad}}{\text{min}} \cdot \frac{1 \text{ min}}{60 \text{ sec}} = 9\pi \frac{\text{rad}}{\text{sec}}$

b. What is the linear speed of the tip of the propeller blade in meters per second?
 $LS = 9\pi \frac{\text{rad}}{\text{sec}} \cdot 1.2 \text{ m} = 10.8\pi \text{ m/sec}$

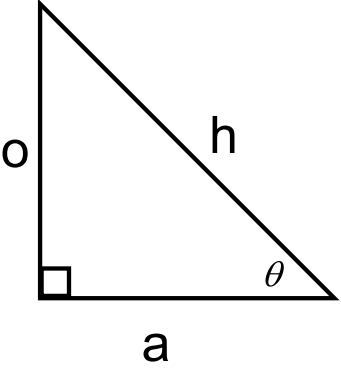
c. What is the linear speed (in meters per second) of a point on a blade halfway between the center of the propeller and the tip of the blade?
 $LS = 9\pi \frac{\text{rad}}{\text{sec}} \cdot 0.6 \text{ m} = 5.4\pi \text{ m/sec}$

Workbook answers

1. 52.36 mph
2. 387.85 rev/min
3. 12566 teeth
- 4a. 14.137 rad/sec
- 4b. 16.96 m/sec
- 4c. 8.48 m/sec

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4.3 Right Triangle Trig
 SOH CAH TOA
 Finding six trig ratios
 Finding theta given a ratio



$$\sin \theta = \frac{o}{h}$$

$$\cos \theta = \frac{a}{h}$$

$$\tan \theta = \frac{o}{a}$$

reciprocal functions

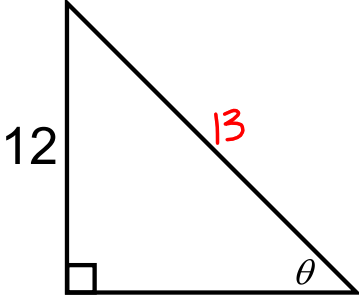
(cosecant θ)
 $\csc \theta = \frac{1}{\sin \theta} = \frac{h}{o}$

(secant θ)
 $\sec \theta = \frac{1}{\cos \theta} = \frac{h}{a}$

(cotangent θ)
 $\cot \theta = \frac{1}{\tan \theta} = \frac{a}{o}$

What observation can you make about $\tan \theta$?

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

$$\cos \theta = \frac{5}{13}$$

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

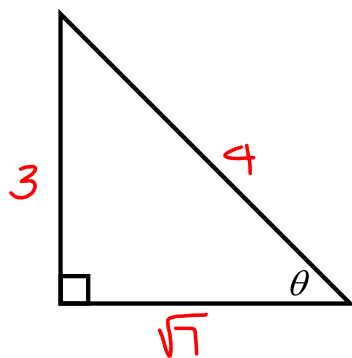
$$\csc \theta = \frac{13}{12}$$

$$\sec \theta = \frac{13}{5}$$

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

$$5^2 + 12^2 = h^2$$

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Given $\sin \theta = \frac{3}{4}$,

find the other 5 trig ratios

$$\sin \theta = \frac{3}{4}$$

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

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

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

$$\tan \theta = \frac{3}{\sqrt{7}}$$

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

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Now let's work backwards!

Given $\sin \theta = \frac{1}{2}$, find θ

in degrees 30°

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

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HOMework



p 284 1, 3, 9-33 odd, 63, 65, 66

answer sheet provided in workbook p 99

Workbook p 97 1-7 odd Answers: 1. 3150 cm/min
3. 17001.03 rev/hour
5. 66659.4 mph
7. 23023.3 rev/hr

Aug 29-6:38 AM