

**TEST BANK**



SULLIVAN



*Trigonometry*<sup>8</sup>  
A UNIT CIRCLE APPROACH

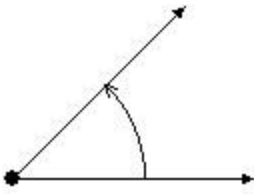
**MULTIPLE CHOICE.** Choose the one alternative that best completes the statement or answers the question.

**Draw the angle.**

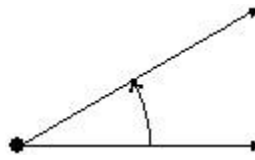
1)  $60^\circ$

1) \_\_\_\_\_

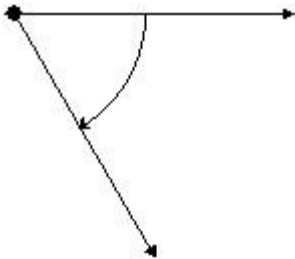
A)



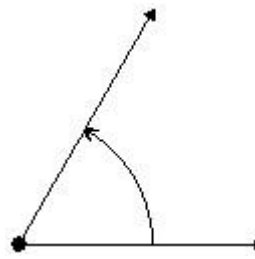
B)



C)



D)

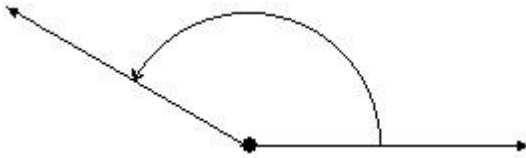


Answer: D

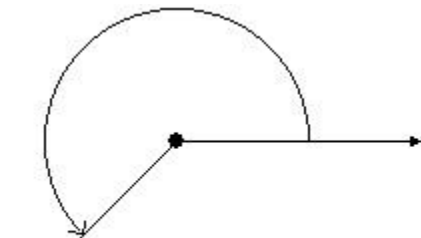
2)  $135^\circ$

2) \_\_\_\_\_

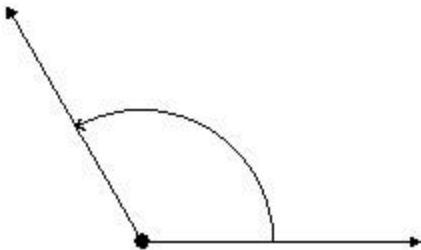
A)



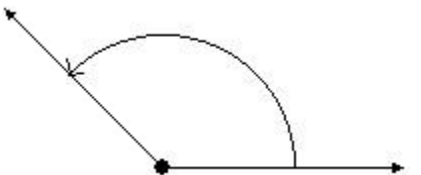
B)



C)



D)

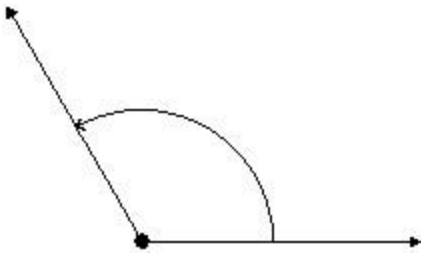


Answer: D

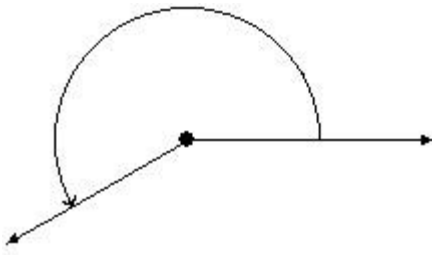
3)  $\frac{2\pi}{3}$

3) \_\_\_\_\_

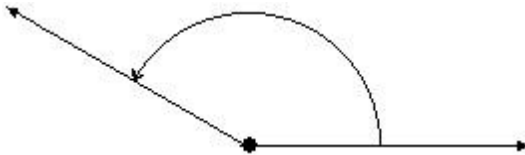
A)



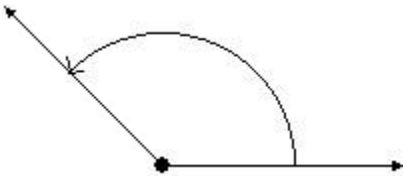
B)



C)



D)

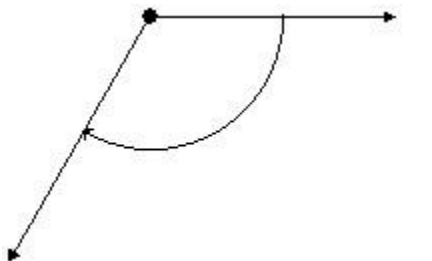


Answer: A

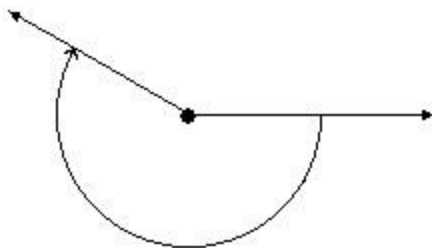
4)  $\frac{3\pi}{4}$

4) \_\_\_\_\_

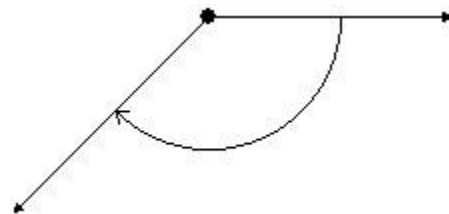
A)



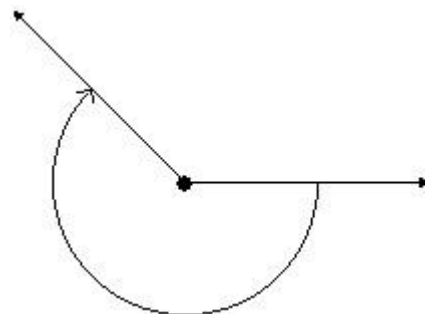
C)



B)



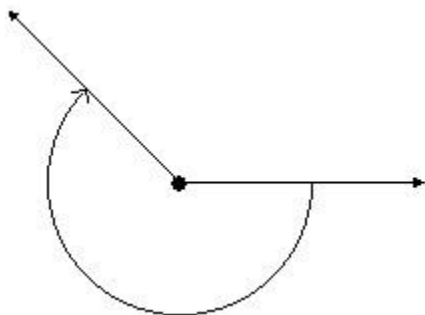
D)



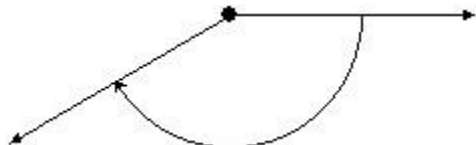
Answer: B

5)  $-150^\circ$

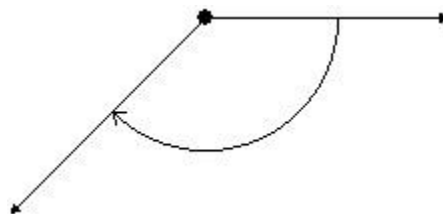
A)



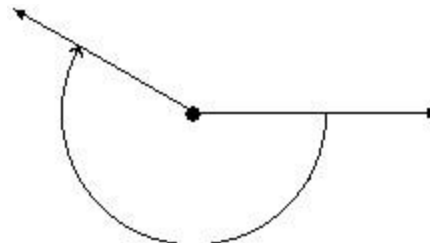
C)



B)



D)

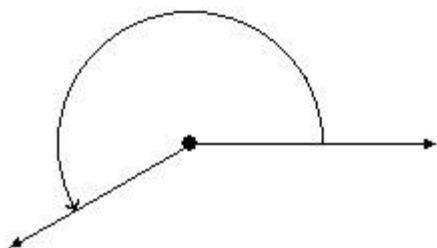


5) \_\_\_\_\_

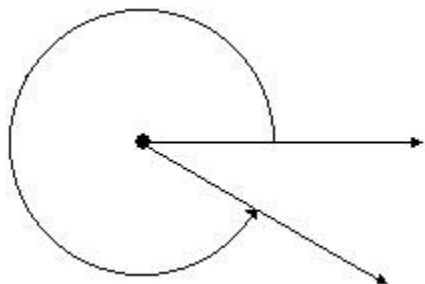
Answer: C

6)  $330^\circ$

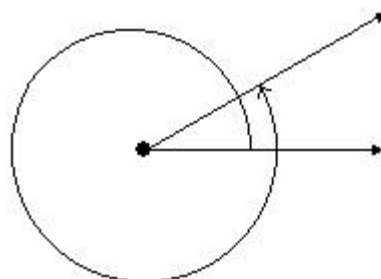
A)



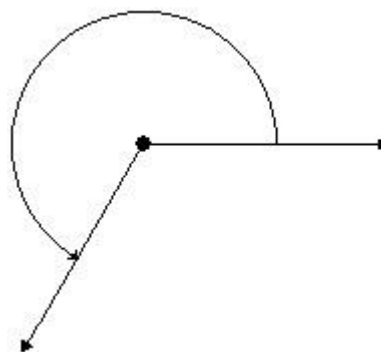
C)



B)



D)

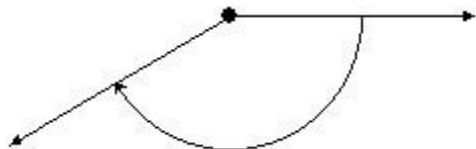


6) \_\_\_\_\_

Answer: C

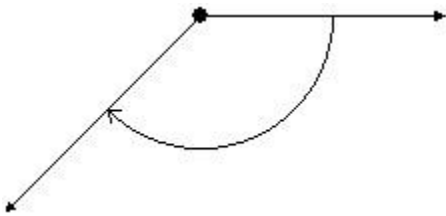
7)  $\frac{7\pi}{6}$

A)

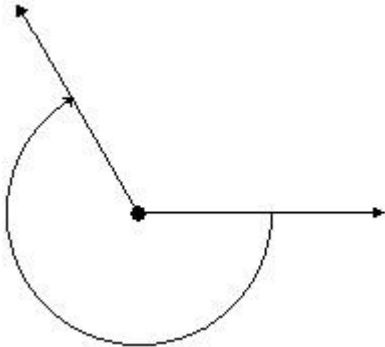


B)

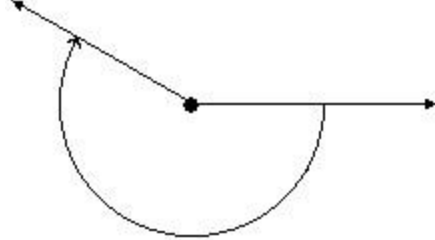
7) \_\_\_\_\_



C)



D)

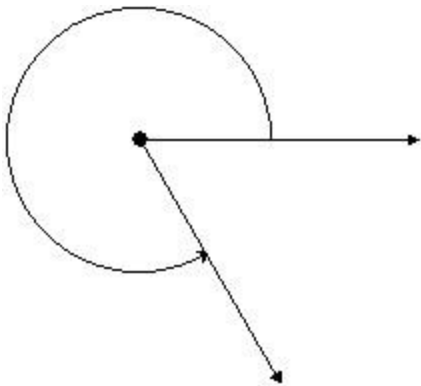


Answer: D

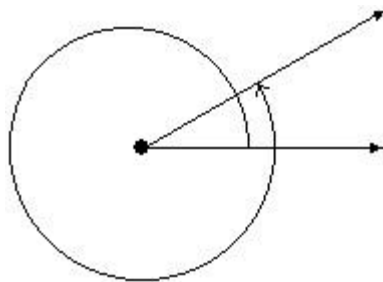
8)  $\frac{5\pi}{3}$

8) \_\_\_\_\_

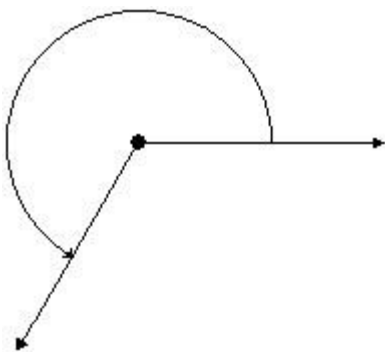
A)



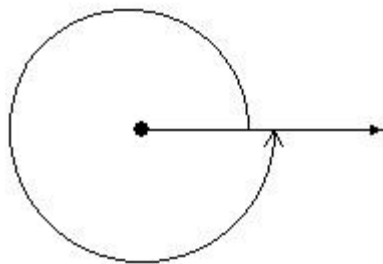
B)



C)



D)

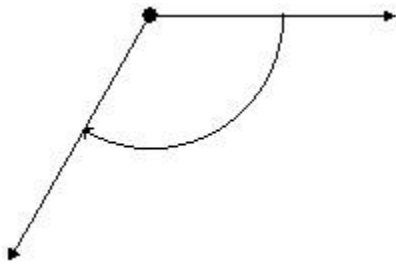


Answer: A

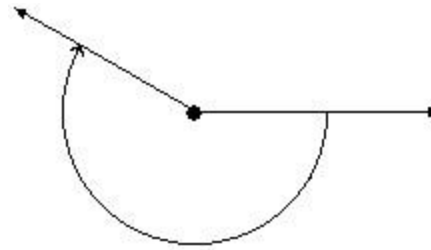
9)  $-120^\circ$

9) \_\_\_\_\_

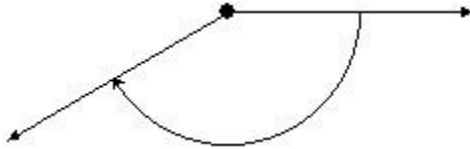
A)



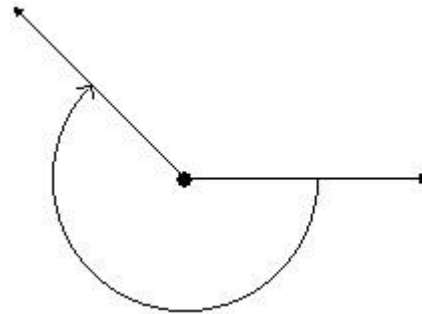
B)



C)



D)

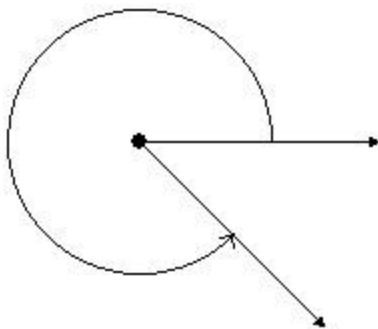


Answer: A

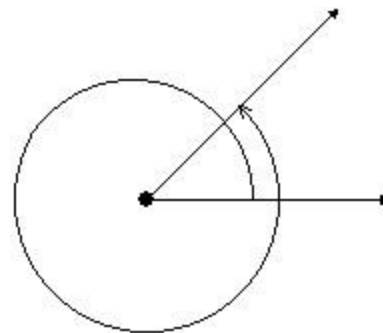
10)  $\frac{7\pi}{4}$

10) \_\_\_\_\_

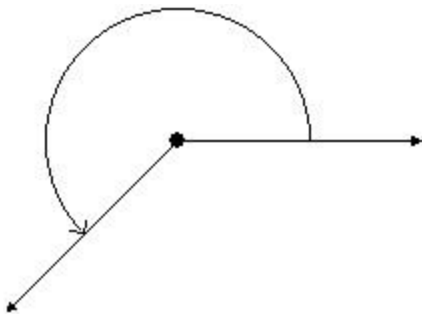
A)



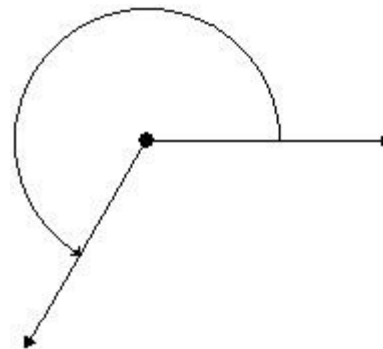
B)



C)



D)



Answer: A

Convert the angle to a decimal in degrees. Round the answer to two decimal places.

11)  $32^\circ 42' 31''$

11) \_\_\_\_\_

A)  $32.71^\circ$

B)  $32.77^\circ$

C)  $32.67^\circ$

D)  $32.72^\circ$

Answer: A

12)  $172^\circ 15' 53''$

12) \_\_\_\_\_

A)  $172.22^\circ$

B)  $172.26^\circ$

C)  $172.27^\circ$

D)  $172.32^\circ$

Answer: B

- 13)  $303^{\circ}6'49''$  13) \_\_\_\_\_  
A)  $303.07^{\circ}$  B)  $303.17^{\circ}$  C)  $303.11^{\circ}$  D)  $303.12^{\circ}$

Answer: C

- 14)  $23^{\circ}47'37''$  14) \_\_\_\_\_  
A)  $23.84^{\circ}$  B)  $23.52^{\circ}$  C)  $23.79^{\circ}$  D)  $23.94^{\circ}$

Answer: C

- 15)  $21^{\circ}17'34''$  15) \_\_\_\_\_  
A)  $21.37^{\circ}$  B)  $21.22^{\circ}$  C)  $21.29^{\circ}$  D)  $21.34^{\circ}$

Answer: C

**Convert the angle to  $D^{\circ} M' S''$  form. Round the answer to the nearest second.**

- 16)  $51.33^{\circ}$  16) \_\_\_\_\_  
A)  $51^{\circ}19'33''$  B)  $51^{\circ}19'36''$  C)  $51^{\circ}19'48''$  D)  $51^{\circ}19'54''$

Answer: C

- 17)  $190.86^{\circ}$  17) \_\_\_\_\_  
A)  $190^{\circ}52'36''$  B)  $190^{\circ}49'86''$  C)  $190^{\circ}51'36''$  D)  $190^{\circ}51'86''$

Answer: C

- 18)  $337.58^{\circ}$  18) \_\_\_\_\_  
A)  $337^{\circ}47'58''$  B)  $337^{\circ}34'48''$  C)  $337^{\circ}35'47''$  D)  $337^{\circ}34'58''$

Answer: B

**If  $s$  denotes the length of the arc of a circle of radius  $r$  subtended by a central angle  $\theta$ , find the missing quantity.**

- 19)  $r = 13.38$  centimeters,  $\theta = 3.5$  radians,  $s = ?$  19) \_\_\_\_\_  
A) 47.8 cm B) 45.8 cm C) 46.8 cm D) 48.8 cm

Answer: C

- 20)  $r = 11.0$  inches,  $\theta = 30^{\circ}$ ,  $s = ?$  20) \_\_\_\_\_  
A) 6.0 in. B) 6.1 in. C) 5.9 in. D) 5.8 in.

Answer: D

- 21)  $r = \frac{1}{2}$  feet,  $s = 8$  feet,  $\theta = ?$  21) \_\_\_\_\_

- A)  $16^{\circ}$  B)  $4^{\circ}$  C) 16 radians D) 4 radians

Answer: C

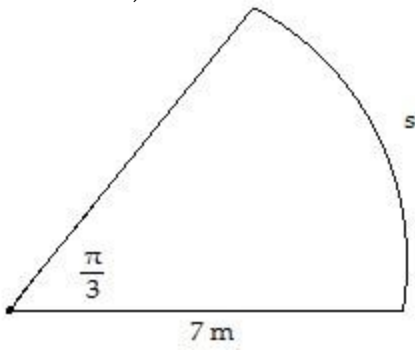
- 22)  $s = 4.62$  meters,  $\theta = 3.3$  radians,  $r = ?$  22) \_\_\_\_\_  
A) 0.71 m B) 1.2 m C) 0.7 m D) 1.4 m

Answer: D

**Find the length  $s$ . Round the answer to three decimal places.**

- 23)

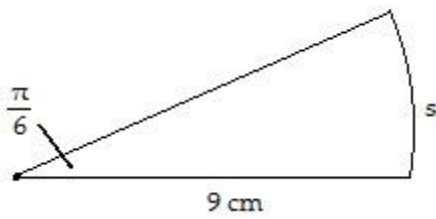
23)



—  
—

- A) 7.33 m      B) 6.685 m      C) 14.66 m      D) 1.346 m  
Answer: A

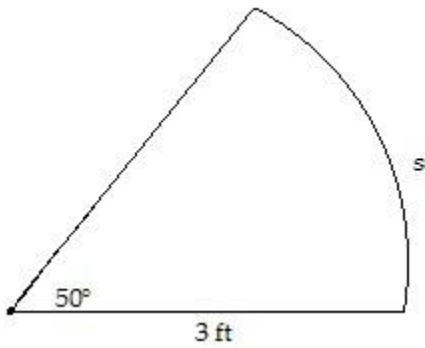
24)



24) \_\_\_\_\_

- A) 2.094 cm      B) 9.424 cm      C) 4.712 cm      D) 17.189 cm  
Answer: C

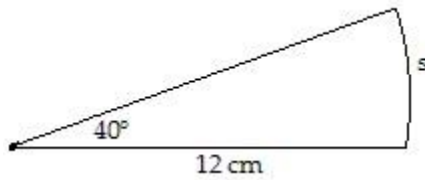
25)



25) \_\_\_\_\_

- A) 2.356 ft      B) 2.094 ft      C) 2.88 ft      D) 2.618 ft  
Answer: D

26)



26) \_\_\_\_\_

- A) 9.216 cm      B) 7.54 cm      C) 6.702 cm      D) 8.378 cm  
Answer: D

**Solve the problem.**

27) For a circle of radius 4 feet, find the arc length  $s$  subtended by a central angle of  $30^\circ$ . Round to the nearest hundredth.

27) \_\_\_\_\_



- A) 376.99 ft                      B) 4.19 ft                      C) 2.09 ft                      D) 6.28 ft  
 Answer: C

- 28) For a circle of radius 4 feet, find the arc length  $s$  subtended by a central angle of  $60^\circ$ . Round to the nearest hundredth. 28) \_\_\_\_\_  
 A) 4.19 ft                      B) 4.25 ft                      C) 4.40 ft                      D) 4.35 ft  
 Answer: A

- 29) A ship in the Atlantic Ocean measures its position to be  $27^\circ 33'$  north latitude. Another ship is reported to be due north of the first ship at  $45^\circ 38'$  north latitude. Approximately how far apart are the two ships? Round to the nearest mile. Assume that the radius of the Earth is 3960 miles. 29) \_\_\_\_\_  
 A) 71,587 mi                      B) 71,610 mi                      C) 1227 mi                      D) 1250 mi  
 Answer: D

**SHORT ANSWER. Write the word or phrase that best completes each statement or answers the question.**

- 30) Salt Lake City, Utah, is due north of Flagstaff, Arizona. Find the distance between Salt Lake City ( $40^\circ 45'$  north latitude) and Flagstaff ( $35^\circ 16'$  north latitude). Assume that the radius of the Earth is 3960 miles. Round to nearest whole mile. 30) \_\_\_\_\_  
 Answer: 379 mi

**MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.**

- 31) The minute hand of a clock is 4 inches long. How far does the tip of the minute hand move in 45 minutes? If necessary, round the answer to two decimal places. 31) \_\_\_\_\_  
 A) 20.08 in.                      B) 21.36 in.                      C) 18.85 in.                      D) 17.11 in.  
 Answer: C
- 32) A pendulum swings through an angle of  $30^\circ$  each second. If the pendulum is 55 inches long, how far does its tip move each second? If necessary, round the answer to two decimal places. 32) \_\_\_\_\_  
 A) 26.95 in.                      B) 30.09 in.                      C) 28.8 in.                      D) 31.23 in.  
 Answer: C

**Convert the angle in degrees to radians. Express the answer as multiple of  $\pi$ .**

- 33)  $36^\circ$  33) \_\_\_\_\_  
 A)  $\frac{\pi}{7}$                       B)  $\frac{\pi}{5}$                       C)  $\frac{\pi}{4}$                       D)  $\frac{\pi}{6}$   
 Answer: B
- 34)  $-60^\circ$  34) \_\_\_\_\_  
 A)  $\frac{\pi}{4}$                       B)  $\frac{\pi}{5}$                       C)  $\frac{\pi}{3}$                       D)  $\frac{\pi}{2}$   
 Answer: C
- 35)  $150^\circ$  35) \_\_\_\_\_  
 A)  $\frac{5\pi}{6}$                       B)  $\frac{6\pi}{5}$                       C)  $\frac{4\pi}{5}$                       D)  $\frac{6\pi}{7}$   
 Answer: A
- 36)  $-480^\circ$  36) \_\_\_\_\_  
 A)  $\frac{8\pi}{3}$                       B)  $\frac{3\pi}{8}$                       C)  $\frac{7\pi}{2}$                       D)  $\frac{9\pi}{4}$   
 Answer: A

37)  $87^\circ$                       A)  $\frac{29\pi}{90}$                       B)  $\frac{29\pi}{120}$                       C)  $\frac{29\pi}{60}$                       D)  $\frac{29\pi}{30}$                       37) \_\_\_\_\_

Answer: C

38)  $6^\circ$                       A)  $\frac{\pi}{15}$                       B)  $\frac{\pi}{60}$                       C)  $\frac{\pi}{18}$                       D)  $\frac{\pi}{30}$                       38) \_\_\_\_\_

Answer: D

**Convert the angle in radians to degrees.**

39)  $\frac{4\pi}{3}$                       A)  $242^\circ$                       B)  $241^\circ$                       C)  $240^\circ$                       D)  $239^\circ$                       39) \_\_\_\_\_

Answer: C

40)  $\frac{11\pi}{4}$                       A)  $-494^\circ$                       B)  $-495^\circ$                       C)  $-497^\circ$                       D)  $-496^\circ$                       40) \_\_\_\_\_

Answer: B

41)  $\frac{\pi}{3}$                       A)  $60^\circ$                       B)  $1^\circ$                       C)  $60\pi^\circ$                       D)  $3^\circ$                       41) \_\_\_\_\_

Answer: A

42)  $\frac{\pi}{5}$                       A)  $1^\circ$                       B)  $-1^\circ$                       C)  $-36\pi^\circ$                       D)  $-36^\circ$                       42) \_\_\_\_\_

Answer: D

43)  $\frac{5\pi}{2}$                       A)  $900^\circ$                       B)  $450^\circ$                       C)  $144^\circ$                       D)  $72\pi^\circ$                       43) \_\_\_\_\_

Answer: B

44)  $\frac{10}{3}\pi$                       A)  $1200\pi^\circ$                       B)  $600^\circ$                       C)  $300^\circ$                       D)  $10^\circ$                       44) \_\_\_\_\_

Answer: B

45)  $\frac{\pi}{6}$                       A)  $15^\circ$                       B)  $1080^\circ$                       C)  $30^\circ$                       D)  $60^\circ$                       45) \_\_\_\_\_

Answer: C

46)  $\frac{11\pi}{12}$                       A)  $160^\circ$                       B)  $210^\circ$                       C)  $165^\circ$                       D)  $150^\circ$                       46) \_\_\_\_\_

Answer: C

Convert the angle in degrees to radians. Express the answer in decimal form, rounded to two decimal places.

- 47)  $338^\circ$  47) \_\_\_\_\_  
A) 5.9 B) 5.88 C) 5.89 D) 5.87  
Answer: A

- 48)  $-222^\circ$  48) \_\_\_\_\_  
A) -3.84 B) -3.86 C) -3.87 D) -3.85  
Answer: C

Convert the angle in radians to degrees. Express the answer in decimal form, rounded to two decimal places.

- 49) 1 49) \_\_\_\_\_  
A)  $57.35^\circ$  B)  $-0.08^\circ$  C)  $0.02^\circ$  D)  $57.3^\circ$   
Answer: D

- 50) 3.24 50) \_\_\_\_\_  
A)  $185.64^\circ$  B)  $0.13^\circ$  C)  $0.06^\circ$  D)  $185.43^\circ$   
Answer: A

- 51)  $\sqrt{7}$  51) \_\_\_\_\_  
A)  $0.23^\circ$  B)  $151.59^\circ$  C)  $151.53^\circ$  D)  $0.05^\circ$   
Answer: B

If A denotes the area of the sector of a circle of radius r formed by the central angle  $\theta$ , find the missing quantity. If necessary, round the answer to two decimal places.

- 52)  $r = 6$  inches,  $\theta = 3$  radians,  $A = ?$  52) \_\_\_\_\_  
A)  $54 \text{ in}^2$  B)  $18 \text{ in}^2$  C)  $108 \text{ in}^2$  D)  $9 \text{ in}^2$   
Answer: A

- 53)  $r = 8$  feet,  $A = 25$  square feet,  $\theta = ?$  53) \_\_\_\_\_  
A) 800 radians B) 1600 radians C) 0.39 radians D) 0.78 radians  
Answer: D

- 54)  $\frac{\pi}{6}$  54) \_\_\_\_\_  
 $\theta = \frac{\pi}{6}$  radians,  $A = 21$  square meters,  $r = ?$   
A) 2.34 m B) 8.96 m C) 5.5 m D) 21.99 m  
Answer: B

- 55)  $r = 19$  inches,  $\theta = 90^\circ$ ,  $A = ?$  55) \_\_\_\_\_  
A)  $283.39 \text{ in}^2$  B)  $14.92 \text{ in}^2$  C)  $566.77 \text{ in}^2$  D)  $29.83 \text{ in}^2$   
Answer: A

- 56)  $r = 4$  feet,  $A = 34$  square feet,  $\theta = ?$  56) \_\_\_\_\_  
A)  $121.82^\circ$  B)  $31,184.71^\circ$  C)  $15,592.36^\circ$  D)  $243.63^\circ$   
Answer: D

- 57)  $\theta = 60^\circ$ ,  $A = 30$  square meters,  $r = ?$  57) \_\_\_\_\_  
A) 15.7 m B) 3.96 m C) 7.57 m D) 62.8 m  
Answer: C

- 58) 58) \_\_\_\_\_  
 $r = 35.1$  centimeters,  $\theta = \frac{\pi}{9}$  radians,  $A = ?$

A)  $6.1 \text{ cm}^2$

B)  $215 \text{ cm}^2$

C)  $430 \text{ cm}^2$

D)  $68.4 \text{ cm}^2$

Answer: B

59)  $r = 27.5 \text{ feet}$ ,  $\theta = 9.402^\circ$ ,  $A = ?$

A)  $65.05 \text{ ft}^2$

B)  $62.05 \text{ ft}^2$

C)  $124.1 \text{ ft}^2$

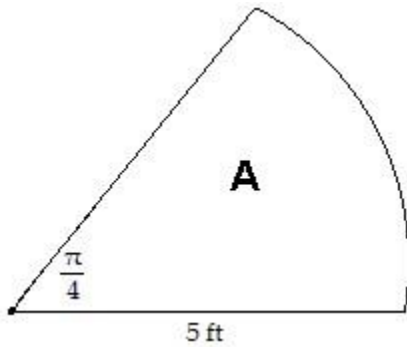
D)  $127.1 \text{ ft}^2$

Answer: B

59) \_\_\_\_\_

Find the area A. Round the answer to three decimal places.

60)



A)  $6.25 \text{ ft}^2$

B)  $9.817 \text{ ft}^2$

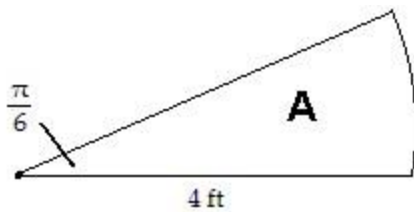
C)  $19.635 \text{ ft}^2$

D)  $1.963 \text{ ft}^2$

Answer: B

60) \_\_\_\_\_

61)



A)  $8.378 \text{ ft}^2$

B)  $1.047 \text{ ft}^2$

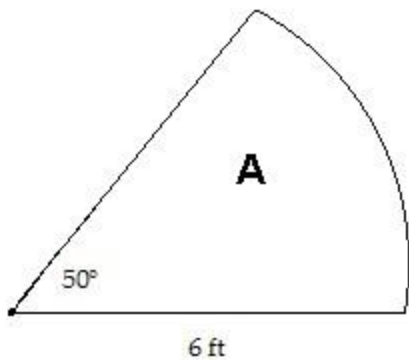
C)  $2.667 \text{ ft}^2$

D)  $4.189 \text{ ft}^2$

Answer: D

61) \_\_\_\_\_

62)



A)  $31.416 \text{ ft}^2$

B)  $5 \text{ ft}^2$

C)  $2.618 \text{ ft}^2$

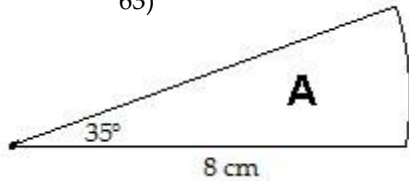
D)  $15.708 \text{ ft}^2$

Answer: D

62) \_\_\_\_\_

63)

63)



- A)  $39.095\text{ cm}^2$       B)  $6.222\text{ cm}^2$       C)  $19.548\text{ cm}^2$       D)  $2.443\text{ cm}^2$   
 Answer: C

**Solve the problem.**

- 64) A circle has a radius of 6 centimeters. Find the area of the sector of the circle formed by an angle of  $75^\circ$ . If necessary, round the answer to two decimal places. 64) \_\_\_\_\_  
 A)  $7.5\text{ cm}^2$       B)  $47.12\text{ cm}^2$       C)  $23.56\text{ cm}^2$       D)  $3.93\text{ cm}^2$   
 Answer: C
- 65) An irrigation sprinkler in a field of lettuce sprays water over a distance of 40 feet as it rotates through an angle of  $145^\circ$ . What area of the field receives water? If necessary, round the answer to two decimal places. 65) \_\_\_\_\_  
 A)  $2024.58\text{ ft}^2$       B)  $4049.16\text{ ft}^2$       C)  $50.61\text{ ft}^2$       D)  $644.44\text{ ft}^2$   
 Answer: A
- 66) As part of an experiment to test different liquid fertilizers, a sprinkler has to be set to cover an area of 120 square yards in the shape of a sector of a circle of radius 50 yards. Through what angle should the sprinkler be set to rotate? If necessary, round the answer to two decimal places. 66) \_\_\_\_\_  
 A)  $17.28^\circ$       B)  $5.5^\circ$       C)  $4.13^\circ$       D)  $2.75^\circ$   
 Answer: B
- 67) The blade of a windshield wiper sweeps out an angle of  $135^\circ$  in one cycle. The base of the blade is 12 inches from the pivot point and the tip is 32 inches from the pivot point. What area does the wiper cover in one cycle? (Round to the nearest 0.1 square inch.) 67) \_\_\_\_\_  
 A)  $1041.8\text{ in}^2$       B)  $1036.7\text{ in}^2$       C)  $948.3\text{ in}^2$       D)  $1105.3\text{ in}^2$   
 Answer: B
- 68) An object is traveling around a circle with a radius of 10 centimeters. If in 20 seconds a central angle of  $\frac{1}{3}$  radian is swept out, what is the linear speed of the object? 68) \_\_\_\_\_  
 A)  $6\text{ cm/sec}$       B)  $6\text{ radians/sec}$       C)  $\frac{1}{6}\text{ radians/sec}$       D)  $\frac{1}{6}\text{ cm/sec}$   
 Answer: D
- 69) An object is traveling around a circle with a radius of 20 meters. If in 10 seconds a central angle of  $\frac{1}{5}$  radian is swept out, what is the linear speed of the object? 69) \_\_\_\_\_  
 A)  $\frac{2}{5}\text{ m/sec}$       B)  $\frac{1}{5}\text{ m/sec}$       C)  $\frac{1}{8}\text{ m/sec}$       D)  $\frac{1}{4}\text{ m/sec}$   
 Answer: A
- 70) An object is traveling around a circle with a radius of 10 meters. If in 15 seconds a central angle of 3 radians is swept out, what is the linear speed of the object? 70) \_\_\_\_\_

A) 3 m/sec

B)  $\frac{1}{3}$  m/sec

C) 2 m/sec

D)  $\frac{2}{3}$  m/sec

Answer: C

71) A weight hangs from a rope 20 feet long. It swings through an angle of  $27^\circ$  each second. How far does the weight travel each second? Round to the nearest 0.1 foot. 71) \_\_\_\_\_

A) 9.4 feet

B) 8.1 feet

C) 9.0 feet

D) 8.7 feet

Answer: A

72) A gear with a radius of 8 centimeters is turning at  $\frac{\pi}{9}$  radians/sec. What is the linear speed at a point on the outer edge of the gear? 72) \_\_\_\_\_

A)  $\frac{8\pi}{9}$  cm/sec

B)  $\frac{\pi}{72}$  cm/sec

C)  $72\pi$  cm/sec

D)  $\frac{9\pi}{8}$  cm/sec

Answer: A

73) A wheel of radius 1.9 feet is moving forward at 18 feet per second. How fast is the wheel rotating? 73) \_\_\_\_\_

A) 5.7 radians/sec

B) 9.5 radians/sec

C) 0.11 radians/sec

D) 1.65 radians/sec

Answer: B

74) A car is traveling at 26 mph. If its tires have a diameter of 24 inches, how fast are the car's tires turning? Express the answer in revolutions per minute. If necessary, round to two decimal places. 74) \_\_\_\_\_

A) 2288 rpm

B) 364.15 rpm

C) 344.15 rpm

D) 728.29 rpm

Answer: B

75) A pick-up truck is fitted with new tires which have a diameter of 45 inches. How fast will the pick-up truck be moving when the wheels are rotating at 405 revolutions per minute? Express the answer in miles per hour rounded to the nearest whole number. 75) \_\_\_\_\_

A) 46 mph

B) 9 mph

C) 27 mph

D) 54 mph

Answer: D

76) The Earth rotates about its pole once every 24 hours. The distance from the pole to a location on Earth  $35^\circ$  north latitude is about 3243.8 miles. Therefore, a location on Earth at  $35^\circ$  north latitude is spinning on a circle of radius 3243.8 miles. Compute the linear speed on the surface of the Earth at  $35^\circ$  north latitude. 76) \_\_\_\_\_

A) 20,381 mph

B) 135 mph

C) 849 mph

D) 913 mph

Answer: C

77) To approximate the speed of a river, a circular paddle wheel with radius 0.55 feet is lowered into the water. If the current causes the wheel to rotate at a speed of 12 revolutions per minute, what is the speed of the current? If necessary, round to two decimal places. 77) \_\_\_\_\_

A) 41.47 mph

B) 0.08 mph

C) 0.24 mph

D) 0.47 mph

Answer: D

**SHORT ANSWER. Write the word or phrase that best completes each statement or answers the question.**

78) The four Galilean moons of Jupiter have orbital periods and mean distances from Jupiter given by the following table.

78)	Distance (km)	Period (Earth hours)	
Io	$4.214 \times 10^5$	42.460	—
Europa	$6.709 \times 10^5$	85.243	—
Ganymeade	$1.070 \times 10^6$	171.709	—
Callisto	$1.883 \times 10^6$	400.536	—

Find the linear speed of each moon. Which is the fastest (in terms of linear speed)?

Answer:  $6.24 \times 10^4$  kmp;  $4.95 \times 10^4$  kmp;  $3.92 \times 10^4$  kmp;  $2.95 \times 10^4$  kmp; Io

**MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.**

79) In a computer simulation, a satellite orbits around Earth at a distance from the Earth's surface of  $2.7 \times 10^4$  miles. The orbit is circular, and one revolution around Earth takes 10.1 days. 79) \_\_\_\_\_

Assuming the radius of the Earth is 3960 miles, find the linear speed of the satellite. Express the answer in miles per hour to the nearest whole mile.

- A) 128 mph                      B) 803 mph                      C) 17,189 mph                      D) 700 mph

Answer: B

80) A carousel has a radius of 19 feet and takes 29 seconds to make one complete revolution. What is the linear speed of the carousel at its outside edge? If necessary, round the answer to two decimal places. 80) \_\_\_\_\_

- A) 119.38 ft/sec                      B) 0.66 ft/sec                      C) 9.59 ft/sec                      D) 4.12 ft/sec

Answer: D

**In the problem,  $t$  is a real number and  $P = (x, y)$  is the point on the unit circle that corresponds to  $t$ . Find the exact value of the indicated trigonometric function of  $t$ .**

81)  $\left(\frac{4}{7}, \frac{\sqrt{33}}{7}\right)$  Find  $\sin t$ . 81) \_\_\_\_\_  
 A)  $\frac{\sqrt{33}}{7}$                       B)  $\frac{4\sqrt{33}}{33}$                       C)  $\frac{\sqrt{33}}{4}$                       D)  $\frac{4}{7}$

Answer: A

82)  $\left(\frac{3}{4}, \frac{\sqrt{7}}{4}\right)$  Find  $\tan t$ . 82) \_\_\_\_\_  
 A)  $\frac{3\sqrt{7}}{7}$                       B)  $\frac{\sqrt{7}}{4}$                       C)  $\frac{4}{3}$                       D)  $\frac{\sqrt{7}}{3}$

Answer: D

83)  $\left(\frac{\sqrt{11}}{6}, \frac{5}{6}\right)$  Find  $\sec t$ . 83) \_\_\_\_\_  
 A) \_\_\_\_\_

$$\frac{5\sqrt{11}}{11}$$

B) 
$$\frac{6\sqrt{11}}{11}$$

C) 
$$\frac{\sqrt{11}}{5}$$

D) 
$$\frac{6}{5}$$

Answer: B

84) 
$$\left(-\frac{\sqrt{55}}{8}, \frac{3}{8}\right)$$
 Find  $\cos t$ .  
A) 
$$\frac{\sqrt{55}}{3}$$

B) 
$$\frac{\sqrt{55}}{8}$$

C) 
$$\frac{3}{8}$$

D) 
$$\frac{8\sqrt{55}}{55}$$

84) \_\_\_\_\_

Answer: B

85) 
$$\left(-\frac{\sqrt{21}}{5}, \frac{2}{5}\right)$$
 Find  $\cot t$ .  
A) 
$$\frac{\sqrt{21}}{5}$$

B) 
$$\frac{5}{2}$$

C) 
$$\frac{\sqrt{21}}{2}$$

D) 
$$\frac{2}{5}$$

85) \_\_\_\_\_

Answer: C

86) 
$$\left(-\frac{\sqrt{11}}{6}, -\frac{5}{6}\right)$$
 Find  $\sin t$ .  
A) 
$$\frac{5}{6}$$

B) 
$$\frac{6\sqrt{11}}{11}$$

C) 
$$\frac{6}{5}$$

D) 
$$\frac{\sqrt{11}}{6}$$

86) \_\_\_\_\_

Answer: A

87) 
$$\left(-\frac{\sqrt{11}}{6}, -\frac{5}{6}\right)$$
 Find  $\cot t$ .  
A) 
$$\frac{\sqrt{11}}{6}$$

B) 
$$\frac{5\sqrt{11}}{11}$$

C) 
$$\frac{\sqrt{11}}{5}$$

D) 
$$\frac{\sqrt{11}}{5}$$

87) \_\_\_\_\_

Answer: D

88) 
$$\left(\frac{4}{9}, -\frac{\sqrt{65}}{9}\right)$$
 Find  $\csc t$ .  
A) 
$$\frac{\sqrt{65}}{9}$$

B) 
$$\frac{\sqrt{65}}{4}$$

C) 
$$\frac{9\sqrt{65}}{65}$$

D) 
$$\frac{\sqrt{65}}{9}$$

88) \_\_\_\_\_

Answer: C

89) 
$$\left(\frac{3}{4}, -\frac{\sqrt{7}}{4}\right)$$
 Find  $\cos t$ .  
A) 
$$\frac{\sqrt{7}}{4}$$

B) 
$$\frac{3}{4}$$

C) 
$$\frac{\sqrt{7}}{4}$$

D) 
$$\frac{3}{4}$$

89) \_\_\_\_\_

Answer: D

90) 
$$\left(\frac{1}{5}, -\frac{2\sqrt{6}}{5}\right)$$
 Find  $\csc t$ .  
A) 
$$\frac{\sqrt{6}}{2}$$

B) 
$$\frac{5\sqrt{6}}{12}$$

C) 
$$\frac{1}{5}$$

D) 
$$\frac{5}{1}$$

90) \_\_\_\_\_

Answer: B





Answer: C

- 102)  $\frac{\pi}{4}$  102) \_\_\_\_\_  
 sin  
 A)  $\frac{\sqrt{2}}{2}$       B)  $\frac{\sqrt{2}}{2}$       C)  $\frac{1}{2}$       D)  $\sqrt{2}$

Answer: B

- 103)  $\cos 45^\circ$  103) \_\_\_\_\_  
 A)  $\frac{1}{2}$       B)  $\sqrt{2}$       C)  $\frac{\sqrt{2}}{2}$       D)  $\frac{\sqrt{3}}{2}$

Answer: C

**Find the exact value of the expression if  $\theta = 45^\circ$ . Do not use a calculator.**

- 104)  $f(\theta) = \cot \theta$  Find  $f(\theta)$ . 104) \_\_\_\_\_  
 A) 0      B) -1      C)  $\sqrt{3}$       D) 1

Answer: D

- 105)  $g(\theta) = \sin \theta$  Find  $[g(\theta)]^2$ . 105) \_\_\_\_\_  
 A)  $\frac{1}{2}$       B)  $\sqrt{2}$       C)  $\frac{\sqrt{2}}{2}$       D) 2

Answer: A

- 106)  $f(\theta) = \sin \theta$  Find  $9f(\theta)$ . 106) \_\_\_\_\_  
 A)  $\frac{9\sqrt{2}}{2}$       B)  $\frac{9\sqrt{2}}{2}$       C)  $\frac{\sqrt{2}}{2}$       D)  $\frac{\sqrt{2}}{2}$

Answer: A

- 107)  $g(\theta) = \sin \theta$  Find  $6g(\theta)$ . 107) \_\_\_\_\_  
 A)  $6\sqrt{2}$       B)  $3\sqrt{2}$       C)  $3\sqrt{2}$       D)  $6\sqrt{2}$

Answer: B

**Solve the problem.**

- 108) If friction is ignored, the time  $t$  (in seconds) required for a block to slide down an inclined plane is given by the formula 108) \_\_\_\_\_

$$t = \sqrt{\frac{2a}{g \sin \theta \cos \theta}}$$

where  $a$  is the length (in feet) of the base and  $g \approx 32$  feet per second per second is the acceleration of gravity. How long does it take a block to slide down an inclined plane with base  $a = 8$  when  $\theta = 45^\circ$ ? If necessary, round the answer to the nearest tenth of a second.

- A) 1 sec      B) 1.1 sec      C) 1.2 sec      D) 0.3 sec

Answer: A

- 109) The force acting on a pendulum to bring it to its perpendicular resting point is called the restoring force. The restoring force  $F$ , in Newtons, acting on a string pendulum is given by the formula perp the  
endi value  
cular of the  
restori  
 $F = mg \sin \theta$   
 where  $m$  is the mass in kilograms of the pendulum's bob,  $g \approx 9.8$  meters per second per second is the acceleration due to gravity, and  $\theta$  is angle at which the pendulum is displaced from the Wha ng  
t is force

when  $m = 109$ )

$= 0.6$

kilogram

and  $\theta =$

$45^\circ$ ? If

necessar

y, round

the

answer

to the

nearest

tenth of a

Newton.

- A) 4 N                      B) 4.2 N                      C) 5 N                      D) 4.3 N

Answer: B

**Find the exact value. Do not use a calculator.**

110)  $\sec 30^\circ$

- A)  $\frac{2\sqrt{3}}{3}$                       B)  $\frac{\sqrt{3}}{2}$                       C) 2                      D)  $\sqrt{2}$

110) \_\_\_\_\_

Answer: A

111)  $\tan 60^\circ$

- A)  $\frac{\sqrt{3}}{2}$                       B)  $\sqrt{3}$                       C) 2                      D)  $\frac{\sqrt{3}}{3}$

111) \_\_\_\_\_

Answer: B

112)  $\frac{\pi}{6}$

$\tan$

- A) 1                      B)  $\frac{\sqrt{3}}{2}$                       C)  $\frac{\sqrt{3}}{3}$                       D)  $\sqrt{3}$

112) \_\_\_\_\_

Answer: C

113)  $\frac{\pi}{3}$

$\cot$

- A)  $\sqrt{3}$                       B) 1                      C)  $\frac{1}{2}$                       D)  $\frac{\sqrt{3}}{3}$

113) \_\_\_\_\_

Answer: D

**Find the exact value of the expression. Do not use a calculator.**

114)  $\sec 60^\circ - \sin 60^\circ$

- A)  $\frac{\sqrt{3}}{6}$                       B)  $\frac{4\sqrt{3} - 3\sqrt{2}}{6}$                       C)  $\frac{4 - \sqrt{2}}{2}$                       D)  $\frac{4 - \sqrt{3}}{2}$

114) \_\_\_\_\_

Answer: D

115)  $\cot 60^\circ - \cos 45^\circ$

- A)  $\frac{2\sqrt{2} - 3\sqrt{3}}{6}$                       B)  $\frac{2\sqrt{3} - 3\sqrt{2}}{6}$                       C)  $\frac{2 - \sqrt{3}}{2}$                       D)  $\frac{2 - \sqrt{2}}{2}$

115) \_\_\_\_\_

Answer: B

116)  $\cos 60^\circ + \tan 60^\circ$  116) \_\_\_\_\_  
 A)  $\frac{1+2\sqrt{3}}{2}$  B)  $2\sqrt{3}$  C)  $\frac{3\sqrt{3}}{2}$  D)  $\frac{1+\sqrt{3}}{2}$

Answer: A

117)  $\sin \frac{\pi}{3} - \cos \frac{\pi}{6}$  117) \_\_\_\_\_  
 A) 0 B) 1 C)  $\sqrt{3}$  D)  $\frac{\sqrt{3}-1}{2}$

Answer: A

118)  $\tan \frac{\pi}{6} - \cos \frac{\pi}{6}$  118) \_\_\_\_\_  
 A)  $\frac{2\sqrt{3}-3\sqrt{2}}{6}$  B)  $\sqrt{3}$  C)  $\frac{\sqrt{6}}{2}$  D)  $\frac{\sqrt{3}}{6}$

Answer: D

**Find the exact value of the expression if  $\theta = 30^\circ$ . Do not use a calculator.**

119)  $f(\theta) = \cot \theta$  Find  $f(\theta)$ . 119) \_\_\_\_\_  
 A)  $\frac{\sqrt{3}}{2}$  B) 1 C)  $\sqrt{3}$  D)  $\frac{\sqrt{3}}{3}$

Answer: C

120)  $g(\theta) = \cos \theta$  Find  $g(2\theta)$ . 120) \_\_\_\_\_  
 A)  $\sqrt{3}$  B) 1 C)  $\frac{\sqrt{3}}{2}$  D)  $\frac{1}{2}$

Answer: D

121)  $f(\theta) = \sin \theta$  Find  $[f(\theta)]^2$ . 121) \_\_\_\_\_  
 A)  $\frac{3}{4}$  B)  $\frac{1}{2}$  C) 1 D)  $\frac{1}{4}$

Answer: D

122)  $g(\theta) = \sin \theta$  Find  $10g(\theta)$ . 122) \_\_\_\_\_  
 A) 5 B)  $\frac{\sqrt{3}}{2}$  C)  $5\sqrt{3}$  D)  $\frac{1}{2}$

Answer: A

123)  $f(\theta) = \cos \theta$  Find  $11f(\theta)$ . 123) \_\_\_\_\_  
 A)  $\frac{1}{2}$  B)  $\frac{\sqrt{3}}{2}$  C)  $\frac{11\sqrt{3}}{2}$  D)  $\frac{11}{2}$

Answer: C

**Find the exact value of the expression if  $\theta = 60^\circ$ . Do not use a calculator.**

124)  $f(\theta) = \sin \theta$  Find  $f(\theta)$ . 124) \_\_\_\_\_  
 A)  $\frac{1}{2}$  B)  $\frac{\sqrt{3}}{2}$  C)  $\frac{\sqrt{2}}{2}$  D)  $\frac{\sqrt{3}}{3}$

Answer: B

125)  $g(\theta) = \cos \theta$  Find  $[g(\theta)]^2$ . 125) \_\_\_\_\_  
 A)  $\frac{\sqrt{3}}{2}$  B)  $\frac{1}{4}$  C)  $\frac{3}{4}$  D)  $\sqrt{3}$

Answer: B

126)  $f(\theta) = \sin \theta$  Find  $10f(\theta)$ . 126) \_\_\_\_\_  
 A)  $\frac{\sqrt{3}}{2}$  B)  $5\sqrt{3}$  C)  $\frac{1}{2}$  D) 5

Answer: B

127)  $g(\theta) = \cos \theta$  Find  $5g(\theta)$ . 127) \_\_\_\_\_  
 A)  $\frac{\sqrt{3}}{2}$  B)  $\frac{5\sqrt{3}}{2}$  C)  $\frac{1}{2}$  D)  $\frac{5}{2}$

Answer: D

**Solve the problem.**

128) If friction is ignored, the time  $t$  (in seconds) required for a block to slide down an inclined plane is given by the formula 128) \_\_\_\_\_

$$t = \sqrt{\frac{2a}{g \sin \theta \cos \theta}}$$

where  $a$  is the length (in feet) of the base and  $g \approx 32$  feet per second per second is the acceleration of gravity. How long does it take a block to slide down an inclined plane with base  $a = 11$  when  $\theta = 30^\circ$ ? If necessary, round the answer to the nearest tenth of a second.

- A) 0.3 sec B) 1.3 sec C) 2.1 sec D) 1.1 sec

Answer: B

129) The force acting on a pendulum to bring it to its perpendicular resting point is called the restoring force. The restoring force  $F$ , in Newtons, acting on a string pendulum is given by the formula 129) \_\_\_\_\_

$$F = mg \sin \theta$$

where  $m$  is the mass in kilograms of the pendulum's bob,  $g \approx 9.8$  meters per second per second is the acceleration due to gravity, and  $\theta$  is angle at which the pendulum is displaced from the perpendicular. What is the value of the restoring force when  $m = 0.6$  kilogram and  $\theta = 30^\circ$ ? If necessary, round the answer to the nearest tenth of a Newton.

- A) 2.9 N B) 2.8 N C) 5.8 N D) 5.1 N

Answer: A

**Find the exact value. Do not use a calculator.**

130)  $\frac{16\pi}{3}$  130) \_\_\_\_\_  
 cos  
 A)  $\frac{\sqrt{3}}{2}$  B)  $\frac{\sqrt{3}}{2}$  C)  $\frac{1}{2}$  D)  $\frac{1}{2}$

Answer: C

131)  $\frac{13\pi}{4}$  131) \_\_\_\_\_  
 sec  
 A)  $-\sqrt{2}$  B)  $\frac{\sqrt{2}}{2}$  C) -2 D)  $\frac{2\sqrt{3}}{3}$

Answer: A

132)  $\sin 765^\circ$  A)  $\frac{1}{2}$  B)  $\frac{1}{2}$  C)  $\frac{\sqrt{2}}{2}$  D)  $\frac{\sqrt{2}}{2}$  132) \_\_\_\_\_

Answer: D

133)  $\cot 570^\circ$  A)  $-\sqrt{3}$  B)  $\sqrt{3}$  C)  $\frac{\sqrt{3}}{3}$  D)  $\frac{\sqrt{3}}{3}$  133) \_\_\_\_\_

Answer: B

**Find the exact value of the expression. Do not use a calculator.**

134)  $\tan \frac{7\pi}{4} + \tan \frac{5\pi}{4}$  A)  $\frac{1}{2}$  B)  $\frac{\sqrt{2}+1}{2}$  C) 0 D)  $\frac{2\sqrt{2}+1}{6}$  134) \_\_\_\_\_

Answer: C

135)  $\sin 135^\circ - \sin 270^\circ$  A)  $\frac{\sqrt{2}}{2}$  B) 2 C)  $\frac{\sqrt{2}+2}{2}$  D)  $\frac{\sqrt{2}-2}{2}$  135) \_\_\_\_\_

Answer: C

136)  $\cos \frac{\pi}{3} + \tan \frac{5\pi}{3}$  A)  $\frac{1-2\sqrt{3}}{2}$  B)  $\frac{2\sqrt{3}+3}{6}$  C)  $\frac{\sqrt{3}+1}{2}$  D)  $\frac{\sqrt{3}+3}{3}$  136) \_\_\_\_\_

Answer: A

137)  $\cos 120^\circ \tan 60^\circ$  A)  $\frac{\sqrt{3}}{2}$  B)  $\frac{1}{4}$  C)  $\frac{3}{2}$  D)  $\frac{\sqrt{3}}{2}$  137) \_\_\_\_\_

Answer: A

138)  $\tan 150^\circ \cos 210^\circ$  A)  $\frac{5\sqrt{3}}{6}$  B)  $\frac{3\sqrt{3}+2\sqrt{3}}{6}$  C)  $\frac{2\sqrt{3}+3}{6}$  D)  $\frac{\sqrt{3}+1}{2}$  138) \_\_\_\_\_

Answer: A

139)  $\sin 330^\circ \sin 270^\circ$  A)  $\frac{\sqrt{3}}{2}$  B)  $\frac{\sqrt{3}}{2}$  C)  $\frac{1}{2}$  D)  $\frac{1}{2}$  139) \_\_\_\_\_

Answer: C

**Use a calculator to find the approximate value of the expression rounded to two decimal places.**

140)  $\sin 18^\circ$  A) 0.36 B) 0.31 C) -0.80 D) -0.75 140) \_\_\_\_\_

Answer: B



- A) 1.2 sec                      B) 1.4 sec                      C) 0.3 sec                      D) 1.1 sec

Answer: A

- 152) The force acting on a pendulum to bring it to its perpendicular resting point is called the restoring force. The restoring force  $F$ , in Newtons, acting on a string pendulum is given by the formula 152) \_\_\_\_\_

$$F = mg \sin\theta$$

where  $m$  is the mass in kilograms of the pendulum's bob,  $g \approx 9.8$  meters per second per second is the acceleration due to gravity, and  $\theta$  is angle at which the pendulum is displaced from the perpendicular. What is the value of the restoring force when  $m = 0.9$  kilogram and  $\theta = 83^\circ$ ? If necessary, round the answer to the nearest tenth of a Newton.

- A) 1.1 N                      B) 8.8 N                      C) 8.5 N                      D) 8.7 N

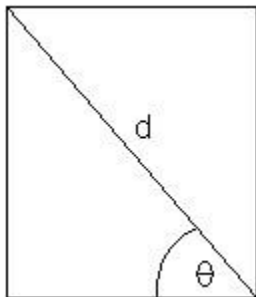
Answer: B

**SHORT ANSWER. Write the word or phrase that best completes each statement or answers the question.**

- 153) The strength  $S$  of a wooden beam with rectangular cross section is given by the formula 153) \_\_\_\_\_

$$S = kd^3 \sin^2 \theta \cos \theta$$

where  $d$  is the diagonal length,  $\theta$  the angle illustrated, and  $k$  is a constant that varies with the type of wood used.



Let  $d = 1$  and express the strength  $S$  in terms of the constant  $k$  for  $\theta = 45^\circ, 50^\circ, 55^\circ, 60^\circ$ , and  $65^\circ$ . Does the strength always increase as  $\theta$  gets larger?

Answer:  $0.354k; 0.377k; 0.385k; 0.375k$  and  $0.347k$ ; No, it reaches a maximum near  $55^\circ$ .

**MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.**

**A point on the terminal side of an angle  $\theta$  is given. Find the exact value of the indicated trigonometric function of  $\theta$ .**

- 154)  $(-3, -4)$  Find  $\sin \theta$ . 154) \_\_\_\_\_

- A)  $\frac{4}{5}$                       B)  $\frac{4}{5}$                       C)  $\frac{3}{5}$                       D)  $\frac{3}{5}$

Answer: A

- 155)  $(-3, -4)$  Find  $\cos \theta$ . 155) \_\_\_\_\_

- A)  $\frac{3}{5}$                       B)  $\frac{3}{5}$                       C)  $\frac{4}{5}$                       D)  $\frac{4}{5}$

Answer: A

- 156)  $(-\frac{1}{3}, \frac{1}{5})$  Find  $\cos \theta$ . 156) \_\_\_\_\_

- A)  $\frac{3\sqrt{34}}{34}$                       B)  $\frac{5\sqrt{34}}{34}$                       C)  $\frac{34}{5}$                       D)  $\frac{34}{3}$

Answer: B



157) (3, -2) Find  $\tan \theta$ .

A)  $\frac{2}{3}$

B)  $\frac{\sqrt{13}}{3}$

C)  $\frac{\sqrt{13}}{3}$

D)  $\frac{3}{2}$

157) \_\_\_\_\_

Answer: A

158) (-2, -3) Find  $\cot \theta$ .

A)  $\frac{\sqrt{13}}{2}$

B)  $\frac{3}{2}$

C)  $\frac{\sqrt{13}}{2}$

D)  $\frac{2}{3}$

158) \_\_\_\_\_

Answer: D

159) (-2, -1) Find  $\csc \theta$ .

A) -5

B)  $-\sqrt{5}$

C) -2

D)  $\sqrt{5}$

159) \_\_\_\_\_

Answer: B

160) (-2, -1) Find  $\sec \theta$ .

A)  $-\sqrt{5}$

B)  $\frac{\sqrt{5}}{2}$

C)  $\frac{3\sqrt{5}}{5}$

D)  $\frac{\sqrt{5}}{2}$

160) \_\_\_\_\_

Answer: D

**Solve the problem.**

161) If  $\sin \theta = 0.3$ , find  $\sin(\theta + \pi)$ .

A) 0.7

B) -0.7

C) -0.3

D) 0.3

161) \_\_\_\_\_

Answer: C

162)  $\frac{1}{9}$

If  $\sin \theta = \frac{1}{9}$ , find  $\csc \theta$ .

A)  $\frac{8}{9}$

B) 9

C)  $\frac{1}{9}$

D) undefined

162) \_\_\_\_\_

Answer: B

163) A racetrack curve is banked so that the outside of the curve is slightly elevated or inclined above the inside of the curve. This inclination is called the elevation of the track. The maximum speed on the track in miles per hour is given by

$$\sqrt{r(29000 + 41000 \tan \theta)}$$

where  $r$  is the radius of the track in miles and  $\theta$  is the elevation in degrees. Find the maximum speed for a racetrack with an elevation of  $28^\circ$  and a radius of 0.5 miles. Round to the nearest mile per hour.

A) 35,921 mph

B) 12,347 mph

C) 159 mph

D) 191 mph

163) \_\_\_\_\_

Answer: C

164) The path of a projectile fired at an inclination  $\theta$  to the horizontal with an initial speed  $v_0$  is a parabola. The range  $R$  of the projectile, the horizontal distance that the projectile travels, is found

$$R = \frac{v_0^2 \sin 2\theta}{g}$$

by the formula where  $g = 32.2$  feet per second per second or  $g = 9.8$  meters per second per second. Find the range of a projectile fired with an initial velocity of 124 feet per second at an angle of  $34^\circ$  to the horizontal. Round your answer to two decimal places.

A) 267.02 ft

B) 442.74 ft

C) 442.64 ft

D) 534.05 ft

164) \_\_\_\_\_

Answer: B

- 1) D
- 2) D
- 3) A
- 4) B
- 5) C
- 6) C
- 7) D
- 8) A
- 9) A
- 10) A
- 11) A
- 12) B
- 13) C
- 14) C
- 15) C
- 16) C
- 17) C
- 18) B
- 19) C
- 20) D
- 21) C
- 22) D
- 23) A
- 24) C
- 25) D
- 26) D
- 27) C
- 28) A
- 29) D
- 30) 379 mi
- 31) C
- 32) C
- 33) B
- 34) C
- 35) A
- 36) A
- 37) C
- 38) D
- 39) C
- 40) B
- 41) A
- 42) D
- 43) B
- 44) B
- 45) C
- 46) C
- 47) A
- 48) C
- 49) D
- 50) A
- 51) B

- 52) A
- 53) D
- 54) B
- 55) A
- 56) D
- 57) C
- 58) B
- 59) B
- 60) B
- 61) D
- 62) D
- 63) C
- 64) C
- 65) A
- 66) B
- 67) B
- 68) D
- 69) A
- 70) C
- 71) A
- 72) A
- 73) B
- 74) B
- 75) D
- 76) C
- 77) D
- 78)  $6.24 \times 10^4$  kmp;  $4.95 \times 10^4$  kmp;  $3.92 \times 10^4$  kmp;  $2.95 \times 10^4$  kmp; Io
- 79) B
- 80) D
- 81) A
- 82) D
- 83) B
- 84) B
- 85) C
- 86) A
- 87) D
- 88) C
- 89) D
- 90) B
- 91) A
- 92) C
- 93) B
- 94) D
- 95) B
- 96) C
- 97) B
- 98) C
- 99) A
- 100) B
- 101) C
- 102) B
- 103) C

- 104) D
- 105) A
- 106) A
- 107) B
- 108) A
- 109) B
- 110) A
- 111) B
- 112) C
- 113) D
- 114) D
- 115) B
- 116) A
- 117) A
- 118) D
- 119) C
- 120) D
- 121) D
- 122) A
- 123) C
- 124) B
- 125) B
- 126) B
- 127) D
- 128) B
- 129) A
- 130) C
- 131) A
- 132) D
- 133) B
- 134) C
- 135) C
- 136) A
- 137) A
- 138) A
- 139) C
- 140) B
- 141) B
- 142) A
- 143) A
- 144) C
- 145) B
- 146) B
- 147) A
- 148) B
- 149) D
- 150) D
- 151) A
- 152) B
- 153) 0.354k; 0.377k; 0.385k; 0.375k and 0.347k; No, it reaches a maximum near 55°.
- 154) A
- 155) A

- 156) B
- 157) A
- 158) D
- 159) B
- 160) D
- 161) C
- 162) B
- 163) C
- 164) B