$\qquad$

Use the right triangle to write the quantity as a fraction in lowest terms.

1. $\tan P$

2. Find $x$ to the nearest hundredth.

3. Find $x$. Round the result to the nearest hundredth.

a. $x=16.58$
b. $x=17.57$
c. $x=13.24$
d. $x=29.19$

## Evaluate without using a calculator.

4. $\csc 45^{\circ}$
5. $\cot 60^{\circ}$
6. $\csc 30^{\circ}$

Use a calculator. Round to three decimal places.
7. $\cos 12^{\circ}$
8. $\sec 27^{\circ}$
9. A ladder 12 feet long makes an angle of $67^{\circ}$ with the ground as it leans against a store. How far up the side of the store does the ladder reach?

Find one positive angle and one negative angle that are coterminal with the given angle.
10. $111^{\circ}$
11. $\frac{3 \pi}{4}$
12. $-\frac{5 \pi}{6}$
13. Convert $72^{\circ}$ to radians.
a. ${ }_{2} \pi$
b. ${ }_{5}^{4} \pi$
c. $\frac{2}{5} \pi$
d. $5 \pi$
14. Convert $\frac{5}{18} \pi$ to degrees.
a. $648^{\circ}$
b. $100^{\circ}$
c. $50^{\circ}$
d. $25^{\circ}$
15. Find the arc length of a sector with a radius of 7 feet and a central angle of $36^{\circ}$.
16. Find the area of a sector with a central angle of $60^{\circ}$ and a radius of 9.7 mm . Round to the nearest tenth. Use 3.14 for pi if necessary.
a. $5.1 \mathrm{~mm}^{2}$
b. $2822.7 \mathrm{~mm}^{2}$
c. $49.2 \mathrm{~mm}^{2}$
d. $98.5 \mathrm{~mm}^{2}$
17. A movie runs from 1:00 P.M. to 3:00 P.M. Consider the rotation completed by the hour hand of a clock during this time.
a. Find the measure of the angle generated by the hour hand in both degrees and radians.
b. How does this angle compare with the angle generated by the minute hand from 1:00 P.M. to 3:00 P.M.? Explain your reasoning.
18. The point $(-3,3)$ is on the terminal side of an angle $\theta$. Find $\cos \theta$.
19. The point $(-1, \sqrt{3})$ is on the terminal side of an angle $\theta$. Find $\cos \theta$.
20. The point $(-1,-2)$ is the terminal side of an angle $\theta$. Find $\sec \theta$.
21. Find the reference angle for $17^{\circ}$.
22. Find the reference angle for $\frac{7 \pi}{4}$.
23. Find $\sin 297^{\circ}$. Round to four decimal places.
a. -0.8910
b. -0.4410
c. 0.4540
d. -1.9626
24. A windmill has 4 sails on long arms that rotate in a circle with a radius of 25 feet. The bottom of the circle is 100 feet above the ground.
a. How high above the ground is the midpoint of the sails?
b. Find the angle measure of the end of one arm when it is at its lowest point.
c. The arm from part (b) rotates $135^{\circ}$ counterclockwise. Find the new height of the end of the arm.
25. Find the value of $\cos ^{-1}\left(-\frac{\sqrt{2}}{2}\right)$. Express your answer in degrees.
a. $90^{\circ}$
b. $135^{\circ}$ or $315^{\circ}$
c. $135^{\circ}$
d. $45^{\circ}$ or $90^{\circ}$
_26. Without using a calculator, find the exact value of $\sin ^{-1}\left(-\frac{\sqrt{2}}{2}\right)$.
a. $\frac{1}{3} \pi$
b. $\frac{1}{2} \pi$
c. $-\frac{3}{4} \pi$
d. $-\frac{1}{4} \pi$

Use a calculator to evaluate the expression. Round your answer to three significant digits.
27. $\cos ^{-1}(-0.25)$

Solve the equation for $\theta$. Round your answer to three significant digits.
28. $\sin \theta=-0.62 ; 180^{\circ}<\theta<270^{\circ}$
29. $\sin \theta=0.3 ; 90^{\circ}<\theta<180^{\circ}$
30. A water skier skis off a ramp in order to do an aerial trick. The ramp has a height of 4 feet and a horizontal length of 15 feet.
a. Write and solve a trigonometric equation to find the angle $\theta$ of the incline of the ramp.
b. If the height of the ramp is doubled and the horizontal length of the ramp is doubled, is the angle $\theta$ of the incline of the ramp doubled? Explain your answer.
31. Find all values of $\theta$ for which $\csc \theta$ is undefined in $0^{\circ} \leq \theta<360^{\circ}$.
32. Find the value of $\theta$ if $\sin \theta=-\frac{\sqrt{3}}{2}$ and $\cos \theta=\frac{1}{2}$.
33. Name the quadrant in which angle $\theta$ may lie if $\cot \theta>0$ and $\csc \theta<0$.
34. If $\sin \theta=-\frac{12}{13}$ and $\cos \theta>0$, what is the exact value of $\tan \theta$ ?
35. If $\sin \theta=-\frac{12}{13}$ and $\cos \theta>0$, what is the value of $\theta$ rounded to the nearest hundreth?
36. Find the exact value.
A. $\sin 2 \pi$
B. $\cos 0$
C. $\tan 0$
D. $\tan \pi$
E. $\cos \pi$
F. $\sin (38 \pi)$
G. $\sin (-\pi / 2)$
H. $\cos (-\pi)$
I. $\cos (5 \pi / 3)$
J. $\cos (5 \pi / 4)$
K. $\tan (4 \pi / 3)$
L. $\tan (-\pi / 3)$
M. $\tan (-3 \pi / 4)$
N. $\tan (7 \pi / 6)$
O. $\cos 2 \pi$
P. $\sin (4 \pi / 3)$
Q. $\sin (3 \pi / 4)$
R. $\cos (-2 \pi / 3)$
S. $\sin 405^{\circ}$
T. $\cos (8 \pi / 3)$
37. Find the value of the variables. Answer in simplest radical form please.
A.

B.

C.

38. Use a trigonometric function to find the value of $\boldsymbol{x}$.

39. Find the values of the six trigonometric functions for $\theta$.

40. Evaluate each inverse trigonometric function. Give your answer in both radians \& degrees.
A. $\operatorname{Sin}^{-1}(-1)$
B. $\operatorname{Tan}^{-1}(-\sqrt{3})$
C. $\operatorname{Cos}^{-1} 1$
D.

$$
\operatorname{Sin}^{-1}\left(\frac{\sqrt{3}}{2}\right)
$$

E.
$\operatorname{Tan}^{-1}\left(-\frac{\sqrt{3}}{3}\right)$
F. $\quad \operatorname{Cos}^{-1}\left(\frac{\sqrt{2}}{2}\right)$

## 41. Solve each equation to the nearest tenth. Use the given restrictions.

A. $\sin \theta=0.45$, for $0^{\circ}<\theta<90^{\circ}$
B. $\tan \theta=2.42$, for $180^{\circ}<\theta<360^{\circ}$
C. $\cos \theta=-0.334$, for $0^{\circ}<\theta<180^{\circ}$
D. $\tan \theta=-10$, for $90^{\circ}<\theta<270^{\circ}$

## APPLICATION problems:

42. A kite string is 102 feet long. The angle between the kite string and the ground is $54.9^{\circ}$. How high is the kite?
43. A surveyor stands 186 feet from the base of a cliff and measures the angle of elevation to be $56.6^{\circ}$. His eye level is 5 feet above the ground. What is the height of the cliff to the nearest foot?
44. The pilot of a hot air balloon measures the angle of depression to a landing spot to be $36.7^{\circ}$. If the pilot's altitude is 1752 meters, what is the horizontal distance to the landing spot to the nearest meter?
45. A restaurant in the round rotates clockwise so diners can view the city. Fifty evenly-spaced window tables are numbered clockwise from 1 to 50 . A waiter noted where Table 1 was at the beginning of his shift. At the end of his shift, the restaurant had made 4 complete rotations and Table 1 was then where Table 22 had been. Through how many degrees had the restaurant rotated during his shift?

The diameter of a merry-go-round at the playground is 12 feet. Elijah stands on the edge and his sister pushes him around.
46. How far does Elijah travel if he moves through an angle of $\frac{5 \pi}{4}$ radians?
A 12.0 ft
C 23.6 ft
B 15.1 ft
D 47.1 ft
47. Through what angle does Elijah move if he travels a distance of 80 feet around the circumference?

F $\frac{40}{3} \pi$ radians H $\frac{40}{3}$ radians
G $\frac{80}{3}$ radians J $\frac{20}{3}$ radians
48. A 21 -foot ladder is leaning against a building. The base of the ladder is 7 feet from the base of a building. To the nearest degree, what is the measure of the angle that the ladder makes with the ground?

Review/ Practice:

- Special triangles
- Solving for x in a triangle using trig
- Writing the 6 trig functions for a triangles'
- Drawing +/ - angles in standard position
- Finding +/- coterminal angles
- Finding reference angles
- Converting between radians and degrees
- Finding all possible inverse trig values
- Using Sin/ Cos/ Tan and their inverses
- Application/ Story Problems: triangle trig applications, length of arc applications, inverse trig applicat


## Chapter 13 Circular Trig Review Sheet Answer Section

1. $\tan P=\frac{9}{40}$
2. 10.06
3. C
4. $\sqrt{2}$
5. $\frac{1}{\sqrt{3}}=\frac{\sqrt{3}}{3}$
6. 2
7. 0.978
8. 1.122
9. 11.05 ft
10. Positive coterminal angle: $471^{\circ}$

Negative coterminal angle: $-249^{\circ}$
11. Positive coterminal angle: $\frac{11 \pi}{4}$

Negative coterminal angle: $-\frac{5 \pi}{4}$
12. ANS:

Positive coterminal angle: $\frac{7 \pi}{6}$
Negative coterminal angle: $-\frac{17 \pi}{6}$
13. C
14. C
15. arc length: ${ }_{5}^{7} \pi$ feet
16. C
17. a. $-60^{\circ} ;-\frac{\pi}{3}$ radians
b. The angle generated by the minute hand is 12 times the angle generated by the hour hand. The minute hand makes two complete clockwise rotations, for an angle of $-720^{\circ}$ or $-4 \pi$ radians.
18. $-\frac{1}{\sqrt{2}}$
19. $-\frac{1}{2}$
20. $-\sqrt{5}$
21. $17^{\circ}$
22. $\frac{\pi}{4}$
23. A
24. a. 125 feet
b. $270^{\circ}$
c. Height $\approx 142.7$ feet; [evaluate $\sin \left(270^{\circ}+135^{\circ}\right)=\frac{y}{25}, y \approx 17.7$ feet. Add 17.7 to the midpoint height of $125,17.7 \mathrm{ft}+125 \mathrm{ft}=142.7 \mathrm{ft}$
25. C
26. D
27. $104^{\circ}$
28. $218^{\circ}$
29. $163^{\circ}$
30. a. $\tan \theta=\frac{4}{15}, \theta=\tan ^{-1}\left(\frac{4}{15}\right), \theta \approx 15^{\circ}$
b. No, the angle $\theta$ of the incline of the ramp is not doubled. The angle $\theta$ of the incline of the ramp remains the same since the ratio of the height and horizontal length remains the same.
31. $\theta=0^{\circ}$ and $180^{\circ}$
32. $\theta=300^{\circ}$
33. Quadrant 3
34. $\tan \theta=\frac{-12}{5}$
35. $\theta=292.62$
36. A. 0
B. 1
C. 0
D. 0
E. -1
F. 0
G. -1
H. -1
I. $\quad 1 / 2$
J. $-\frac{\sqrt{2}}{2}$
K. $\sqrt{3}$
L. $-\sqrt{3}$
M. 1
N. $\frac{\sqrt{3}}{3}$
O. 1
P. $-\frac{\sqrt{3}}{2}$
Q. $\frac{\sqrt{2}}{2}$
R. $-\frac{\sqrt{3}}{2}$
S. $\frac{\sqrt{2}}{2}$
T. $1 / 2$
37. A. $\mathrm{x}=\frac{8 \sqrt{3}}{3}, \mathrm{y}=\frac{16 \sqrt{3}}{3}$
B. $x=y=5 \sqrt{2}$
C. $x=\frac{10 \sqrt{3}}{3}, y=\frac{20 \sqrt{3}}{3}$
38. A. $x=20 \sqrt{3}$
B. $x=16$
39. $\sin \theta=$
$\cos \theta=\frac{\sqrt{15}}{5}$
$\tan \theta=\frac{\sqrt{6}}{3}$
$\csc \theta=\frac{\sqrt{10}}{2}$
$\sec \theta=\frac{\sqrt{15}}{3}$
$\cot \theta=\frac{\sqrt{6}}{2}$
40.
A. $-\frac{\pi}{2}$ or -90
B. $-\frac{\pi}{3}$ or -60
C. 0 or 0
D. $\frac{\pi}{3}$ or 60
E. $-\frac{\pi}{6}$ or -30
F. $\frac{\pi}{4}$ or 45
41. A. 26.7
B. 247.5
C. 109.5
D. $\quad 95.7$
42. 83.5 ft
43. 287 ft
44. 2350 m
45. 1591.2 degrees during waiter's shift

