1. What is the measure of an angle that is its own complement?

2. Find the measure of the smaller angle formed by the hands of a clock at the following time.

![Clock Image]

The angle is \( \square^\circ \).
(Simplify your answer. Type an integer or a simplified fraction.)

3. Find the measure of the smaller angle formed by the hands of a clock at the following time.

1:15

The angle is \( \square^\circ \) \( \square^\prime \). (Simplify your answer.)

4. Find the sum \( \alpha + \beta \) of the two angles \( \alpha = 43^\circ 56' \) and \( \beta = 17^\circ 13' \).

\[ \alpha + \beta = \square^\circ \square^\prime \] (Simplify your answer. Type an integer or a fraction.)

5. Convert the following angle to degrees, minutes, and seconds form.

\( \alpha = 83.6177^\circ \)

The answer is \( \square^\circ \square^\prime \square^\prime\prime \).
(Simplify your answer. Round to the nearest second as needed.)

6. Give an expression that generates all angles coterminal with the given angle.

225°

The correct expression is \( 225^\circ + \square^\circ \).
(Type an equation using \( n \) as the variable.)
7. Locate the point in a coordinate system. Draw a ray from the origin through the given point. Choose the graph showing the angle in standard position having least positive measure. Then find the distance $r$ from the origin to the point, using the distance formula.

$$(-2, 3\sqrt{2})$$

Choose the correct graph below, where the curve on each graph traces the angle beginning at the positive x-axis and ending at the ray through the given point.

![Graph Options]

The distance $r$ from the origin to the point is $r = \square$.
(Simplify your answer, including any radicals. Use integers or fractions for any numbers in the expression.)

8. A pulley rotates through $100^\circ$ in one minute. How many rotations does the pulley make in an hour?

The pulley makes $\square$ rotations per hour.
(Simplify your answer. Round to the nearest whole number.)

9. Find the measure of each marked angle.

![Triangle Diagram]

The degree measure of the top angle of the triangle, with angle measure $(6x - 25)^\circ$, is $\square^\circ$.

The degree measure of the bottom left angle of the triangle, with angle measure $(3x - 24)^\circ$, is $\square^\circ$.

The angle with measure $(7x - 13)^\circ$, that is supplement to the last interior angle of the triangle is $\square^\circ$. 
10. In the diagram to the right, $HK$ is parallel to $JI$. Find the angle in triangle $IJK$ that corresponds to angle $K$. Find the side of triangle $IJK$ that corresponds to side $HL$.

The angle in triangle $IJK$ that corresponds to angle $K$ is angle $\boxed{\ldots}$.

The side of triangle $IJK$ that corresponds to side $HL$ is side $\boxed{\ldots}$.

11. In the diagram, there are two similar triangles. Find the unknown measurement.

The length of the hypotenuse of the large triangle, $c$, is $\boxed{\ldots}$.
(Type an integer or decimal rounded to the nearest tenth as needed.)

12. The sun of galaxy X has a diameter of about 415,000 mi with a maximum distance from Planet X's surface of about 73,400,000 mi. Planet X's moon has a diameter of 1,746 mi. For a total solar eclipse to occur, the moon must pass between the sun and Planet X. The moon must also be close enough to Planet X for the moon's umbra (shadow) to reach the surface of Planet X.

The maximum distance that the moon can be from Planet X and still have a total solar eclipse occur is approximately $\boxed{\ldots}$ mi.
(Round to the nearest thousand as needed.)

The closest approach of the moon to Planet X's surface was 367,485 mi and the farthest was 392,189 mi. Can a total eclipse happen every time the moon is between Planet X and the sun?

- $\bigcirc$ No
- $\bigcirc$ Yes
13. Suppose that the point \((x, y)\) is in the indicated quadrant. Decide whether the given ratio is positive or negative.

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<th>IV, (\frac{r}{y})</th>
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Choose whether the given ratio is positive or negative.

- [ ] Negative
- [ ] Positive

14. Use the trigonometric function values of quadrantal angles to evaluate the expression below.

\[
\cos^2(90^\circ) - \sin^2(-270^\circ)
\]

15. If \(n\) is an integer, \(n \cdot 180^\circ\) represents an integer multiple of \(180^\circ\) and \((2n + 1) \cdot 90^\circ\) represents an odd integer multiple of \(90^\circ\), and so on. Determine whether the expression is equal to 0, 1, \(-1\), or is undefined.

\[
\tan((2n + 1) \cdot 180^\circ)
\]
16. Approximate the five remaining trigonometric function values for an angle \( \theta \). Use a calculator.

\( \sin \theta = 0.2198 \), given that \( \theta \) is in quadrant II.

Select the correct choice below and, if necessary, fill in the answer box to complete your choice.

- **Option A**: \( \cos \theta = \) 
  
  (Do not round until the final answer. Then round to four decimal places as needed.)

- **Option B**: The function is undefined.

Select the correct choice below and, if necessary, fill in the answer box to complete your choice.

- **Option A**: \( \csc \theta = \) 
  
  (Do not round until the final answer. Then round to four decimal places as needed.)

- **Option B**: The function is undefined.

Select the correct choice below and, if necessary, fill in the answer box to complete your choice.

- **Option A**: \( \sec \theta = \) 
  
  (Do not round until the final answer. Then round to four decimal places as needed.)

- **Option B**: The function is undefined.

Select the correct choice below and, if necessary, fill in the answer box to complete your choice.

- **Option A**: \( \tan \theta = \) 
  
  (Do not round until the final answer. Then round to four decimal places as needed.)

- **Option B**: The function is undefined.

Select the correct choice below and, if necessary, fill in the answer box to complete your choice.

- **Option A**: \( \cot \theta = \) 
  
  (Do not round until the final answer. Then round to four decimal places as needed.)

- **Option B**: The function is undefined.
17. Suppose that $-90^\circ < \theta < 90^\circ$. Find the sign of the function value $\cos(\theta + 180^\circ)$.

Choose the correct answer below.

- Negative
- Positive

18. Find the least positive value of $\theta$.

$$\sin(4\theta + 8^\circ) \csc(6\theta + 4^\circ) = 1$$

$\theta = \boxed{}^\circ$

19. Evaluate the expression.

$$3 \tan 2\cdot135^\circ + 5 \sin 2\cdot120^\circ - \cos 2\cdot180^\circ$$

20. Find the coordinates of the point $P$ on the circumference of the circle. (Hint: Add $x$- and $y$-axes, assuming that the angle is in standard position.)

The coordinates of $P$ are $\boxed{}$.

(Type an ordered pair. Simplify your answer, including any radicals. Use integers or fractions for any numbers in the expression.)

21. Suppose $\theta$ is in the interval $(90^\circ, 180^\circ)$. Find the sign of the following.

$\cos(\theta + 180^\circ)$

Choose whether the sign of $\cos(\theta + 180^\circ)$ is positive or negative.

- Negative
- Positive
22. Find all values of $\theta$, if $0$ is in the interval $[0^\circ, 360^\circ)$ and has the given function value.

$$\sec \theta = -2$$

$0 = \square^\circ$

(Type your answer in degrees. Use a comma to separate answers as needed.)

23. Use a calculator to find a decimal approximation for each value. Give as many digits as your calculator displays. Simplify the expression before using the calculator.

$$\frac{1}{\csc (90^\circ - 42^\circ)}$$

24. Solve the right triangle $ABC$, where $C = 90^\circ$.

$$a = 1, \ c = 2$$

$b \approx \square$

(Round to the nearest hundredth as needed.)

A = $\square^\circ$

(Round to the nearest tenth as needed.)

B = $\square^\circ$

(Round to the nearest tenth as needed.)

25. A company safety committee has recommended that a floodlight be mounted in a parking lot so as to illuminate the employee exit. Find the angle of depression of the light to the nearest minute.

The angle of depression of the light to the nearest minute is $\square^\circ$.
26. The altitude of a mountain peak is measured as shown in the figure to the right. At an altitude of 14,567 feet on a different mountain, the straight-line distance to the peak of mountain is 27.9741 miles and the peak's angle of elevation is 5.17°.
Approximate the height of the mountain to the nearest foot. (Neglect the curvature of the earth.)
The height of the mountain is approximately □ feet.
(Do not round until the final answer. Then round to the nearest foot as needed.)

27. Two ships leave a port at the same time. The first ship sails on a bearing of 36° at 12 knots (nautical miles per hour) and the second on a bearing of 126° at 28 knots. How far apart are they after 1.5 hours? (Neglect the curvature of the earth.)
After 1.5 hours, the ships are approximately □ nautical miles apart.
(Round to the nearest nautical mile as needed.)

28. Find h as indicated in the figure.

\[ h = □ \] (Round to the nearest integer as needed.)

29. In one area, the lowest angle of elevation of the sun in winter is 25° 11'. Find the minimum distance, x, that a plant needing full sun can be placed from a fence 4.69 ft high.
The minimum distance is □ ft.
(Type an integer or a decimal rounded to the nearest tenth as needed.)
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| 3. | 52  
|    | 30 |
| 4. | 61  
|    | 9  |
| 5. | 83  
|    | 37  
|    | 4  |
| 6. | n \cdot 360 |
| 7. | \frac{A}{\sqrt{22}} |
| 8. | 17 |
| 9. | 83  
|    | 30  
|    | 113 |
| 10. | J  
|     | IL |
| 11. | 128 |
| 12. | 309,000  
|     | No |
| 13. | Negative |
| 14. | − 1 |
| 15. | 0 |
16. \( A_1 = -0.9755 \), \( A_2 = 4.5496 \), \( A_3 = -1.0251 \), \( A_4 = 0.2253 \), \( A_5 = -4.4383 \)

17. Negative

18. 2

19. \( \frac{23}{4} \)

20. \( (-4\sqrt{3}, 4) \)

21. Positive

22. 240,120

23. 0.7431448

24. \( \frac{1.73}{30} \)

25. 37

26. 27,877

27. 46

28. 157

29. 10.0