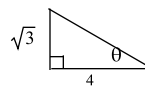1. Find the value of each of the six trigonometric functions of the angle θ in the figure.

sin θ = ☐

(Simplify your answer, including any radicals. Use integers or fractions for any numbers in the expression. Type an exact answer, using radicals as needed.)

cos θ = ☐

(Simplify your answer, including any radicals. Use integers or fractions for any numbers in the expression. Type an exact answer, using radicals as needed.)

tan θ = ☐

(Simplify your answer, including any radicals. Use integers or fractions for any numbers in the expression. Type an exact answer, using radicals as needed.)

csc θ = ☐

(Simplify your answer, including any radicals. Use integers or fractions for any numbers in the expression. Type an exact answer, using radicals as needed.)

sec θ = ☐

(Simplify your answer, including any radicals. Use integers or fractions for any numbers in the expression. Type an exact answer, using radicals as needed.)

cot θ = ☐

(Simplify your answer, including any radicals. Use integers or fractions for any numbers in the expression. Type an exact answer, using radicals as needed.)

---

2. Use Fundamental Identities and/or the Complementary Angle Theorem to find the exact value of each expression. Do not use a calculator.

$$\cos 24° \sin 66° + \cos 66° \sin 24°$$

$\cos 24° \sin 66° + \cos 66° \sin 24° =$ ☐ (Simplify your answer.)

---

3. A state trooper is hidden 30 feet from a highway. One second after a truck passes, the angle θ between the highway and the line of observation from the patrol car to the truck is measured. See the illustration. Complete parts (a)–(c).
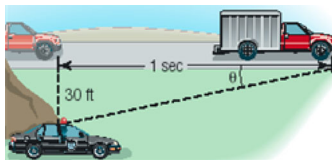
(a) If the angle measures 13°, how fast is the truck traveling? Express the answer in feet per second and in miles per hour.

If the angle measures 13°, the speed of the truck is ☐ feet per second.
(Do not round until the final answer. Then round to two decimal places as needed.)

If the angle measures 13°, the speed of the truck is ☐ miles per hour.
(Use the answer from part (a) to find this answer. Round to one decimal place as needed.)

(b) If the angle measures 21°, how fast is the truck traveling? Express the answer in feet per second and in miles per hour.

If the angle measures 21°, the speed of the truck is ☐ feet per second.
(Do not round until the final answer. Then round to two decimal places as needed.)

If the angle measures 21°, the speed of the truck is ☐ miles per hour.
(Use the answer from part (b) to find this answer. Round to one decimal place as needed.)

(c) If the speed limit is 50 miles per hour and a speeding ticket is issued for speeds of 10 miles per hour or more over the limit, for what angles should the trooper issue a ticket?

The trooper should issue a ticket when the angle is equal to or less than ☐ °.
(Round to the nearest tenth as needed.)

---

4. A carpenter is preparing to put a roof on a garage that is 20 feet by 40 feet by 20 feet. A steel support beam h = 42 feet in length is positioned in the center of the garage. To support the roof, another beam will be attached to the top of the center beam (see the figure). At what angle of elevation is the new beam? In other words, what is the pitch of the roof?
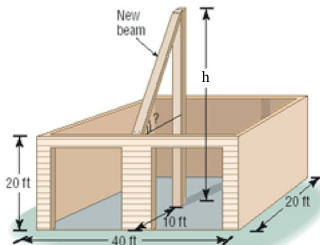
The angle of elevation of the new beam is ☐ °.
(Do not round until the final answer. Then round to one decimal place as needed.)

5. Coast Guard Station Able is located L = 120 miles due south of Station Baker. A ship at sea sends an SOS call that is received by each station. The call to Station Able indicates that the ship is located N55°E; the call to Station Baker indicates that the ship is located S60°E.

Use this information to answer the questions below.

(a) How far is each station from the ship?

The distance from Station Able to the ship is [____] miles.
(Do not round until the final answer. Then round to two decimal places as needed.)

The distance from Station Baker to the ship is [____] miles.
(Do not round until the final answer. Then round to two decimal places as needed.)

(b) If a helicopter capable of flying 200 miles per hour is dispatched from the nearest station to the ship, how long will it take to reach the ship?

[____] minutes (Round to two decimal places as needed.)

6. A famous leaning tower was originally 181.5 feet high. At a distance of 120 feet from the base of the tower, the angle of elevation to the top of the tower is found to be 63°. Find ∠RPQ indicated in the figure. Also find the perpendicular distance from R to PQ.
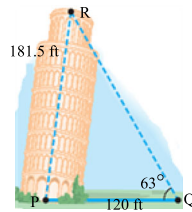
∠RPQ = [____] °
(Round the final answer to one decimal place as needed. Round all intermediate values to four decimal places as needed.)

The perpendicular distance from R to PQ is [____] feet.
(Round to two decimal places as needed.)

7. An awning that covers a sliding glass door that is 88 inches tall forms an angle of 50° with the wall. The purpose of the awning is to prevent sunlight from entering the house when the angle of elevation of the sun is more than X = 65°. See the figure. Find the length L of the awning.
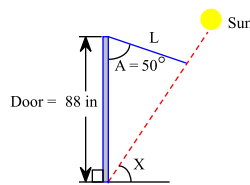
L ≈ [____] in
(Do not round until the final answer. Then round to one decimal place as needed.)

8. Solve the triangle.
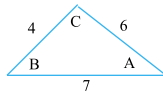
A ≈ [____] ° (Round to one decimal place as needed.)

B ≈ [____] ° (Round to one decimal place as needed.)

C ≈ [____] ° (Round to one decimal place as needed.)

9. Solve the triangle.

b = 9, c = 4, A = 80°

a ≈ [____] (Round to two decimal places as needed.)
B ≈ [____] ° (Round to one decimal place as needed.)
C ≈ [____] ° (Round to one decimal place as needed.)

10. Solve the triangle.

a = 9, b = 17, c = 20

A ≈ [____] ° (Round to one decimal place as needed.)

B ≈ [____] ° (Round to one decimal place as needed.)

C ≈ [____] ° (Round to one decimal place as needed.)

11. Find the area K of the triangle.

b = 1, c = 5, A = 80°

K = [____] square units
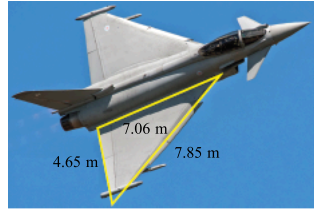(Do not round until the final answer. Then round to two decimal places as needed.)

12. Find the area K of the triangle.

a = 5, c = 2, B = 130°

K = [_____] square units
(Round to two decimal places as needed.)

13. A particular plane has a canard-delta wing design that contains a large triangular main wing. Use the dimensions shown to approximate the area of one of the main wings.
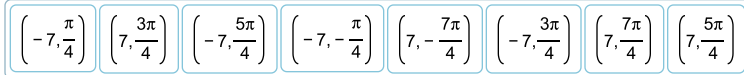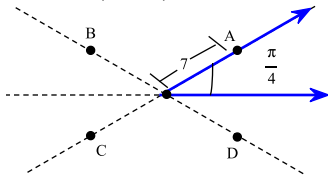

7.06 m
7.85 m
4.65 m

The area of one of the main wings is [_____] (1) _____
(Round to two decimal places as needed.)

(1) ○ meters.
    ○ square meters.
    ○ cubic meters.

14. Match each point in polar coordinates with either A, B, C, or D on the graph.

$\left(-7, \dfrac{\pi}{4}\right)$ $\left(7, \dfrac{3\pi}{4}\right)$ $\left(-7, \dfrac{5\pi}{4}\right)$ $\left(-7, -\dfrac{\pi}{4}\right)$ $\left(7, -\dfrac{7\pi}{4}\right)$ $\left(-7, \dfrac{3\pi}{4}\right)$ $\left(7, \dfrac{7\pi}{4}\right)$ $\left(7, \dfrac{5\pi}{4}\right)$

Drag the correct point given above into the appropriate area below.

A [_____]   C [_____]

B [_____]   D [_____]

15. The rectangular coordinates of a point are given. Find polar coordinates (r,θ) of this point with θ expressed in radians. Let r > 0 and −2π < θ < 2π.

(10, − 10)

One possibility for the polar coordinates of this point is [_____].
(Simplify your answer. Type an ordered pair. Type your answer in radians. Type exact answers, using π as needed. Use integers or fractions for any numbers in the expression.)

16. Transform the polar equation to an equation in rectangular coordinates. Then identify and graph the equation.   r = − 12 sin θ

Write an equation in rectangular coordinates.

[_____] (Type an equation.)

What is the graph of this equation?

○ A. circle with center at (0, 6)   ○ B. h
○ C. vertical line   ○ D. c

Select the graph of r = − 12 sin θ.

○ A.   ○ B.   ○ C.

17.

Find zw and $\dfrac{z}{w}$. Write each answer in polar form and in exponential form.

$$z = 4\left(\cos\frac{2\pi}{9} + i\sin\frac{2\pi}{9}\right)$$

$$w = 16\left(\cos\frac{\pi}{9} + i\sin\frac{\pi}{9}\right)$$

The product zw in polar form is [＿＿＿＿＿] and in exponential form is [＿＿＿＿＿].
(Simplify your answer. Type an exact answer, using π as needed. Use integers or fractions for any numbers in the expression.)

The quotient $\dfrac{z}{w}$ in polar form is [＿＿＿＿＿] and in exponential form is [＿＿＿＿＿].
(Simplify your answer. Type an exact answer, using π as needed. Use integers or fractions for any numbers in the expression.)

18.

Write the expression in rectangular form, $x + yi$, and in exponential form, $re^{i\theta}$.
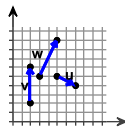
$$\left(\sqrt{6} - i\right)^8$$

The rectangular form of the given expression is [＿＿＿＿＿], and the exponential form of the given expression is [＿＿＿＿＿].
(Simplify your answers. Use integers or decimals for any numbers in the expressions. Do not round until the final answer. Then round to three decimal places as needed.)
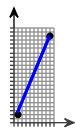
19. Use the vectors in the figure at the right to graph the following vector.

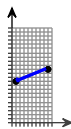$2\mathbf{v} + \mathbf{u} - 3\mathbf{w}$

Select the figure with a vector that is equivalent to $2\mathbf{v} + \mathbf{u} - 3\mathbf{w}$.
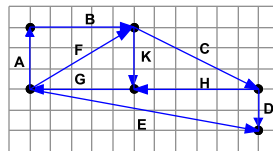
○ **A.**

○ **B.**

○ **C.**

20. Use the figure at the right. Determine whether the given statement is true or false.

$\mathbf{A} + \mathbf{B} = \mathbf{K} + \mathbf{G}$

Is the statement $\mathbf{A} + \mathbf{B} = \mathbf{K} + \mathbf{G}$ true or false?

○ **A.** False; because vector $\mathbf{A} + \mathbf{B}$ moves 5 units horizontally and 3 units vertically, and vector $\mathbf{K} + \mathbf{G}$ moves -5 units horizontally and $-$

○ **B.** True; because vector $\mathbf{A} + \mathbf{B}$ moves 5 units horizontally and 3 units vertically, and vector $\mathbf{K} + \mathbf{G}$ moves 5 units horizontally and 3 uni

○ **C.** False; because vector $\mathbf{A} + \mathbf{B}$ moves -5 units horizontally and -3 units vertically, and vector $\mathbf{K} + \mathbf{G}$ moves 5 units horizontally and

○ **D.** True; because vector $\mathbf{A} + \mathbf{B}$ moves -5 units horizontally and 3 units vertically, and vector $\mathbf{K} + \mathbf{G}$ moves -5 units horizontally and

21. The vector $\mathbf{v}$ has initial point P and terminal point Q. Write $\mathbf{v}$ in the form $a\mathbf{i} + b\mathbf{j}$; that is, find its position vector.

$P = (8,0);$ $Q = (0,2)$

What is the position vector?

○ $8\mathbf{i} - 2\mathbf{j}$

○ $-8\mathbf{i} - 2\mathbf{j}$

○ -8

○ $8\mathbf{i} +$

22. Find $\|\mathbf{v}\| - \|\mathbf{w}\|$, if $\mathbf{v} = 6\mathbf{i} - 3\mathbf{j}$ and $\mathbf{w} = 4\mathbf{i} - 6\mathbf{j}$.

$\|\mathbf{v}\| - \|\mathbf{w}\| =$ [＿＿＿＿＿]
(Type an exact answer, using radicals as needed. Simplify your answer.)

23. Find the direction angle of **v** for the following vector.

   v = 7**i** − 5**j**

   What is the direction angle of **v**?

   [　　　　　]°

   (Round to one decimal place as needed.)

24. A circle has the equation $2x^2 + 16x + 2y^2 = 0$.
   (a) Find the center (h,k) and radius r of the circle.
   (b) Graph the circle.
   (c) Find the intercepts, if any, of the graph.

   (a) The center of the circle is [　　　　　].
   (Type an ordered pair, using integers or decimals.)

   The radius of the circle is [　　　　　].
   (Type an integer or a decimal.)

   (b) Use the graphing tool to graph the circle.

   (c) What are the intercepts? Select the correct choice below and, if necessary, fill in the answer box within your choice.

   ○ A. The intercept(s) of the circle is/are [　　　　　].
   (Type an ordered pair. Use a comma to separate answers as radicals as needed.)

   ○ B. There are no intercepts.
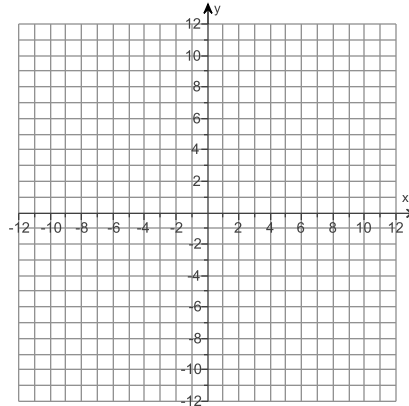
25. A Ferris wheel has a maximum height of 311 feet and a wheel diameter of 300 feet. Find an equation for the wheel if the center of the wheel is on the y-axis and y represents the height above the ground.
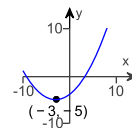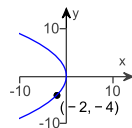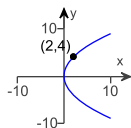
   The equation is [　　　　　].
   (Simplify your answer. Type your answer in standard form.)

26.
   | $(y-5)^2 = -8(x-3)$ | $y^2 = -8x$ | $(y-5)^2 = 8(x-3)$ | $x^2 = 8y$ | $x^2 = -8y$ | $(x+3)^2 = 8(y+5)$ | $y^2 = 8x$ | $(x+3)^2 = -8(y+5)$ |

   The graphs of several parabolas are given. Match each graph to its equation by dragging the appropriate equation to the area below its graph.
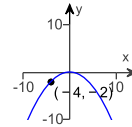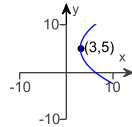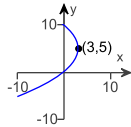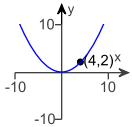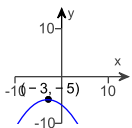
27. Find the equation of the parabola described. Find the two points that define the latus rectum, and graph the equation.

   Vertex at (0,0); axis of symmetry the y-axis; containing the point (5,6)

   What is the equation of the parabola?

   [　　　　　]

   (Use integers or fractions for any numbers in the equation.)

   Find the two points that define the latus rectum.

   The left point is [　　　　　] and the right point is [　　　　　].

   (Type ordered pairs. Simplify your answers.)
   Use the graphing tool to graph the equation.

28. Write an equation for the parabola shown to the right.

The equation of the parabola is ☐ .
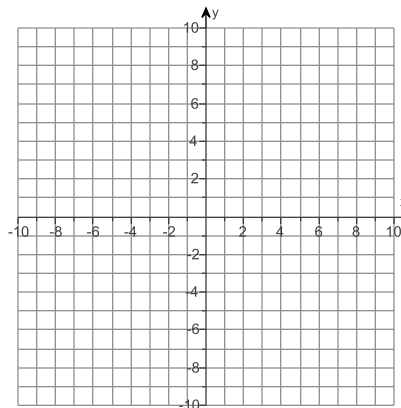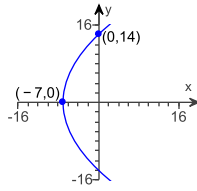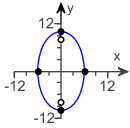(Use integers or fractions for any numbers in the equation.)

29. Find an equation for the ellipse. Graph the equation.

   center at (0,0); focus at (8,0); vertex at (10,0)

The equation of the ellipse is ☐ = 1.
(Simplify your answer. Use integers or fractions for any numbers in the expression.)
Choose the correct graph below.

○ **A.**

○ **B.**
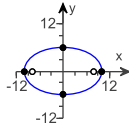
○ **C.**
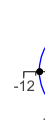
30. Use the fact that the orbit of a planet about the Sun is an ellipse, with the Sun at one focus. The aphelion of a planet is its greatest distance from the Sun, and the perihelion is its shortest distance. The mean distance of a planet from the Sun is the length of the semimajor axis of the elliptical orbit. See the illustration. The mean distance of planet A from the Sun is 90 million miles. If the aphelion of planet A is 93.5 million miles, what is the perihelion? Write an equation for the orbit of planet A around the Sun.
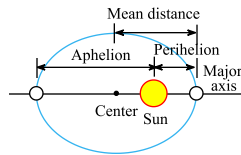
The perihelion is ☐ million miles.
(Type an integer or a decimal.)

The equation for the orbit of planet A around the Sun is ☐ = 1.
(Use integers or decimals for any numbers in the expression.)

31. Write an equation for the hyperbola shown in the graph.
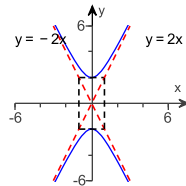
The equation for the hyperbola above is ☐ = 1.
(Simplify your answer. Use integers or fractions for any numbers in the expression.)

32. Analyze this conic section to answer the questions below.

$$\frac{(x-5)^2}{4} - \frac{y^2}{9} = 1$$

What type of conic section is the equation?

○ Parabola

○ Circle

○ Hyperbola

○ Ellipse

Where is the center of this conic section? Select the correct choice below and fill in any answer boxes in your choice.

○ **A.** [____] (Type an ordered pair.)

○ **B.** The answer is undefined.

What are the values of a and b for this conic section? Select the correct choice below and fill in any answer boxes in your choice.

○ **A.** $a =$ [____] , $b =$ [____]

○ **B.** The answer is undefined.

Determine the vertex or vertices for the conic section.

○ **A.** This conic section has a vertex at (2,3).

○ **B.** This conic section has a vertex at (3,2).

○ **C.** This conic section has vertices at (7,0) and (3,0).

○ **D.** This conic section has vertices at (13,0) and (3,0).

What is the value of c for this conic section? Select the correct choice below and fill in any answer boxes in your choice.

○ **A.** $c =$ [____] (Simplify your answer. Type an exact answer, using radicals as needed.)

○ **B.** The answer is undefined.

Determine the focus or foci for the conic section.

○ **A.** The focus for this conic section is at $(5 - \sqrt{13}, 5 + \sqrt{13})$.

○ **B.** The foci for this conic section are at (2,0) and (13,0).

○ **C.** The foci for this conic section are at $(5 - \sqrt{13}, 0)$ and $(5 + \sqrt{13}, 0)$.

○ **D.** The focus for this conic section is at (2,3).

Which of the following statements is true?

○ **A.** The transverse axis for this conic section is along the y-axis.

○ **B.** The directrix for this conic section is y = 1.

○ **C.** This conic section has a major and a minor axis.

○ **D.** The transverse axis for this conic section is along the x-axis.

○ **E.** The directrix for this conic section is y = 9.

Determine the asymptotes for the conic section.

○ **A.** The asymptotes for this conic section are $y = \pm \frac{3}{2}(x-5)$.

○ **B.** The asymptotes for this conic section are $y = \pm \frac{2}{13}(x-3)$.

○ **C.** This conic section does not have any asymptotes.

Choose the correct graph of the conic section below.

○ **A.**
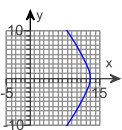
○ **B.**
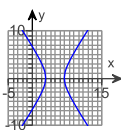
○ **C.**

33. Analyze this conic section to answer the questions below.

$$16x^2 + 25y^2 - 256x + 624 = 0$$

What type of conic section is the equation?

○ Circle

○ Hyperbola

○ Parabola

○ Ellipse

Where is the center of this conic section? Select the correct choice below and fill in any answer boxes in your choice.

○ **A.** [　　　　] (Type an ordered pair.)

○ **B.** The answer is undefined.

What are the values of a and b for this conic section? Select the correct choice below and fill in any answer boxes in your choice.

○ **A.** a = [　　　　] , b = [　　　　]

○ **B.** The answer is undefined.

Determine the vertex or vertices for the conic section.

○ **A.** This conic section has vertices at (9,0) and (4,0).

○ **B.** This conic section has a vertex at (4,5).

○ **C.** This conic section has a vertex at (5,4).

○ **D.** This conic section has vertices at (13,0) and (3,0).

What is the value of c for this conic section? Select the correct choice below and fill in any answer boxes in your choice.

○ **A.** c = [　　　　] (Simplify your answer. Type an exact answer, using radicals as needed.)

○ **B.** The answer is undefined.

Determine the focus or foci for the conic section.

○ **A.** The foci for this conic section are at (5,0) and (9,0).

○ **B.** The focus for this conic section is at (5,11).

○ **C.** The focus for this conic section is at (5,4).

○ **D.** The foci for this conic section are at (5,0) and (11,0).

Which of the following statements is true?

○ **A.** The transverse axis for this conic section is on the x-axis.

○ **B.** The transverse axis for this conic section is on the y-axis.

○ **C.** This conic section has a major and a minor axis.

○ **D.** The directrix for this conic section is y = 5.

○ **E.** The directrix for this conic section is y = 16.

Determine the asymptotes for the conic section.

○ **A.** The asymptotes for this conic section are $y = \pm \dfrac{4}{5}(x - 8)$.

○ **B.** The asymptotes for this conic section are $y = \pm \dfrac{5}{9}(x - 4)$.

○ **C.** This conic section does not have any asymptotes.

Choose the correct graph of the conic section below.

○ **A.**
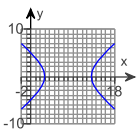
○ **B.**
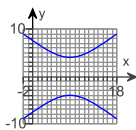
○ **C.**

34. Analyze this conic section to answer the questions below.

$$x^2 - 4x - 8y - 4 = 0$$

What type of conic section is the equation?

○ Ellipse

○ Circle

○ Parabola

○ Hyperbola

Where is the center of this conic section? Select the correct choice below and fill in any answer boxes in your choice.

○ **A.** [_____] (Type an ordered pair.)

○ **B.** The answer is undefined.

What are the values of a and b for this conic section? Select the correct choice below and fill in any answer boxes in your choice.

○ **A.** a = [_____], and b does not have a value

○ **B.** a does not have a value and b = [_____]

○ **C.** The answer is undefined.

Determine the vertex or vertices for the conic section.

○ **A.** This conic section has a vertex at $(-5, -2)$.

○ **B.** This conic section has a vertex at $(2, -1)$.

○ **C.** This conic section has vertices at $(29,0)$ and $(-5,0)$.

○ **D.** This conic section has vertices at $(-4,0)$ and $(0,0)$.

What is the value of c for this conic section? Select the correct choice below and fill in any answer boxes in your choice.

○ **A.** c = [_____] (Simplify your answer. Type an exact answer, using radicals as needed.)

○ **B.** The answer is undefined.

Determine the focus or foci for the conic section.

○ **A.** The foci for this conic section are at $(2 - \sqrt{29},0)$ and $(2 + \sqrt{29},0)$.

○ **B.** The focus for this conic section is at $(2,1)$.

○ **C.** The focus for this conic section is at $(2 - \sqrt{29}, 2 + \sqrt{29})$.

○ **D.** The foci for this conic section are at $(2,0)$ and $(29,0)$.

Which of the following statements is true?

○ **A.** This conic section has a major and a minor axis.

○ **B.** The directrix for this conic section is $y = 25$.

○ **C.** The transverse axis for this conic section is on the y-axis.

○ **D.** The directrix for this conic section is $y = -3$.

○ **E.** The transverse axis for this conic section is on the x-axis.

Determine the asymptotes for the conic section.

○ **A.** The asymptotes for this conic section are $y = \pm \dfrac{2}{29}(x - 5)$.

○ **B.** The asymptotes for this conic section are $y = \pm \dfrac{5}{2}(x - 2)$.

○ **C.** This conic section does not have any asymptotes.

Which of the graphs below is a correct representation of this conic section?

○ **A.**
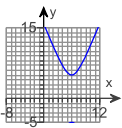
○ **B.**

○ **C.**

35. The cross-section of a nuclear power plant's cooling tower is in the shape of a hyperbola. Suppose the tower has a base diameter of 264 meters and the diameter at its narrowest poi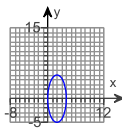nt, 40 meters above the ground, is 88 meters. If the diameter at the top of the tower is 176 meters, how tall is the tower?

The tower is about [   ] meters tall.
(Round to one decimal place as needed.)

36. Write the augmented matrix of the given system of equations.

$$\begin{cases} x + y - z &= 5 \\ 3x - 3y &= 5 \\ 5x + 4y - z &= 1 \end{cases}$$

The augmented matrix is $\left[\begin{array}{ccc|c} \square & \square & \square & \square \\ \square & \square & \square & \square \\ \square & \square & \square & \square \end{array} \right]$.

37. Write the system of equations corresponding to the augmented matrix. Then perform the row operations $R_2 = -2r_1 + r_2$ and $R_3 = 3r_1 + r_3$ on the given augmented matrix.

$$\left[\begin{array}{ccc|c} 1 & -6 & 4 & 5 \\ 2 & -6 & 7 & 6 \\ -3 & 4 & 2 & 6 \end{array} \right]$$

Which of the following is the system of equations corresponding to the augmented matrix?

○ A.
$$\begin{cases} x - 6y + 4z &= 5 \\ 2x - 6y + 7z &= 6 \\ -3x + 4y + 2z &= 6 \end{cases}$$

○ B.

○ C.
$$\begin{cases} x - 6y + 4z &= 5w \\ 2x - 6y + 7z &= 6w \\ -3x + 4y + 2z &= 6w \end{cases}$$

○ D.

Perform the row operations $R_2 = -2r_1 + r_2$ and $R_3 = 3r_1 + r_3$ on the original matrix given in the problem statement, and enter the resulting matrix below.

$\left[\begin{array}{ccc|c} \square & \square & \square & \square \\ \square & \square & \square & \square \\ \square & \square & \square & \square \end{array} \right]$

38. Solve the following system of equations using matrices (row operations). If the system has no solution, say that it is inconsistent.

$$\begin{cases} x + 4y &= 3 \\ 3x + 12y &= 9 \end{cases}$$

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

○ A. The solution is ([   ] , [   ]).
(Simplify your answers.)

○ B. There are infinitely many solutions. The solution can be written as $\{(x,y) | x = $ [   ] , y is any real number$\}$.
(Simplify your answer. Type an expression using y as the variable.)

○ C. The system is inconsistent.

39. Solve the following system of equations using matrices (row operations). If the system has no solution, say that it is inconsistent.

$$\begin{cases} 2x - 5y = 2 \\ 10x + 5y = 16 \end{cases}$$

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

○ A. The solution is ([   ] , [   ]).
(Simplify your answers.)

○ B. There are infinitely many solutions. The solution can be written as $\{(x,y) | x = $ [   ] , y is any real number$\}$.
(Simplify your answer. Type an expression using y as the variable.)

○ C. The system is inconsistent.

40. Solve the following system of equations using matrices (row operations). If the system has no solution, say that it is inconsistent.

$$\begin{cases} 3x - 2y + z = 4 \\ 12x + 9y + 72z = 0 \\ -3x + y - 5z = 1 \end{cases}$$

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

○ **A.** The solution is ([＿＿] , [＿＿] , [＿＿]) .
   (Simplify your answers.)

○ **B.** There are infinitely many solutions. The solution can be written as $\{(x,y,z)\,|\,x =$ [＿＿] , $y =$ [＿＿] , z is any real n
   (Simplify your answers. Type expressions using z as the variable.)

○ **C.** There are infinitely many solutions. The solution can be written as $\{(x,y,z)\,|\,x =$ [＿＿] , y is any real number, z is any real
   (Simplify your answer. Type an expression using y and z as the variables.)

○ **D.** The system is inconsistent.

---

41. Solve the following system of equations using matrices (row operations). If the system has no solution, say that it is inconsistent.

$$\begin{cases} x + 2y - z \;=\; 4 \\ 2x - 4y + z \;=\; 1 \\ -2x + 2y - 3z \;=\; 0 \end{cases}$$

Select the correct choice below and, if necessary, fill in the answer box(es) in your choice.

○ **A.** The solution is ([＿＿] , [＿＿] , [＿＿]) .
   (Simplify your answers.)

○ **B.** There are infinitely many solutions. The solution can be written as $\{(x,y,z)\,|\,x =$ [＿＿] , $y =$ [＿＿] , z is any real n
   (Simplify your answers. Type expressions using z as the variable.)

○ **C.** There are infinitely many solutions. The solution can be written as $\{(x,y,z)\,|\,x =$ [＿＿] , y is any real number, z is any real
   (Simplify your answer. Type an expression using y and z as the variables.)

○ **D.** The system is inconsistent.

---

42. To manufacture an automobile requires painting, drying, and polishing. Epsilon Motor Company produces three types of cars, the Delta, the Beta, and the Sigma. Each Delta requires 7 hours for painting, 3 hours for drying, and 4 hours for polishing. A Beta requires 17 hours for painting, 8 hours for drying, and 5 hours for polishing, and a Sigma requires 4 hours for painting, 5 hours for drying, and 4 hours for polishing. If the company has 230 hours for painting, 151 hours for drying, and 113 hours for polishing per month, how many of each type of car are produced?

Select the correct choice below and fill in any answer boxes within your choice.

○ **A.** The Epsilon Motor Company produces [＿＿] Deltas, [＿＿] Betas, and [＿＿] Sigmas in a month.
   (Simplify your answers.)

○ **B.** There are infinitely many combinations of each type of car that can be produced. Using ordered triplets, the solution can be writter
   (Simplify your answers. Type expressions using S as the variable as needed.)

○ **C.** There is no possible combination of each type of car that can be produced that meets the criteria.

---

43. Write the partial fraction decomposition of the given rational expression.

$$\frac{x}{(x+1)(x+2)}$$

What is the partial fraction decomposition?

$$\frac{x}{(x+1)(x+2)} = \text{[＿＿]}$$

---

44. Write the partial fraction decomposition of the given rational expression.

$$\frac{x^2 - 3x - 6}{\left(x^2 + 9\right)^2}$$

What is the partial fraction decomposition?

$$\frac{x^2 - 3x - 6}{\left(x^2 + 9\right)^2} = \text{[＿＿]}$$

45. Solve the system. Use any method you wish.

$$\begin{cases} y = x + 8 \\ 11x^2 + y^2 = 64 \end{cases}$$

List all the solutions. Select the correct choice below and fill in any answer boxes in your choice.

○ **A.** The solution(s) is/are [   ].
   (Type an ordered pair. Use a comma to separate answers as needed.)

○ **B.** There is no solution.

46. Solve the system. Use any method you wish.

$$\begin{cases} x^2 - 3xy + 2y^2 = 0 \\ x^2 + xy = 6 \end{cases}$$

What are the solutions?

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

○ **A.** The solution(s) is/are [   ].
   (Type an ordered pair. Use a comma to separate answers as needed. Type an exact answer, using radicals as needed. Simplify y

○ **B.** There is no solution.

47. Graph the given system of inequalities.

$$\begin{cases} x^2 + y^2 \le 16 \\ x - y \le 4 \end{cases}$$

Use the graphing tool to graph the intersection.
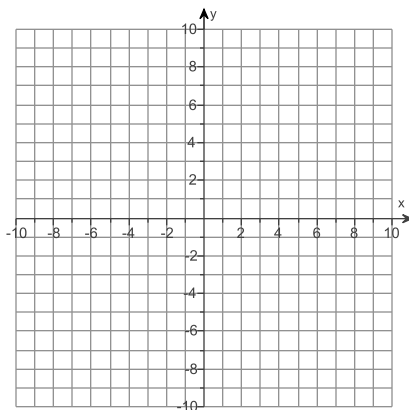
48. Graph the given system of inequalities. Tell whether the graph is unbounded or bounded, and label the corner points.

$$\begin{cases} x \ge 0 \\ y \ge 0 \\ x + y \ge 4 \\ 2x + y \le 8 \end{cases}$$
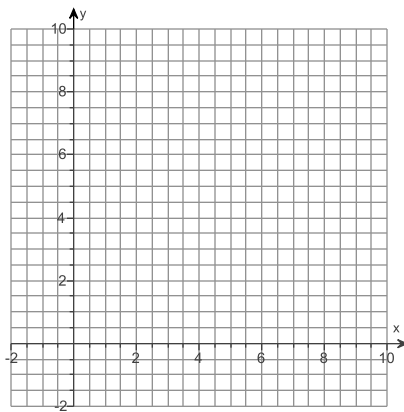
Use the graphing tool to graph all four inequalities in the system. Then use the paint can icon to fill in the region that solves all of the inequalities.

Is the graph of the system bounded or unbounded?

○ unbounded

○ bounded

What are the corner points of the graph?

[   ]

(Type ordered pairs. Use a comma to separate answers as needed. Type integers or simplified fractions.)

49. The given pattern continues. Write down the nth term of the sequence $\{a_n\}$ suggested by the pattern.

$$\frac{1}{2}, \frac{2}{3}, \frac{3}{4}, \frac{4}{5} \dots$$

$\{a_n\} = \{$ [   ] $\}$

50. A sequence is defined recursively. Write the first five terms.

$a_1 = -4; \quad a_n = n + a_{n-1}$

Type the first five terms of the sequence.

$a_1 = $ ☐

$a_2 = $ ☐

$a_3 = $ ☐

$a_4 = $ ☐

$a_5 = $ ☐

51. Find the indicated term for the given arithmetic sequence.

The 120th term of 3,6,9,...

$a_{120} = $ ☐

52. An outdoor amphitheater has 31 seats in the first row, 33 in the second row, 35 in the third row, and so on. There are 39 rows altogether. How many can the amphitheater seat?

The amphitheater can seat ☐ people.

53. Find the fifth term and the nth term of the geometric sequence whose initial term a and common ratio r are given.

$a = \sqrt{13}, r = \sqrt{13}$

Type the fifth term of the geometric sequence.

$a_5 = $ ☐ (Simplify your answer.)

Type the nth term of the geometric sequence.

$a_n = $ ☐ (Simplify your answer.)

54. Find the sum.

$$\sum_{k=1}^{n} \left(\frac{7}{9}\right)^k$$

Complete the sum of the sequence.

$S_n = $ ☐ $\left[1 - \left(\text{☐}\right)^n\right]$
(Simplify your answer.)

55. Determine whether the infinite geometric series converges or diverges. If it converges, find its sum.

$$1 + \frac{1}{7} + \frac{1}{49} + \cdots$$

Select the correct choice below and fill in any answer boxes within your choice.

○ **A.** The series converges. The sum of the series is ☐ .
(Type an integer or a simplified fraction.)

○ **B.** The series diverges.

56. Expand the expression using the binomial theorem.

$(x - 2)^5$

$(x - 2)^5 = $ ☐

57. Use the Binomial Theorem to find the coefficient of x^3 in the expansion of $(2x + 3)^7$.

In the expansion of $(2x + 3)^7$, the coefficient of x^3 is ☐ .
(Simplify your answer.)

58. Use the Binomial Theorem to find the coefficient of x^0 in the expansion of $\left(x^2 - \frac{1}{x}\right)^{12}$.

The coefficient of x^0 is ☐ . (Simplify the answer.)

1. $\dfrac{\sqrt{57}}{19}$

$\dfrac{4\sqrt{19}}{19}$

$\dfrac{\sqrt{3}}{4}$

$\dfrac{\sqrt{57}}{3}$

$\dfrac{\sqrt{19}}{4}$

$\dfrac{4\sqrt{3}}{3}$

2. 1

3. 129.94

88.6

78.15

53.3

18.8

4. 65.6

5. 114.67

108.46

32.54

6. 80.9

179.22

7. 38.5

8. 34.8

58.8

86.4

9. 9.19

74.6

25.4
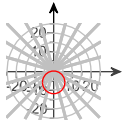
10. 26.6

57.8

95.6

11. 2.46

12. 3.83

13. 16.23

(1) square meters.

14.

15. $\left(10\sqrt{2}, \dfrac{7\pi}{4}\right)$

16. $x^2 + (y + 6)^2 = 36$

   D. circle with center at $(0, -6)$

   A.

---

17. $64\left(\cos\ \dfrac{\pi}{3} + i\sin\ \dfrac{\pi}{3}\right)$
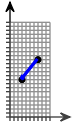
   $64e^{i\frac{\pi}{3}}$

   $\dfrac{1}{4}\left(\cos\ \dfrac{\pi}{9} + i\sin\ \dfrac{\pi}{9}\right)$

   $\dfrac{1}{4}e^{i\frac{\pi}{9}}$

---

18. $-2399.000 - 97.980i$

   $2401.000e^{i \cdot 3.182}$

19.

   C.

---

20. A.
   False; because vector **A** + **B** moves 5 units horizontally and 3 units vertically, and vector **K** + **G** moves -5 units horizontally and -3 units vertically.
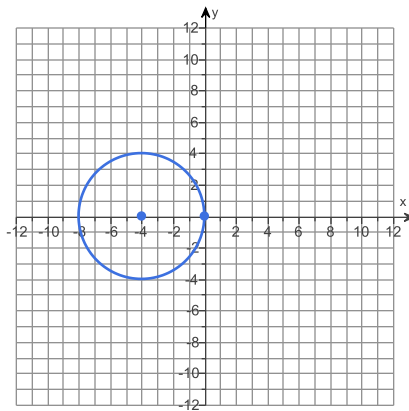
---

21. $-8\mathbf{i} + 2\mathbf{j}$

---

22. $3\sqrt{5} - 2\sqrt{13}$

---

23. 324.5

---

24. $(-4,0)$

   4

   A. The intercept(s) of the circle is/are $(-8,0),(0,0)$.
   (Type an ordered pair. Use a comma to separate answers as needed. Type exact answers for each coordinate, using radicals as needed.)
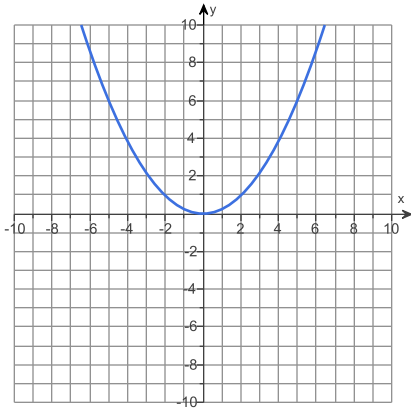
---

25. $x^2 + (y - 161)^2 = 22500$
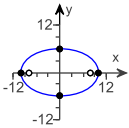

26.

27. $x^2 = \dfrac{25}{6} y$

$\left(-\dfrac{25}{12}, \dfrac{25}{24} \right)$

$\left(\dfrac{25}{12}, \dfrac{25}{24} \right)$

28. $y^2 = 28(x + 7)$

29. $\dfrac{x^2}{100} + \dfrac{y^2}{36}$

B.

30. 86.5

$\dfrac{x^2}{8100} + \dfrac{y^2}{8087.75}$

31. $\dfrac{y^2}{4} - x^2$

32. Hyperbola

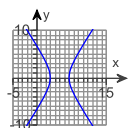A. [**(5,0)**] (Type an ordered pair.)

A. a = [2], b = [3]

C. This conic section has vertices at (7,0) and (3,0).

A. c = [$\sqrt{13}$] (Simplify your answer. Type an exact answer, using radicals as needed.)

C. The foci for this conic section are at $(5 - \sqrt{13}, 0)$ and $(5 + \sqrt{13}, 0)$.

D. The transverse axis for this conic section is along the x-axis.

A. The asymptotes for this conic section are $y = \pm \dfrac{3}{2}(x - 5)$.

B.

33. Ellipse

A. [**(8,0)**] (Type an ordered pair.)
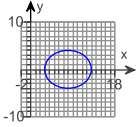
A. a = [**5**] , b = [**4**]

D. This conic section has vertices at (13,0) and (3,0).

A. c = [**3**] (Simplify your answer. Type an exact answer, using radicals as needed.)

D. The foci for this conic section are at (5,0) and (11,0).

C. This conic section has a major and a minor axis.

C. This conic section does not have any asymptotes.

C.

---

34. Parabola

B. The answer is undefined.

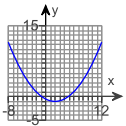A. a = [**2**] , and b does not have a value

B. This conic section has a vertex at (2, − 1).

B. The answer is undefined.

B. The focus for this conic section is at (2,1).

D. The directrix for this conic section is y = − 3.

C. This conic section does not have any asymptotes.

D.

---

35. 64.5

---

36. 1

1

− 1

5

3

− 3

0

5

5

4

− 1

1

37.

A. $\begin{cases} x - 6y + 4z = 5 \\ 2x - 6y + 7z = 6 \\ -3x + 4y + 2z = 6 \end{cases}$

1

-6

4

5

0

6

-1

-4

0

-14

14

21

---

38. B. There are infinitely many solutions. The solution can be written as $\{(x,y) \mid x =$ **3 − 4y** $,$ y is any real number$\}$.
(Simplify your answer. Type an expression using y as the variable.)

39.
A. The solution is $\left(\begin{array}{c} \dfrac{3}{2} \end{array}, \begin{array}{c} \dfrac{1}{5} \end{array}\right)$.(Simplify your answers.)

---

40. D. The system is inconsistent.

41.
A. The solution is $\left(\boxed{2}, \boxed{\dfrac{1}{2}}, \boxed{-1} \right)$.(Simplify your answers.)

---

42. A. The Epsilon Motor Company produces $\boxed{3}$ Deltas, $\boxed{9}$ Betas, and $\boxed{14}$ Sigmas in a month.
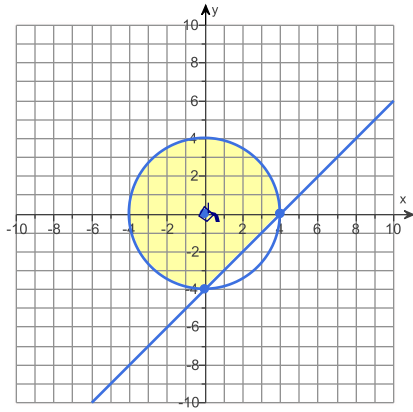(Simplify your answers.)

---

43. $\dfrac{-1}{(x+1)} + \dfrac{2}{(x+2)}$

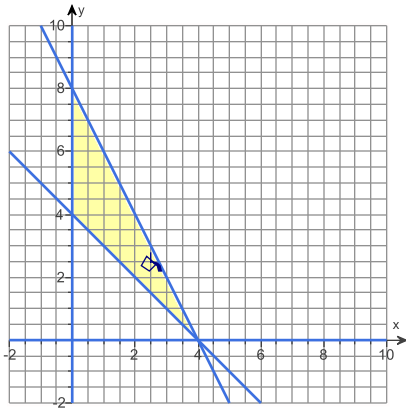44. $\dfrac{1}{\left(x^2 + 9\right)} + \dfrac{-3x - 15}{\left(x^2 + 9\right)^2}$

45.
A. The solution(s) is/are $\boxed{(0,8), \left(-\dfrac{4}{3}, \dfrac{20}{3} \right)}$. (Type an ordered pair. Use a comma to separate answers as needed.)

---

46. A. The solution(s) is/are $\boxed{(2,1), (-2,-1), \left(\sqrt{3}, \sqrt{3}\right), \left(-\sqrt{3}, -\sqrt{3}\right)}$.
(Type an ordered pair. Use a comma to separate answers as needed. Type an exact answer, using radicals as needed. Simplify your answer.)

47.

48.

bounded

(0,8), (4,0), (0,4)

49. $\dfrac{n}{n+1}$

50. -4

   -2

   1

   5

   10

51. 360

52. 2,691

53. $169\sqrt{13}$

   $\left(\sqrt{13}\right)^{n}$

54. $\dfrac{7}{2}$

   $\dfrac{7}{9}$

55.
   A. The series converges. The sum of the series is $\boxed{\dfrac{7}{6}}$.(Type an integer or a simplified fraction.)

56. $x^{5}-10x^{4}+40x^{3}-80x^{2}+80x-32$

57. 22,680

58. 495