1. Find the distance between points $P(-2, -3)$ and $Q(4, -1)$.
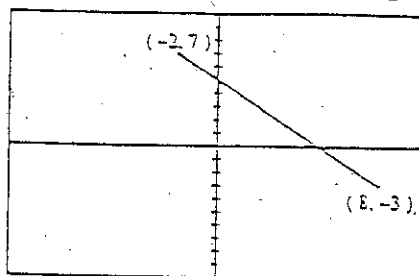
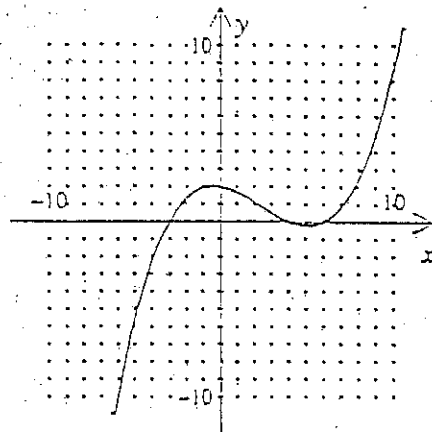   [A] $2\sqrt{5}$ [B] $5\sqrt{2}$ [C] $\sqrt{26}$ [D] $2\sqrt{10}$

2. Find the midpoint of the line segment shown on the graphing utility.

10. Identify the x- and y-intercepts of the graph.

11. Find the equation whose graph is symmetric with respect to the y-axis.
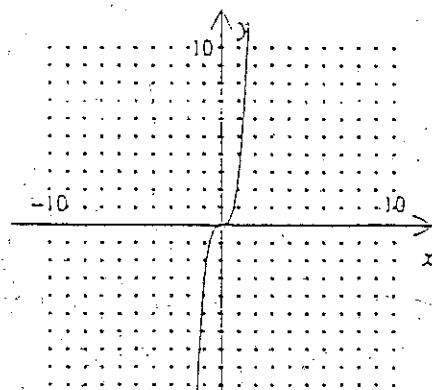
   [A] $y = 3x^3$ [B] $-5x = 18$ [C] $y^3 = 3x^4$ [D] $x = 3y^2$

12. Use symmetry tests to verify any of the three symmetries (x-axis, y-axis, or origin) the graph suggests.

$$y = 3x^3$$

36. For the data given, use a graphing utility to find the equation of the line of best fit.

x	1	2	7	8	10
y	4	6	6	8	10

Solve algebraically:

37. $-\dfrac{24}{x} + \dfrac{12}{x-1} = -2$ [A] $x = 4$ [B] $x = 3$ or 4 [C] $x = 3$ [D] $x = 2$ or 3

38. $4(x-4) = 2(4-x)+4$

39. Use a graphing utility to approximate the solutions. Express the answer correct to two decimal places. $x^3 - 2.13x^2 - 11.43x + 14.81 = 0$

    [A] $\{-3.1, -1.18, 4.05\}$ [B] $\{-4.05, -1.18, 3.1\}$

    [C] $\{-4.05, 1.18, 3.1\}$ [D] $\{-3.1, 1.18, 4.05\}$

40. Use a graphing utility to approximate the solutions. Express the answer correct to two decimal places. $x^3 - 0.08x^2 - 17.48x + 23.45 = 0$

9

1. Which of the following is a function?
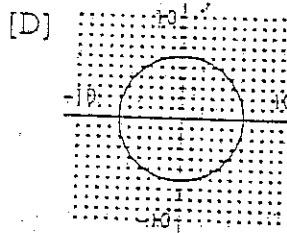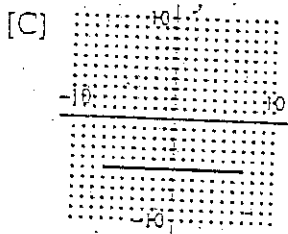
   [A] $\{(2,-7),(-7,-5),(2,-8)\}$

   [C] $\{(2,-7),(-7,2),(-8,-8)\}$

   [B] $\{(2,-7),(-5,-8),(-5,2),(-8,-5)\}$
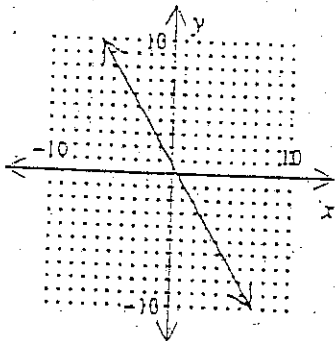
   [D] $\{2,-7,-5,-8\}$

2. Is the relation $\{(3,6),(2,6),(1,6)\}$ a function?

3. Which graph represents a function?

   [A]

   [B]

   [C]

   [D]
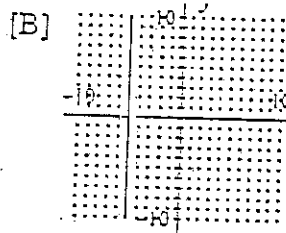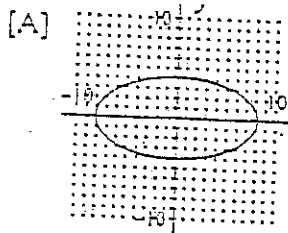
4. Use the vertical line test to determine if the graph represents a function.

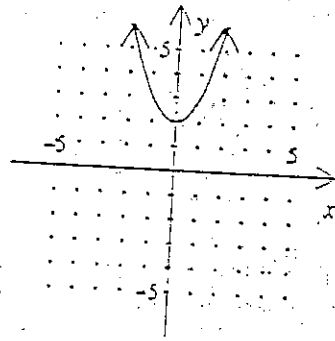5. Find $f(-2)$ given $f(x) = 4x^2 + x + 30$.   [A] 14   [B] 44   [C] 20   [D] 50

5. Given $f(x) = \dfrac{x+5}{x-5}$, answer the following questions.

    (a) Is the point $(8, \dfrac{13}{3})$ on the graph of f?

    (b) If $x = -3$, what is $f(x)$?

    (c) What is the domain of f?

7. Find the domain and range for the function graphed below.

    [A] D = {x|x is a real number}
        R = {y|y is a real number}

    [C] D = {x|x is a real number}
        R = {y|y ≥ 2}

    [B] D = {x|x ≤ 2}
        R = {y|y is a real number}

    [D] D = {x|x > 2}
        R = {y|y > 2}

8. Determine the domain of the function $h(x) = \dfrac{3x}{x(x^2 - 4)}$.

9. At 2:00 pm there was 9 feet 7 inches of snow at Timberline Ski Resort. By 11:00 pm the same night there was 9 feet $10\dfrac{3}{8}$ inches of snow. What is the average rate of change for the snow level?

    [A] $\dfrac{3}{4}$ in. per hr   [B] $1\dfrac{11}{16}$ in. per hr   [C] $3\dfrac{3}{8}$ in. per hr   [D] $\dfrac{3}{8}$ in. per hr

10. Find the average rate of change of f between 1 and x, $\dfrac{f(x) - f(1)}{x-1}$, $x \neq 1$. Be sure to simplify.
$f(x) = 2x$

11. A biologist estimated the population of seals on a group of islands during the first eight years after restrictions were put on hunting. Her data can be modeled by the equation $P = 0.8x^4 - 20x^3 + 220x^2 - 960x + 2650$, where x is the number of years after the restrictions went into place, and P is the total population of seals. Use a graphing calculator to find when the population reached a minimum after the restrictions went into place and the population at that time.

   [A] 3.6 years; 1250 seals

   [C] 4.3 years; 1210 seals

   [B] 4 years; 1220 seals

   [D] 3.3 years; 1310 seals

12. Determine where $f(x) = 15x^3 + 31x^2 - 16x + 1$ has any local maximum or local minimum values and the intervals where the function is increasing, decreasing, and constant.

✗ Which of the following functions is neither odd nor even?

[A] $f(x) = 3x^4 + x^2$

[B] $F(x) = \dfrac{x^3}{x^2 + 1}$

[C] $g(x) = x^4 + x^2 + 3$

[D] $h(x) = x^3 + x + 6$

✗ Is the following function an even function, an odd function, or neither?
$f(x) = 6x^4 - 3x^2$

17. Classify $f(x) = 7x^2 + 8x$ as a constant, linear, quadratic, or cube function.
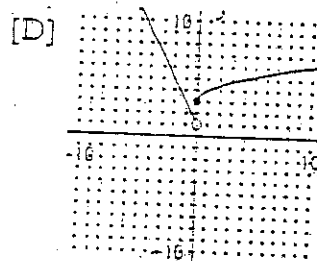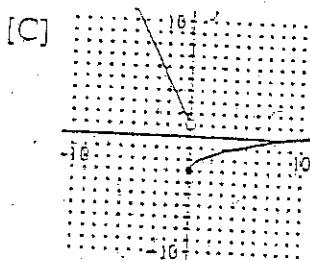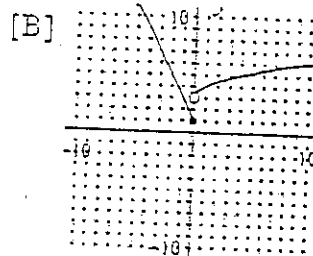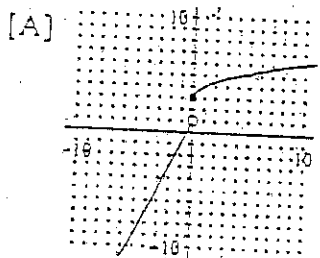
[A] cube function

[B] linear function

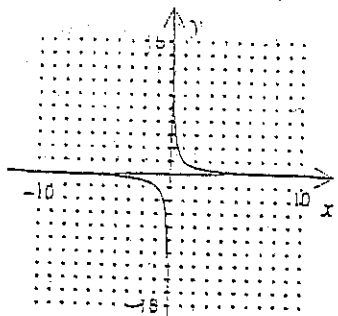[C] constant function

[D] quadratic function

18. Graph $y + 4 = |x|$.

19. Graph the function: $f(x) = \begin{cases} \sqrt{x} + 3, & x \geq 0 \\ -2x + 1, & x < 0 \end{cases}$

[A]

[B]

[C]

[D]

20. Graph the piecewise defined function: $f(x) = \begin{cases} -x + 1 & \text{if } x < -1 \\ 2x + 4 & \text{if } x \geq -1 \end{cases}$

26. The graph of the function $y_1 = \dfrac{1}{x}$ is shown below. Name and graph the function y_2 which is the reflection of y_1 across the y-axis.

27. Let $f(x) = 4 - x^2$, $g(x) = 2 - x$. Find $(fg)(x)$.

   [A] $-x^2 - x + 6$ [B] $x^3 - 2x^2 - 4x + 8$ [C] $-x^2 + x + 2$ [D] $2 + x$

28. Given the functions $f(x) = 2x - 2$ and $g(x) = x - 7$, find $(f+g)(x)$, $(f-g)(x)$, $(f \cdot g)(x)$, and $(f / g)(x)$.

29. Given $f(x) = \dfrac{x-7}{x}$ and $g(x) = x^2 + 7$, find $(g \circ f)(3)$.

   [A] $\dfrac{121}{16}$ [B] $\dfrac{17}{3}$ [C] $\dfrac{79}{9}$ [D] $\dfrac{9}{16}$

30. If $f(x) = x^2$ and $g(x) = -3 + 6x$, find $(g \circ f)(x)$ and find the domain of $(g \circ f)(x)$.

31. Let $P = (x, y)$ be a point on the graph of $y = 2x + 2$. Express the distance d from P to the point $(3, 3)$ as a function of x.

   [A] $d = 4x^2 + 2x + 13$ [B] $d = 5x^2 - 10x + 10$

   [C] $d = \sqrt{4x^2 + 2x + 13}$ [D] $d = \sqrt{5x^2 - 10x + 10}$

23

32. The price p and x, the quantity of a certain product sold, obey the demand equation
$p = -\frac{1}{5}x + 50$,
$0 \leq x \leq 250$.
   a. Express the revenue R as a function of x.
   b. What is the revenue if 200 units are sold?
   c. Graph the revenue function using a graphing utility.
   d. What quantity x maximizes revenue? What is the maximum revenue?
   e. What price should the company charge to maximize revenue?

33. A farmer has available 1044 feet of fencing and wishes to enclose a rectangular area. If x represents the width of the rectangle, for what value of x is the area largest?

   [A] 262 feet   [B] 260 feet   [C] 259.5 feet   [D] 261 feet

34. A farmer has 278 feet of fencing available to enclose a rectangular field. One side of the field lies along a river, so only three sides require fencing.
   (a) Express the area A of the rectangle as a function of x, where x is the length of the side parallel to the river.
   (b) For what value of x is the area largest?

X   Convert 28° 28′ 22″ to decimal degrees.

X   Convert 37.7781° to D° M′ S″ form.

   [A] 37° 77′ 81″   [B] 37° 46′ 80″   [C] 37° 46′ 70″   [D] 37° 46′ 41″

3.   For a circle of radius 9 feet, find the arc length s subtended by a central angle of 6°.
     Round to the nearest hundredth.

4.   For a circle of radius 4 feet, find the arc length s subtended by a central angle of 30°.
     Round to the nearest hundredth.

   [A] 6.28 feet   [B] 2.09 feet   [C] 376.99 feet   [D] 4.19 feet

5.   Convert 30° to radians.

6.   Convert 99° to radian measure. Give the exact answer.

   [A] $\frac{11}{10}\pi$ [B] $\frac{11}{40}\pi$ [C] $\frac{11}{20}\pi$ [D] $\frac{11}{30}\pi$

7.   Convert $\frac{2}{9}\pi$ to degrees.

8.   Convert $\frac{13}{20}\pi$ to degrees.   [A] 234°   [B] 59°   [C] 277°   [D] 117°

9.   An object is traveling around a circle with a radius of 10 centimeters. If in 35 seconds a
     central angle of $\frac{1}{5}$ radian is swept out, what is the linear speed of the object?

10. An object is traveling around a circle with a radius of 5 feet. If in 35 seconds a central
     angle of $\frac{1}{3}$ radian is swept out, what is the linear speed of the object?

   [A] $\frac{1}{21}\frac{radians}{second}$ [B] $\frac{1}{21}\frac{feet}{second}$ [C] $21\frac{radians}{second}$ [D] $21\frac{feet}{second}$

11. Find $\sin \theta$ if $(-12, -5)$ is a point on the terminal side of θ.

12. Find $\sin \theta$ if $(8, 15)$ is a point on the terminal side of θ.

   [A] $\dfrac{8}{15}$ [B] $\dfrac{15}{17}$ [C] $\dfrac{15}{8}$ [D] $\dfrac{8}{17}$

13. Use the unit circle to find the exact values of $\sin \pi$ and $\cos \pi$.

14. Use the unit circle to find the exact values of $\sin 2\pi$ and $\cos 2\pi$.

   [A] $\sin 2\pi = 0$, $\cos 2\pi = 1$ [B] $\sin 2\pi = 0$, $\cos 2\pi = -1$
   [C] $\sin 2\pi = 1$, $\cos 2\pi = 0$ [D] $\sin 2\pi = -1$, $\cos 2\pi = 0$

15. Find the exact value of $\sin 30° - \sin 45°$. Do not use a calculator.

16. Find the exact value of $\tan 30° - \cos 30°$. Do not use a calculator.

   [A] $\dfrac{3 - 2\sqrt{3}}{6}$ [B] $\dfrac{\sqrt{3}}{6}$ [C] $\dfrac{1 - \sqrt{3}}{2}$ [D] $\dfrac{-\sqrt{3}}{6}$

17. Use a calculator to find the value of $\sin 48°$. Round to the nearest hundredth.

18. Use a calculator to find the value of $\cos 80°$. Round to the nearest hundredth.

   [A] -0.98 [B] 0.98 [C] -0.17 [D] 0.17

19. What is the domain and range of $f(t) = \cos t$?

20. Find the domain and range of $f(t) = \cot t$.

   [A] D: $-\infty < t < \infty$

   R: All real numbers except odd multiples of $\dfrac{\pi}{2}$

   [B] D: All real numbers except multiples of π
   R: $-\infty < f(t) < \infty$

   [C] D: $-\infty < t < \infty$
   R: $-1 \le f(t) \le 1$

   [D] D: $-\dfrac{\pi}{2} < t < \dfrac{\pi}{2}$
   R: $-\infty < f(t) < \infty$

21. Given $\sin \theta = \dfrac{4}{7}$ and $\sec \theta < 0$, find $\cos \theta$ and $\tan \theta$.

22. Given $\sin \theta = \dfrac{2}{3}$ and $\sec \theta < 0$, find $\cos \theta$ and $\tan \theta$.

   [A] $\cos \theta = -\sqrt{5}$, $\tan \theta = -\dfrac{6}{\sqrt{5}}$

   [B] $\cos \theta = -\dfrac{\sqrt{5}}{3}$, $\tan \theta = -\dfrac{2}{\sqrt{5}}$

   [C] $\cos \theta = -\dfrac{\sqrt{5}}{3}$, $\tan \theta = \dfrac{2}{\sqrt{5}}$

   [D] $\cos \theta = \dfrac{\sqrt{5}}{3}$, $\tan \theta = \dfrac{2}{\sqrt{5}}$

23. Find the exact value of $\cot\left(-\dfrac{3}{4}\pi\right)$.
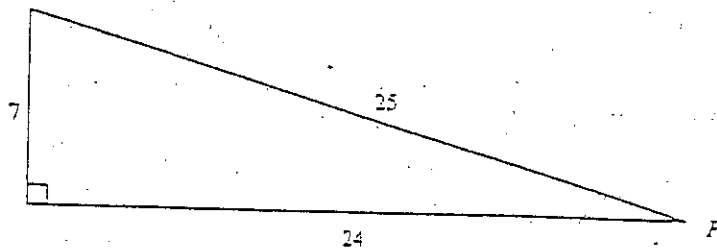
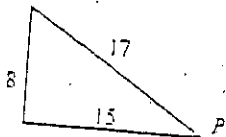24. Find $\cot\left(-\dfrac{1}{4}\pi\right)$.   [A] $-\sqrt{3}$ [B] 1   [C] $-\dfrac{\sqrt{3}}{3}$ [D] -1

25. Find the exact value of each of the six trigonometric functions of the angle P.

26. Find $\tan P$.

[A] $\tan P = \dfrac{8}{17}$ [B] $\tan P = \dfrac{15}{8}$ [C] $\tan P = \dfrac{8}{15}$ [D] $\tan P = \dfrac{15}{17}$

27. If $\sec \theta = 5$, find the exact value of:
   (a) $\csc(90° - \theta)$
   (b) $\sin(\pi/2 - \theta)$

28. If $\tan \theta = 0.7$, find the exact value of: $\tan \theta + \cot(90° - \theta)$

   [A] 0.84 [B] 1.54 [C] 0.7 [D] 1.4

Evaluate:

29. $\cos \dfrac{11}{6}\pi$

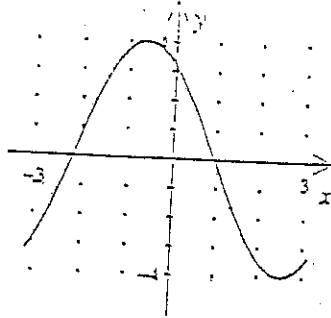30. $\cos \dfrac{11}{6}\pi$ [A] $-\dfrac{1}{2}$ [B] $\dfrac{\sqrt{3}}{2}$ [C] $\dfrac{1}{2}$ [D] $-\dfrac{\sqrt{3}}{2}$

31. Graph $y = -3\cos\left(x + \dfrac{\pi}{2}\right)$ on the interval $-\pi \le x \le \pi$.
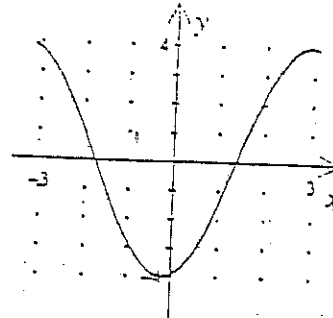
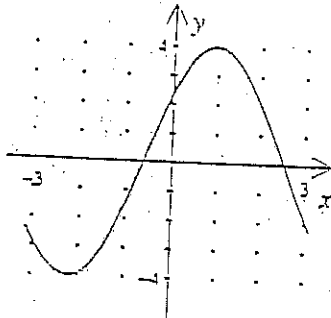32. Graph $y = 4\cos\left(x + \dfrac{\pi}{5}\right)$ on the interval $-\pi \le x \le \pi$.

[A]

[B]

[C]

[D]
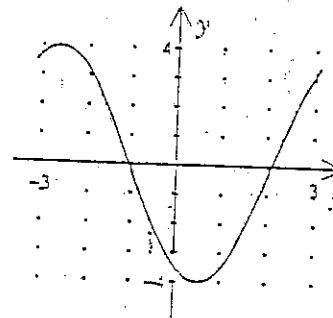
Graph:

33. $y = \tan\left(x + \dfrac{\pi}{2}\right)$

39. You are flying a kite and want to know its angle of elevation. The string on the kite is 38 meters long and the kite is level with the top of a building that you know is 25 meters high. Use an inverse trigonometric function to find the angle of elevation of the kite. Round to two decimal places.

40. Find two values of θ for the trigonometric equation $\sin \theta = 0.225$. Round your answer to the nearest degree.

[A] 13°, 167°   [B] 167°, 347°   [C] 193°, 347°   [D] 13°, 193°

1. Is the statement an identity? $\dfrac{\tan x}{\csc x} = \dfrac{1}{\cos x} - \cos x$

2. The expression $\dfrac{7 - 7 \sin \alpha}{-5 \cos \alpha}$ forms an identity with which of the following?

   [A] $\dfrac{7 \sin \alpha}{-5(1 - \cos \alpha)}$ [B] $\dfrac{7 \cos \alpha}{-5(1 - \sin \alpha)}$ [C] $\dfrac{7 \cos \alpha}{-5(1 + \sin \alpha)}$ [D] $\dfrac{7 \sin \alpha}{-5(1 + \cos \alpha)}$

3. If $\sin A = \dfrac{7}{8}$ and $\cos B = \dfrac{3}{7}$, where $\dfrac{\pi}{2} \le A \le \pi$ and $-\dfrac{\pi}{2} \le B \le 0$, find the exact value of $\sin(A - B)$.

4. If $\sin A = \dfrac{4}{7}$, $\dfrac{\pi}{2} \le A \le \pi$, and $\cos B = -\dfrac{2}{3}$, $\pi \le B \le \dfrac{3\pi}{2}$, find the exact value of $\cos(A + B)$.

   [A] $\dfrac{1}{21}\left(2\sqrt{33} - 4\sqrt{5}\right)$ [B] $-\dfrac{2}{21}$ [C] $\dfrac{1}{21}\left(2\sqrt{33} + 4\sqrt{5}\right)$ [D] $\dfrac{1}{21}\left(4\sqrt{5} - 2\sqrt{33}\right)$

5. Establish the identity $\cos\left(\theta - \dfrac{\pi}{2}\right) = \sin\theta$.

6. $\sin(\theta - 2\pi)$ forms an identity with which of the following?

   [A] $-\sin\theta$ [B] $\cos\theta$ [C] $-\cos\theta$ [D] $\sin\theta$

7. If $\cos\theta = \dfrac{\sqrt{5}}{3}$ and θ terminates in the first quadrant, find the exact value of $\tan 2\theta$.

8. Find the exact value of $\sin 2B$ if $\sin B = \dfrac{8}{17}$ and B lies in quadrant II.

   [A] $-\dfrac{161}{289}$ [B] $\dfrac{240}{289}$ [C] $-\dfrac{240}{289}$ [D] $\dfrac{161}{289}$

9. Establish $\csc 2\theta + \cot 2\theta = \cot\theta$ as an identity.

1. A tree casts a shadow of 28 meters when the angle of elevation of the sun is $23°$. Find the height of the tree to the nearest meter.

2. A photographer points a camera at a window in a nearby building forming an angle of $49°$ with the camera platform. If the camera is 57 m from the building, how high above the platform is the window, to the nearest hundredth?
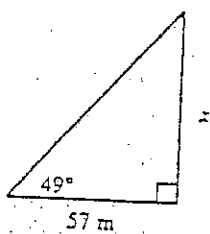
[A] 49.55 m   [B] 65.57 m   [C] 0.87 m   [D] 1.15 m

3. Given a triangle with $a = 12$, $\alpha = 46°$ and $\beta = 28°$, what is the length of c? Round your answer to two decimal places.

4. A ship at sea, the Admiral, spots two other ships, the Barstow and the Cauldrew and measures the angle between them to be $45°$. They radio the Barstow and by comparing known landmarks, the distance between the Admiral and the Barstow is found to be 412 meters. The Barstow reports an angle of $73°$ between the Admiral and the Cauldrew. To the nearest meter, what is the distance between the Barstow and the Cauldrew?

    [A] 91 meters   [B] 330 meters   [C] 305 meters   [D] 54 meters

5. Given a triangle with $a = 12$, $b = 14$, and $\alpha = 23°$, what is (are) possible length(s) of c? Round your answer to two decimal places.

6. Given a triangle with $a = 8$, $b = 10$, and $\alpha = 15°$, what is (are) possible length(s) of c? Round your answer to two decimal places.

    [A] $c = 17.23$ or 2.09 [B] $c = 2.68$ [C] $c = 17.23$ or 2.93 [D] $c = 12.81$

7. Given a triangle with $b = 9$, $c = 2$, and $\alpha = 34°$, what is the length of a? Round the answer to two decimal places.

8. Given a triangle with $b = 8$, $c = 5$, and $\alpha = 66°$, what is the length of a? Round the answer to two decimal places.

   [A] 7.3   [B] 8.53   [C] 11.02   [D] 7.51

9. Solve the triangle given that $a = 11$, $b = 17$, and $c = 15$.

10. Island A is 150 miles from island B. A ship captain travels 160 miles from island A and then finds that he is off course and 150 miles from island B. What angle, in degrees, must he turn through to head straight for island B? Round the answer to two decimal places. (Hint: Be careful to properly identify which angle is the turning angle.)

    [A] 122.23°   [B] 64.46°   [C] 57.77°   [D] 32.23°

11. Find the area of the triangle with $\alpha = 89°$, $b = 2$ feet, and $c = 6$ feet. Round your answer to two decimal places.

12. Find the area of the triangle with $\alpha = 59°$, $b = 4$ feet, and $c = 10$ feet. Round your answer to two decimal places.

    [A] 10.30 ft^2 [B] 34.29 ft^2 [C] 17.14 ft^2 [D] 20.00 ft^2

13. Find the area of a triangle with sides 4 m, 5 m, and 7 m. Round to the nearest hundredth.

14. Find the area of a triangle with sides 8 m, 9 m, and 13 m. Round to the nearest hundredth.

    [A] 5.48 m^2 [B] 35.5 m^2 [C] 9.17 m^2 [D] 30 m^2

15. Find the amplitude and period of $f(x) = -3 \sin(5x)$.

16. A water wave is created in a wave tank. It has an amplitude of 3 and a period of 2π. Find the equation of this wave as a sine function.

    [A] $y = \sin 3x$ [B] $y = 2 \sin \frac{1}{3}x$ [C] $y = \frac{1}{3} \sin 2x$ [D] $y = 3 \sin x$