Name: ______________________________ Date: ____________

1. Multiply; then use fundamental identities to simplify the expression below and determine which of the following is *not* equivalent.

$$(\sin x + \cos x)(\sin x - \cos x)$$

a)

$2\sin^2 x - \sec^2 x - \tan^2 x$

____

b)

$\sin^2 x - \cos^2 x$

____

c)

$1 - 2\cos^2 x$

____

d)

$\csc^2 x - \cot^2 x - 2\cos^2 x$

____

e)

$1 - 2\sin\left(\dfrac{\pi}{2} - x\right)\cos x$

____

2. A park ranger at point A observes a fire in the direction $\mathrm{N}\,23°38'\mathrm{E}$. Another ranger at point B, 9 miles due east of A, sites the same fire at $\mathrm{N}\,55°27'\mathrm{W}$. Determine the distance from point B to the fire. Round answer to two decimal places.

a) miles
b) miles
c) miles
d) miles
e) miles

3. Evaluate the sine of the angle without using a calculator.

$\dfrac{7\pi}{4}$

a) $\dfrac{\sqrt{2}}{2}$
b) $\dfrac{\sqrt{2}}{2}$
c) $-\dfrac{\sqrt{3}}{2}$
d) $-\dfrac{1}{2}$
e) 0

4. Simplify the given expression algebraically.

$\sin(x - \pi)$

a) $\sin x$

b) $-\sin x$

c) $\cos x$

d) $-\cos x$

e) 1

5. Determine the period and amplitude of $y = 3\cos\left(\frac{x}{13} + \frac{\pi}{4}\right)$.

a) period: $\frac{2\pi}{13}$; amplitude: 3
b) period: 26π ; amplitude: 3
c) period: 3π ; amplitude: 10
d) period: $\frac{\pi}{3}$; amplitude: 5
e) period: $-\frac{2\pi}{3}$; amplitude: –5

6. Write the standard form of the equation of the parabola that has a vertex at $(-4,8)$ and passes through the point $(-6,2)$.

a) $f(x)=\frac{1}{2}(x+4)^2-6$

b) $f(x)=-\frac{3}{2}(x+4)^2+8$

c) $f(x)=-\frac{3}{8}(x-4)^2+8$

d) $f(x)=-\frac{4}{3}(x-8)^2+2$

e) $f(x)=\frac{1}{2}(x-8)^2+6$

7. Consider the function $f(x)=\dfrac{x^2-49}{4x^2-31x+21}$. Find the function's domain and identify any horizontal and vertical asymptotes.

a) **domain:** all real numbers x except for $x=\frac{7}{3}$; **vertical asymptote:** $x=\frac{7}{3}$; **horizontal asymptote:** $y=\frac{1}{3}$

b) **domain:** all real numbers x except for $x=1$ and $x=\frac{7}{3}$; **vertical asymptote:** $x=\frac{7}{3}$; **horizontal asymptote:** $y=\frac{1}{3}$

c) **domain:** all real numbers x except for $x=\frac{7}{3}$; **vertical asymptote:** $x=1$ and $x=\frac{7}{3}$; **horizontal asymptote:** $y=\frac{1}{3}$

d) **domain:** all real numbers x except for $x=\frac{7}{3}$; **vertical asymptote:** $x=1$ and $x=\frac{7}{3}$; **horizontal asymptote:** $y=0$

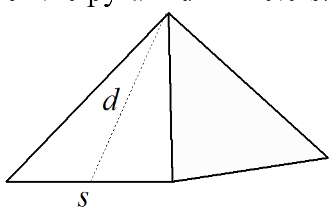
e) **domain:** all real numbers x except for $x=1$ and $x=\frac{7}{3}$; **vertical asymptote:** $x=\frac{7}{3}$; **horizontal asymptote:** $y=0$

8. Determine the area of a triangle having the following measurements. Round your answer to two decimal places.

$B = 85°18', a = 13,$ and $c = 9$

a) 78.70 sq. units
b) 59.02 sq. units
c) 52.47 sq. units
d) 65.58 sq. units
e) 72.14 sq. units

9. A pyramid has a square base measuring $s = 6$ meters on each side (see figure). The triangles making up the sides of the pyramid each have an altitude of $d = 5$ meters. Find the height of the pyramid in meters.



a) 8 meters
b) 16 meters
c) 10 meters
d) 4 meters
e) 12 meters

10. Solve $\ln x^2 = 5$ for x.

a) e^{25}
b) $10^{\sqrt{3}}$
c) $e^{\sqrt{5}}$
d) $-e^{5/2}, e^{5/2}$
e) no solution

11. Given $C = 130°$, $a = 9.93$, and $c = 18$, use the Law of Sines to solve the triangle (if possible) for the value of b. If two solutions exist, find both. Round answer to two decimal places.
a) $b = 3.39$
b) $b = 0.58$ and 2.73
c) $b = 10.10$
d) $b = 11.89$ and 4.03
e) not possible

12. Approximate the solution of $4e^{x-5} = 22$ to 3 decimal places. (You may use a graphing utility.)
a) –1.921
b) 3.389
c) –3.699
d) 4.693
e) –3.307

13. A sign next to the highway at the top of Saura Mountain states that, for the next 8 miles, the grade is 10%. Determine the change in elevation (in feet) over the 8 miles for a vehicle descending the mountain. Round answer to nearest foot.
a) –2840 feet
b) –2851 feet
c) 2845 feet
d) 813 feet
e) –1829 feet

14. The electrical resistance, R, of a wire is directly proportional to its length, l, and inversely proportional to the square of its diameter, d. A wire 80 meters long of diameter 4 millimeters has a resistance of 10 ohms. Find the resistance of a wire made of the same material that has a diameter of 5 millimeters and is 125 meters long.
a) $R = 10.5$ ohms
b) $R = 11.5$ ohms
c) $R = 11.8$ ohms
d) $R = 8$ ohms
e) $R = 0.125$ ohms

15. Find the exact value of $\cos\left(\sin^{-1}\frac{3}{5}\right)$.

a) $\frac{3}{5}$

b) $\frac{9}{5}$

c) $\frac{5}{3}$

d) $\frac{4}{9}$

e) $\frac{4}{5}$

16. Find a mathematical model for the verbal statement:
"The force of attraction F between two oppositely charged particles varies directly as the product of the magnitudes Q_1 and Q_2 of the charges and inversely as the square of the distance d between the particles."

a)
$F = kQ_1 Q_2 d^2$

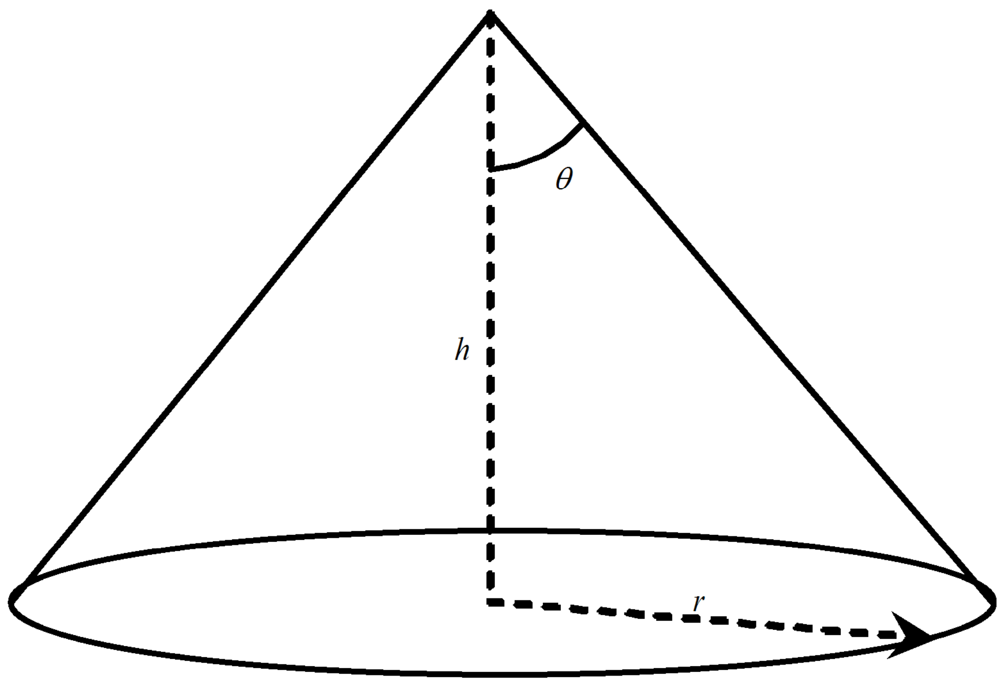
b)
$F = \frac{kQ_1}{Q_2 d^2}$

c)
$F = \frac{kQ_1 Q_2}{d^2}$

d)
$F = \frac{kQ_2}{Q_1 d^2}$

e)
$F = \frac{kd^2}{Q_1 Q_2}$

17. A pile of sawdust at a sawmill is in the shape of a right circular cone (see figure). The pile has a height $h = 6$ feet and the lateral surface forms an angle $\theta = 24°$ with the pile's axis. Use this information to approximate the area of the circular base of the pile (area of base $= \pi r^2$). Round to the nearest square foot.



not drawn to scale

a) 94 square ft
b) 19 square ft
c) 8 square ft
d) 22 square ft
e) 50 square ft

18. A signal amplifier is an electronic device that sends a large output voltage in response to a small input voltage. The response of a certain signal amplifier at several input voltages is shown in the table below.

Input signal (millivolts)	Output signal (volts)
20	0.51
40	0.78
60	1.43
80	2.19
100	2.58

A model for the data is given by $g(x) = \dfrac{2.35}{1 + 84.8e^{-0.07x}} + 0.4$, where x is the input voltage in millivolts and $g(x)$ is the output voltage in volts.

Use the model to estimate the output voltage (to the nearest hundredth of a volt) for an input signal of 84 millivolts.

a) $g(21) = 0.52$ volts
b) $g(21) = 0.36$ volts
c) $g(21) = 0.62$ volts
d) $g(21) = 1.52$ volts
e) $g(21) = 0.72$ volts

19. Find the inverse function of f.

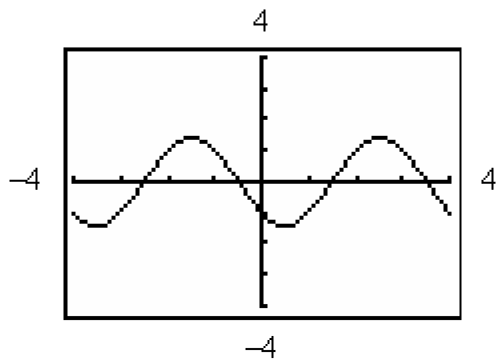
$f(x) = x^5 - 2$

a) $f^{-1}(x) = -\sqrt[7]{x} - 2$
b) $f^{-1}(x) = \sqrt[5]{x} + 5$
c) $f^{-1}(x) = -\sqrt[7]{x - 3}$
d) $f^{-1}(x) = \sqrt[3]{x - 1}$
e) $f^{-1}(x) = \sqrt[9]{x} + 9$

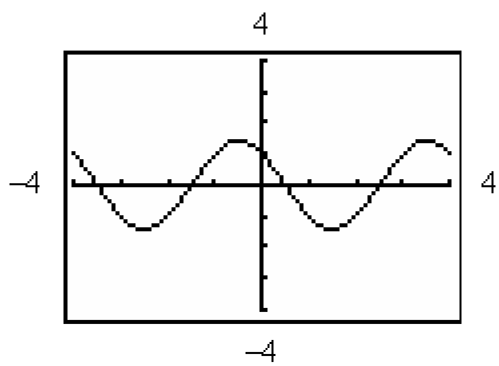
20. Use a graphing utility to graph the function below. Be sure to include at least two full periods.

$$y = -\sqrt{2}\sin\left(\frac{\pi x}{2} - \frac{\pi}{4}\right)$$

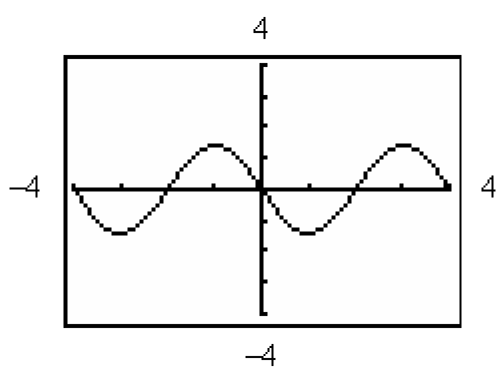
a)



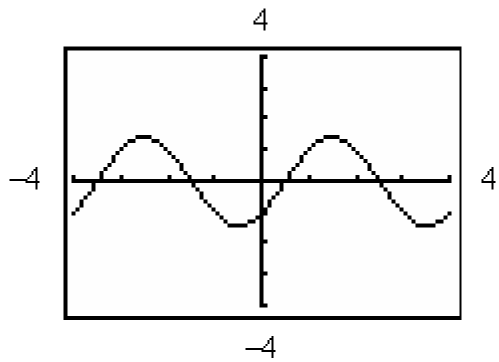
b)



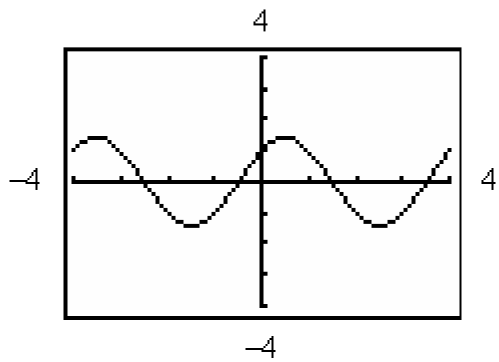
c)



d)



e)



21. Suppose a species of sea turtles is confined to an island and has a current population of 53 turtles. If the population, N, is modeled by

$$N = \frac{53(5+2t)}{5+0.04t},\ \ t \geq 0$$

where t is the time in years, how many turtles are predicted to be on the island in 35 years? Round to the nearest integer.

a) 372
b) 621
c) 985
d) 275
e) 821

22. Use the given function values and the trigonometric identities (including the cofunction identities), to find the indicated trigonometric function.

$\sin\theta = \dfrac{9}{\sqrt{130}}, \cos\theta = \dfrac{7}{\sqrt{130}}$; find $\cot\theta$

a) $\dfrac{9}{7}$

b) $\dfrac{7}{9}$

c) $\dfrac{\sqrt{130}}{9}$

d) $\dfrac{\sqrt{130}}{7}$

e) 1

23. Determine a value for b such that a triangle with $A = 65°$ and $a = 13$ has only one solution.

a) $b = 9$
b) $b = 12$
c) $b = 13$
d) $b = 14$
e) $b = 15$

24. If $\sin x = \frac{1}{2}$ and $\cos x = \frac{\sqrt{3}}{2}$, evaluate the following function.

$\cot x$

a)

$\cot x = \frac{2\sqrt{3}}{3}$

b)

$\cot x = \sqrt{3}$

c)

$\cot x = 2$

d)

$\cot x = \frac{\sqrt{3}}{3}$

e)

$\cot x = \frac{1}{3}$

25. Evaluate the sine of the angle without using a calculator.
$-30°$

a) $-\frac{\sqrt{2}}{2}$
b) $\frac{\sqrt{2}}{2}$
c) $-\frac{\sqrt{3}}{2}$
d) $-\frac{1}{2}$
e) 0

26. Determine whether the variation model below is of the form $y = kx$ or $y = \frac{k}{x}$.

x	12	24	36	48	60
y	$\frac{1}{18}$	$\frac{1}{36}$	$\frac{1}{54}$	$\frac{1}{72}$	$\frac{1}{90}$

a) $y = kx$
b) $y = \frac{k}{x}$

27. Given $C = 112°$, $a = 5$, and $b = 8$, use the Law of Cosines to solve the triangle for the value of c. Round answer to two decimal places.
a) 9.04
b) 7.92
c) 9.42
d) 6.43
e) 8.67

28. Find the average rate of change of the function from x_1 to x_2.

$f(x) = x^2 + x + 3 \;\; x_1 = 2, x_2 = 4$
a) 2
b) –14
c) 14
d) 12
e) 7

29. Which of the following is not a solution to the inequality $x^2 - 25 \le 0$?

a) $x = -12$
b) $x = -11$
c) $x = \frac{11}{2}$
d) $x = -8$
e) $x = 0$

30. Given $a = 6$, $b = 7$, and $c = 8$, use the Law of Cosines to solve the triangle for the value of B. Round answer to two decimal places.

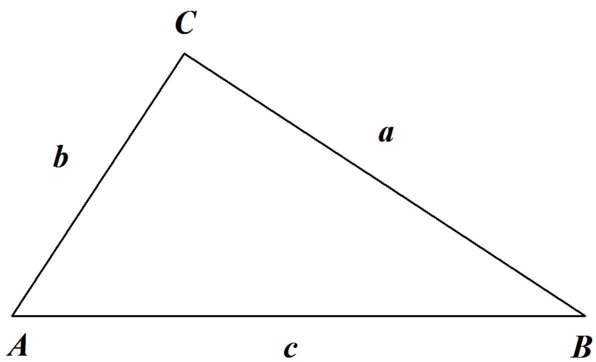


Figure not drawn to scale

a) 60.33°
b) 88.26°
c) 80.44°
d) 39.98°
e) 51.75°

31. Glove and mitten warmers have become popular over the past few years. These devices consist of a paper pouch filled with a chemical mixture that reacts and releases heat when exposed to air. At a time *t* (in minutes) after being exposed to air at a temperature of 32 °F, the temperature *T* of the pouch (in °F) can be modeled by the equation

$T(t) = 84e^{-11/t^2} + 32, \quad 0 \le t \le 200$

Find the time necessary for the warmer to reach a temperature of 104 °F. Round to the nearest tenth of a minute.

a) 49.3 minutes
b) 7.3 minutes
c) 9.1 minutes
d) 5.9 minutes
e) 7.0 minutes

32. Find all zeros of the function $f(x) = (x-1)(x+4i)(x-4i)$.

a) $x = -1, -4i, 4i$
b) $x = 1, 4i$
c) $x = 1, -4, 4$
d) $x = 1, -4i, 4i$
e) $x = 1$

33. Use a graphing utility to approximate the solutions (to three decimal places) of the given equation in the interval $\left(-\frac{\pi}{2}, \frac{\pi}{2}\right)$.

$6\sin^3 x + 18\sin^2 x = 5\sin x + 15$

a)
$x = -1.150, 1.150$

b)
$x = 1.265$

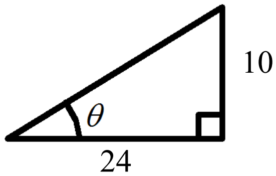
c)
$x = -0.825, 1.336$

d)
$x = -1.193, 0, 1.139$

e)
$x = -1.265, 0.398$

34. Use the figure below to find the exact value of the given trigonometric expression.

$\sin\dfrac{\theta}{2}$



(*figure not necessarily to scale*)

a) $\dfrac{5}{26}$

b) $\dfrac{5}{6}$

c) $\dfrac{4\sqrt{17}}{17}$

d) $\dfrac{\sqrt{17}}{17}$

e) $\dfrac{1}{26\sqrt{26}}$

35. Find all solutions of the following equation in the interval $[0, 2\pi)$.

$\tan^3 x = \tan x$

a)

$x = 0, \frac{\pi}{6}, \frac{5\pi}{6}, \frac{7\pi}{6}, \frac{11\pi}{6}$

b)

$x = 0, \frac{\pi}{2}, \pi, \frac{3\pi}{2}$

c)

$x = 0, \frac{\pi}{4}, \frac{7\pi}{4}$

d)

$x = 0, \frac{\pi}{3}, \frac{2\pi}{3}, \pi, \frac{4\pi}{3}, \frac{5\pi}{3}$

e)

$x = 0, \frac{\pi}{4}, \frac{3\pi}{4}, \pi, \frac{5\pi}{4}, \frac{7\pi}{4}$

36. Find the exact value of $\cos(u+v)$ given that $\sin u = \frac{5}{13}$ and $\cos v = -\frac{4}{5}$. (Both u and v are in Quadrant II.)

a) $\cos(u+v) = \frac{12}{65}$

b) $\cos(u+v) = -\frac{36}{325}$

c) $\cos(u+v) = \frac{253}{325}$

d) $\cos(u+v) = -\frac{246}{325}$

e) $\cos(u+v) = \frac{204}{325}$

37. An observer is 380 feet from a hot air balloon before it lifts off. Determine the angle of elevation, θ, when the balloon reaches a height of 240 feet. State your answer in degrees and round to one decimal place.

a) $\theta = 32.6°$

b) $\theta = 28.3°$

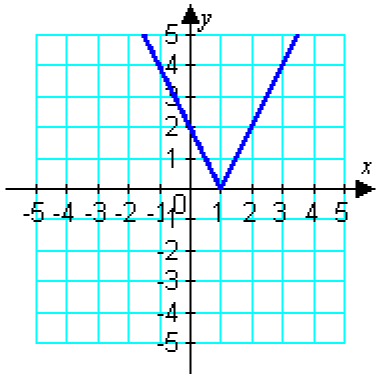
c) $\theta = 57.4°$

d) $\theta = 61.7°$

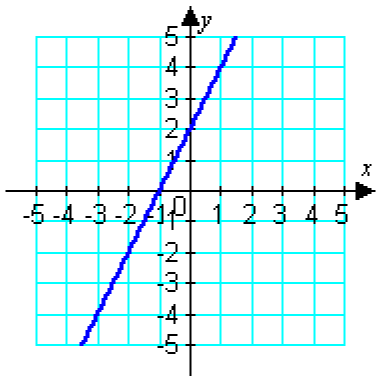
e) $\theta = 30.4°$

38. Use symmetry to sketch the graph of the given equation.
$y = -2x + 2$

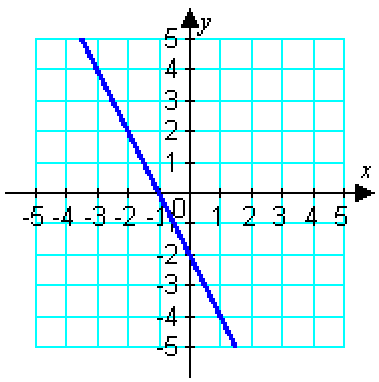
a)



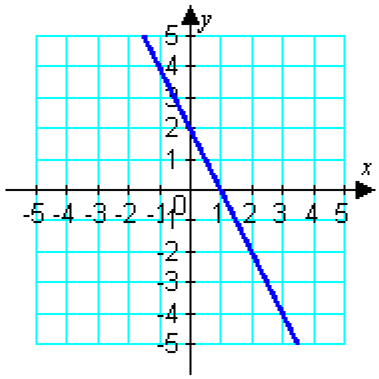
b)



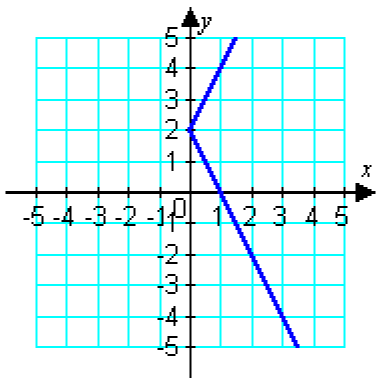
c)



d)



e)



39. Add or subtract as indicated; then use fundamental identities to simplify the expression below and determine which of the following is *not* equivalent.

$$\frac{1}{1+\csc x} - \frac{1}{1-\csc x}$$

a)
$$\frac{-2\csc x}{1-\csc^2 x}$$

b)
$$\frac{2\sin x}{\cos^2 x}$$

c)
$$\frac{2\sin x}{1+\sin^2 x}$$

d)
$$\frac{2\csc x}{\cot^2 x}$$

e)
$$\frac{2\tan x}{\cos x}$$

40. A three-inch-diameter pulley on an electric motor that runs at 3100 revolutions per minute is connected by a drive belt to a four-inch-diameter pulley that turns the mandrel on a woodworking lathe. Find the angular speed (in radians per minute) of each pulley.

a) three-inch-diameter pulley: 6200π radians per minute
four-inch-diameter pulley: 4650π radians per minute

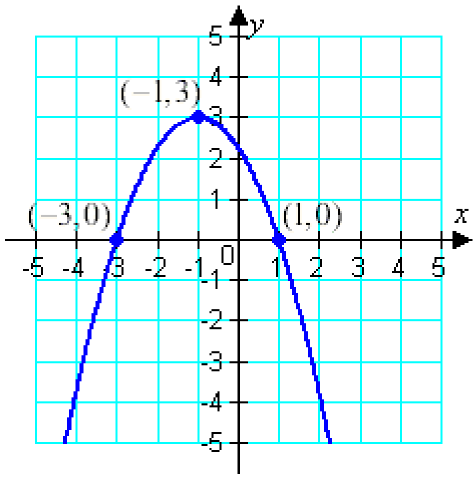
b) three-inch-diameter pulley: 6π radians per minute
four-inch-diameter pulley: 8π radians per minute

c) three-inch-diameter pulley: 6200π radians per minute
four-inch-diameter pulley: $\frac{24800\pi}{3}$ radians per minute

d) three-inch-diameter pulley: 3100π radians per minute
four-inch-diameter pulley: 2325π radians per minute

e) three-inch-diameter pulley: 3100π radians per minute
four-inch-diameter pulley: $\frac{12400\pi}{3}$ radians per minute

41. Find the standard form of the quadratic function shown below:



a) $f(x) = -(x+1)^2 + 3$

b) $f(x) = -\frac{1}{4}(x+1)^2 + 3$

c) $f(x) = -(1-x)^2 + 3$

d) $f(x) = -\frac{3}{4}(x+1)^2 + 3$

e) $f(x) = -\frac{3}{4}(x-1)^2 + 3$

42. Solve the equation $\log(1-x) = \log(1)$ for x using the One-to-One Property.

a) 101
b) –99
c) –101
d) –1
e) The equation has no solution.

43. Which of the following is *not* an identity?

a)

$$\sin\left(\frac{\pi}{2}-\theta\right)=\cos\theta$$

b)

$$\cot\left(\frac{\pi}{2}-\theta\right)=\tan\theta$$

c)

$$\sec\left(\frac{\pi}{2}-\theta\right)=\csc\theta$$

d)

$$\cos\left(\frac{\pi}{2}-\theta\right)=\cot\theta$$

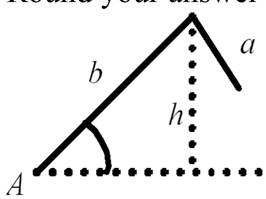
e)

$$\csc\left(\frac{\pi}{2}-\theta\right)=\sec\theta$$

44. Write $f(x) = x^5 - 6x^4 + 15x^3 - 18x^2 + 10x$ as a product of linear factors.

a) $(x-2+i)^3(x-3-i)^2$
b) $x^2(x-2-i)(x-3+i)(x-3-i)$
c) $x(x-2+i)(x-2-i)(x-3+i)(x-3-i)$
d) $x^3(x-2-i)(x-3-i)$
e) $(x-2-i)^2(x-3-i)^3$

45. Determine a value for *b* such that a triangle with $A = 50°$ and $a = 10$ has no solution. Round your answer to the nearest hundredth.

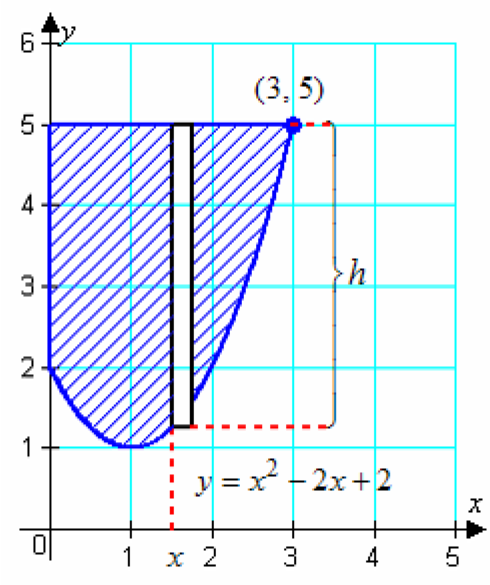


a) 0.94
b) 2.36
c) 11.32
d) 1.18
e) 4.62

46. Find all the rational zeros of the function $f(x) = x^5 - 4x^4 - 2x^3 + 14x^2 - 3x + 18$.

a) $x = -1, 1, 3, -2$
b) $x = -2, 3$
c) $x = -1, -3, 2$
d) $x = -3, -1$
e) $x = -1, 1, -3, 3, 2$

47. Write the height h of the rectangle as a function of x.



a)

$h(x) = -x^2 + 2x + 3$

b)

$h(x) = -x^2 - 2x + 7$

c)

$h(x) = x^2 + 2x - 3$

d)

$h(x) = x^2 - 2x - 5$

e)

$h(x) = -x^2 + 2x - 5$

48. Write the standard form of the equation of the parabola that has a vertex at $\left(\frac{-2}{3},\frac{1}{9}\right)$ and passes through the point $(2,-1)$.

a) $f(x)=-\frac{5}{4}\left(x+\frac{2}{3}\right)^2+\frac{1}{9}$

b) $f(x)=-\frac{5}{32}\left(x-\frac{3}{2}\right)^2+\frac{1}{9}$

c) $f(x)=-\frac{5}{32}\left(x+\frac{2}{3}\right)^2+\frac{1}{9}$

d) $f(x)=-\frac{5}{4}\left(x-\frac{2}{3}\right)^2-\frac{1}{9}$

e) $f(x)=-\frac{5}{8}\left(x-\frac{3}{2}\right)^2-\frac{1}{9}$

49. Which of the following is a solution to the given equation?

$\sec x - 2 = 0$

a)

$x = \dfrac{7\pi}{6}$

b)

$x = \dfrac{\pi}{4}$

c)

$x = \dfrac{5\pi}{6}$

d)

$x = \dfrac{5\pi}{3}$

e)

$x = \dfrac{7\pi}{4}$

50. Rewrite the logarithm $\log_6 142$ in terms of the common logarithm (base 10).

a) $\dfrac{\log 4}{\log 322}$

b) $\dfrac{\log 322}{\log 4}$

c) $\log 4 \log 322$

d) $\dfrac{\log 322}{\log_4 10}$

e) $\log 322$

51. Use a calculator to evaluate the function. Round your answers to four decimal places. (Be sure the calculator is in the correct angle mode.)

$\csc 68°4'$

a) 0.9276

b) –1.1539

c) 1.0780

d) 2.6772

e) –1.0663

52. Find the inverse function of $f(x) = \sqrt{x+6}$

a) $g(x) = x^{1/2} + 6,\ x \geq 0$

b) $g(x) = x^2 + 8,\ x \geq 0$

c) $g(x) = x^2 - 8,\ x \geq 0$

d) $g(x) = \sqrt{x-6},\ x \geq 6$

e) $g(x) = x^{1/2} - 6,\ x \geq 0$

53. Simplify $(5+i)(-3+4i)$ and write the answer in standard form.

a) $23+17i$

b) $-19-7i$

c) $-17+17i$

d) $-17-11i$

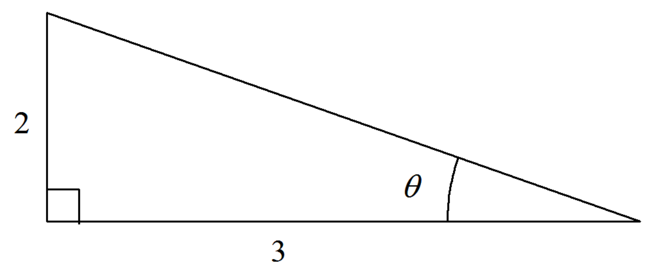
e) $-19+17i$

54. Evaluate the function $f(x) = 300(1.005)^x$ at x = 180. Round to 3 decimal places.

a) 2.454
b) 54,270.000
c) 736.228
d) 803.695
e) 303.007

55. Use the figure below to determine the exact value of the given function.

$\tan 2\theta$



a)

$\tan 2\theta = \dfrac{7}{13}$

b)

$\tan 2\theta = \dfrac{9}{13}$

c)

$\tan 2\theta = \dfrac{5}{13}$

d)

$\tan 2\theta = \dfrac{12}{13}$

e)

$\tan 2\theta = \frac{12}{5}$

____

56. Solve $\left(\frac{1}{2}\right)^x = 8$ for x.

a) 1
b) -1
c) -3
d) -4
e) no solution

57. Rewrite $\ln|\sin\theta| - \ln|\cos\theta|$ as a single logarithm and then simplify the result.

a) $\ln|\sin\theta|$
b) $\ln|\cot\theta|$
c) $\ln|\cos\theta|$
d) $\ln|\sec\theta|$
e) $\ln|\csc\theta|$

58. Given $1+i$ is a root, determine all other roots of $f(x) = x^5 - 8x^4 + 24x^3 - 32x^2 + 20x$.

a) $x = 3+i, 1-i$
b) $x = 3+i, 1-i, 0$
c) $x = 3\pm i, 1-i, 0$
d) $x = 3-i, 1-i, 0$
e) $x = 3-i, 1-i$

59. Find the exact solutions of the given equation in the interval $[0, 2\pi)$.

$\cos 2x + 3\cos x + 2 = 0$

a)

$x = 0, \frac{\pi}{3}, \frac{2\pi}{3}, \pi, \frac{4\pi}{3}$

---

b)

$x = \frac{2\pi}{3}, \pi, \frac{4\pi}{3}$

---

c)

$x = 0, \frac{\pi}{3}, \pi, \frac{5\pi}{3}$

---

d)

$x = \frac{\pi}{2}, \frac{7\pi}{6}, \frac{11\pi}{6}$

---

e) $x = 0$

60. Determine the quadrant in which the angle lies. (The angle measure is given in radians.)

$$\frac{\pi}{3}$$

a) I
b) II
c) III
d) IV
e) The angle lies on a coordinate axis.

61. Given $A = 54°$, $b = 6$, and $c = 11$, use the Law of Cosines to solve the triangle for the value of a. Round answer to two decimal places.

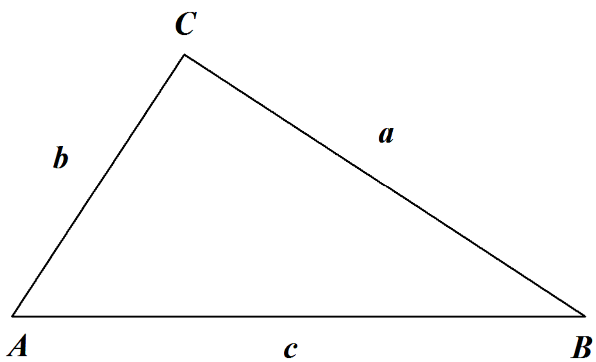
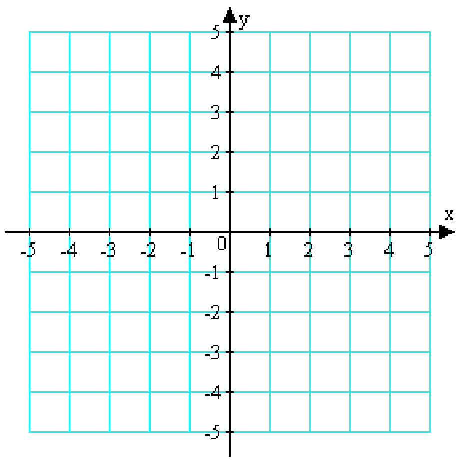


Figure not drawn to scale

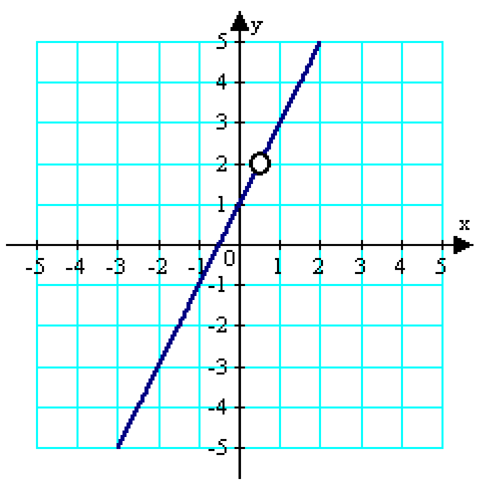
a) 16.66
b) 18.51
c) 17.12
d) 20.36
e) 17.58

62. For the function given below, determine the domain, all x-intercepts, and find any vertical and slant asymptotes. Use all of this information plus any additional solution points as needed to sketch the graph of the function on the axes provided.

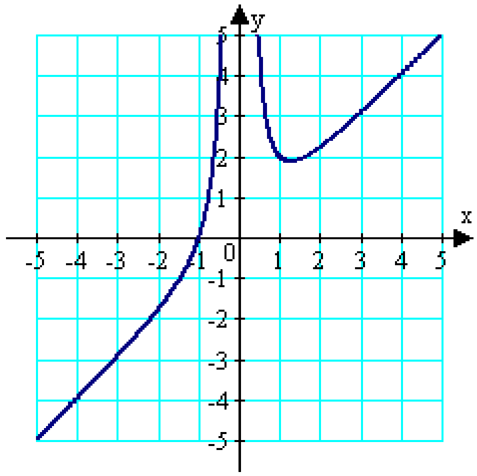
$$f(x) = \frac{x^2 - 1}{x}$$



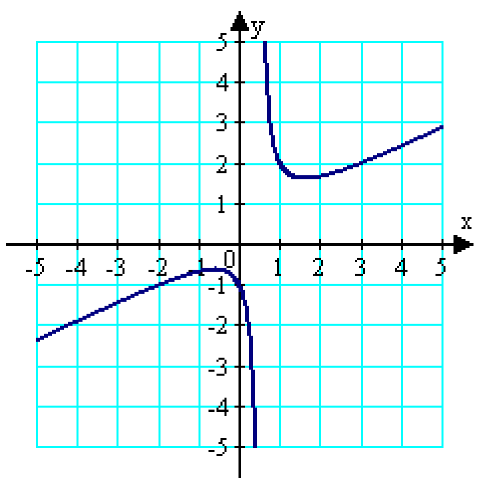
a)



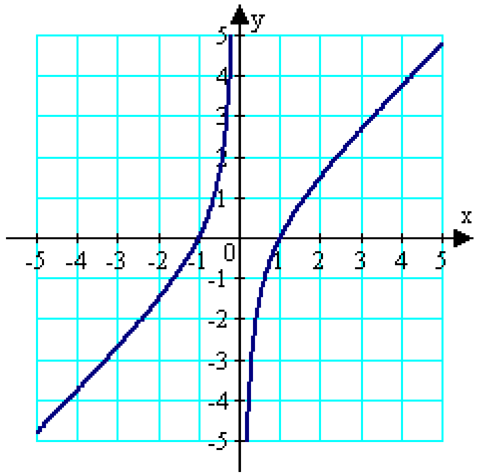
b)



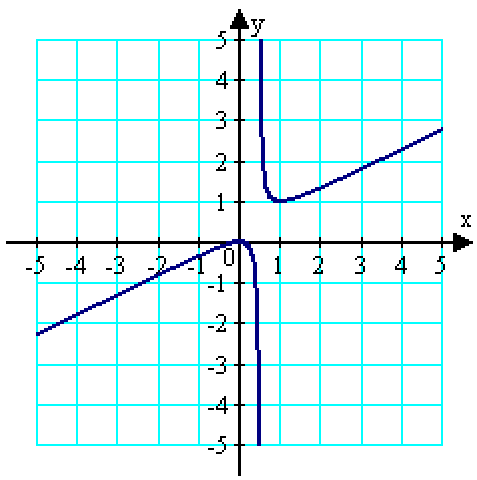
c)



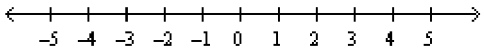
d)



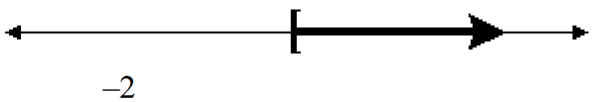
e)



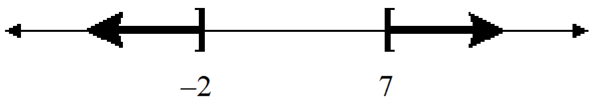
63. Graph the solution of $x^2 - 5x - 14 \ge 0$ on a number line.



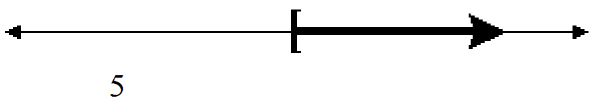
a)



b)



c)



d)

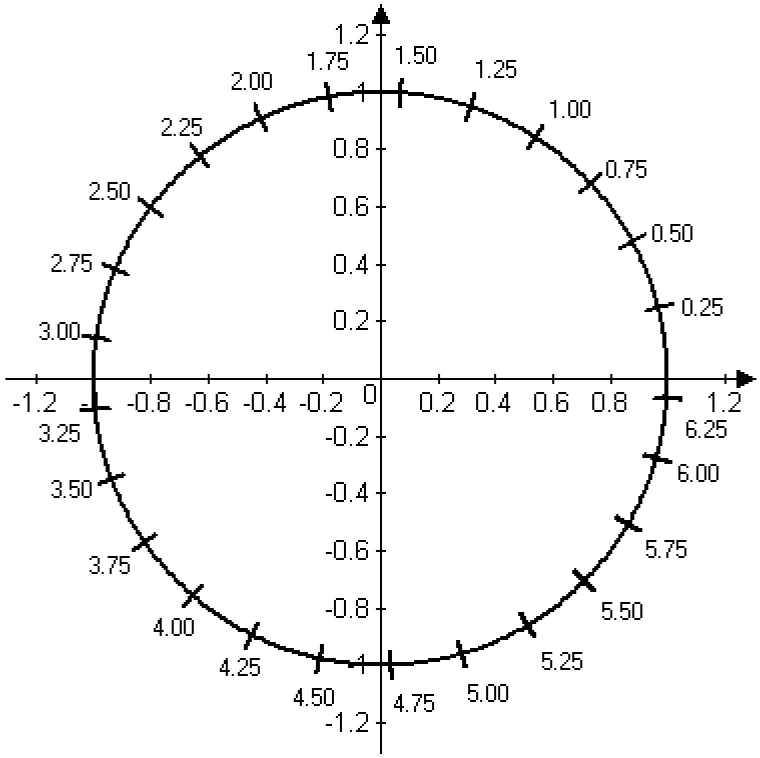
e)

64. Describe the sequence of transformations from the related common function $f(x) = \sqrt{x}$ to g.

$g(x) = -\sqrt{x} + 9$

a) reflection in the x-axis; then vertical shift 9 units down
b) reflection in the x-axis; then vertical shift 9 units up
c) reflection in the y-axis; then vertical shift 9 units up
d) reflection in the y-axis; then horizontal shift 9 units right
e) reflection in the y-axis; then horizontal shift 9 units left

65. Use the figure and a straightedge to approximate the value of $\sin 2.25$



a) 0.06
b) –0.35
c) –0.94
d) 0.37
e) –2.85

66. Evaluate the function $f(x) = -1.568 \ln x$ at $x = 28.481$. Round to 3 decimal places. (You may use your calculator.)
a) –6.125
b) 13.038
c) –13.038
d) 2.079
e) undefined

67. Find the indicated trigonometric value in the specified quadrant.

Function	*Quadrant*	*Trigonometric Value*
$\csc\theta = -\frac{4}{3}$	IV	$\sec\theta$

a) $\frac{3}{\sqrt{7}}$
b) $\frac{\sqrt{7}}{4}$
c) $\frac{4}{\sqrt{7}}$
d) $\frac{3}{4}$
e) undefined

68. Write the slope-intercept form of the equation of the line through the given point perpendicular to the given line.

point: (–5, 2) line: $2x + 8y = 1$
a) $y = -\frac{1}{2}x - \frac{1}{2}$
b) $y = -\frac{1}{4}x + \frac{3}{4}$
c) $y = 4x + 22$
d) $y = 2x - 8$
e) $y = 4x - \frac{9}{2}$

69. A jet is traveling at 590 miles per hour at a bearing of $51°$. After flying for 1.9 hours in the same direction, how far north will the plane have traveled? Round answer to nearest mile.
a) 1464 miles east
b) 998 miles east
c) 399 miles east
d) 1024 miles east
e) 931 miles east

70. Which of the following is not a solution to the inequality $\frac{x}{x} \geq ?$

a)
b)
c)
d)
e)

71. Use the cofunction identities to evaluate the expression below without the aid of a calculator.

$\sin^2 56° + \sin^2 25° + \sin^2 34° + \sin^2 65°$

a) 1
b) 2
c) -1
d) 0
e) $\frac{1}{2}$

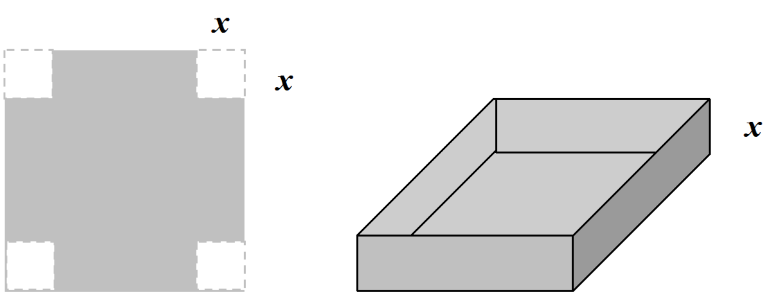
72. Find the exact value of $\tan(u+v)$ given that $\sin u = -\frac{9}{41}$ and $\cos v = \frac{15}{17}$. (Both u and v are in Quadrant IV.)

a) $\tan(u+v) = \frac{37}{767}$
b) $\tan(u+v) = \frac{2488}{2301}$
c) $\tan(u+v) = -\frac{980}{2301}$
d) $\tan(u+v) = \frac{797}{767}$
e) $\tan(u+v) = -\frac{833}{767}$

73. Determine the vertex of the graph of the quadratic function $f(x) = x^2 - 5x + \dfrac{29}{4}$.

a) $\left(\dfrac{5}{2}, \dfrac{27}{2}\right)$
b) $\left(-5, \dfrac{29}{4}\right)$
c) $\left(-\dfrac{5}{2}, \dfrac{29}{4}\right)$
d) $\left(-\dfrac{5}{4}, \dfrac{21}{4}\right)$
e) $\left(\dfrac{5}{2}, 1\right)$

74. An open box is to be made from a square piece of cardboard, 26 inches on a side, by cutting equal squares with sides of length x from the corners and turning up the sides (see figure below). Determine the function, V, in terms of x, that represents the volume of the box.



a) $V(x) = -2x^3 + 33x^2$
b) $V(x) = -4x^3 + 66x^2$
c) $V(x) = 4x^3 - 66x^2 + 33x$
d) $V(x) = -4x^3 + 66x^2 - 33x$
e) $V(x) = 4x^3 - 132x^2 + 1089x$

75. Evaluate the indicated function for $f(x) = x^2 - 2$ and $g(x) = x + 3$.

$(fg)(-1)$

a) 8
b) 40
c) 4
d) 0
e) 24

76. Use a double-angle formula to find the exact value of $\cos 2u$ when $\sin u = \frac{3}{5}$, where $\frac{\pi}{2} < u < \pi$.

a) $\cos 2u = \frac{2}{25}$
b) $\cos 2u = \frac{12}{25}$
c) $\cos 2u = \frac{24}{25}$
d) $\cos 2u = \frac{7}{25}$
e) $\cos 2u = -\frac{32}{25}$

77. Solve the following equation.

$\cos^2 x + \cos x = 0$

a)

$x = n\pi$ and $x = \dfrac{\pi}{2} + 2n\pi$, where n is an integ

b)

$x = \dfrac{\pi}{2} + n\pi$ and $x = \pi + 2n\pi$, where n is an i

c)

$x = 2n\pi$ and $x = \dfrac{3\pi}{2} + 2n\pi$, where n is an int

d)

$x = \pi + n\pi$ and $x = \dfrac{5\pi}{4} + n\pi$, where n is an in

e)

$x = \dfrac{2\pi}{3} + 2n\pi$ and $x = \dfrac{5\pi}{3} + 2n\pi$, where n is

78. Which of the following is equivalent to the expression below?

$$\frac{1+\sec\theta}{\tan\theta+\sin\theta}$$

a)

$\csc\theta$

b)

$\tan\theta$

c)

-1

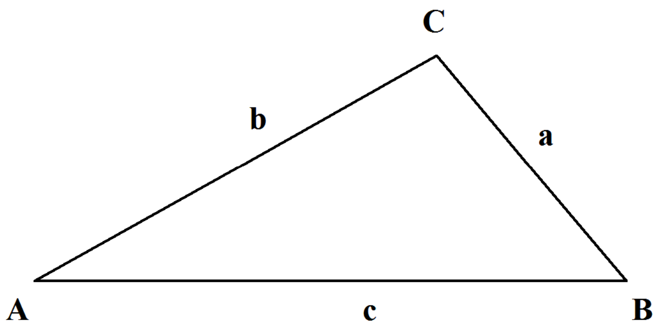
d)

$\sec\theta$

e)

$\cot\theta$

79. Given $A = 52°$, $B = 72°$, and $c = 8$, use the Law of Sines to solve the triangle for the value of a. Round answer to two decimal places.



a) $b = 6.56$
b) $b = 8.34$
c) $b = 7.67$
d) $b = 10.18$
e) $b = 6.29$

80. Find the exact value of $\sin(u+v)$ given that $\sin u = \frac{5}{13}$ and $\cos v = -\frac{4}{5}$. (Both u and v are in Quadrant II.)

a) $\sin(u+v) = -\frac{315}{1037}$
b) $\sin(u+v) = \frac{315}{1037}$
c) $\sin(u+v) = -\frac{645}{1037}$
d) $\sin(u+v) = -\frac{812}{1037}$
e) $\sin(u+v) = \frac{645}{1037}$

81. Evaluate the trigonometric function using its period as an aid.

$$\sin\left(\frac{31\pi}{6}\right)$$

a) $-\frac{1}{2}$

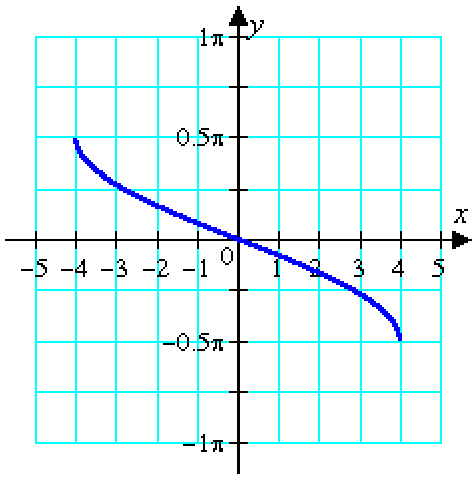
b) $\frac{1}{2}$

c) $\frac{\sqrt{3}}{2}$

d) $-\frac{\sqrt{3}}{2}$

e) $\frac{2\sqrt{3}}{3}$

82. Which of the following functions is represented by the graph below?



a)

$2\arccos(x+1)$

---

b)

$\arccos\left(\frac{x}{4}\right)-\frac{\pi}{2}$

---

c)

$\arccos\left(\frac{x+1}{2}\right)$

---

d)

$\frac{1}{2}\arcsin 2x$

---

e)

$\frac{1}{2}\arcsin\frac{x}{4}$

83. Consider the function $f(x)=\dfrac{5x^2+11x+6}{6x^2+11x+5}$. Find the function's domain and identify any horizontal and vertical asymptotes.

a) **domain:** all real numbers x except for $x=-\frac{4}{7}$; **vertical asymptote:** $x=-\frac{4}{7}$; **horizontal asymptote:** $y=\frac{4}{7}$

b) **domain:** all real numbers x except for $x=-1$ and $x=-\frac{5}{2}$; **vertical asymptotes:** $x=-1$ and $x=-\frac{5}{2}$; **horizontal asymptote:** $y=\frac{5}{2}$

c) **domain:** all real numbers x except for $x=-1$ and $x=-\frac{4}{7}$; **vertical asymptote:** $x=-\frac{4}{7}$; **horizontal asymptote:** $y=\frac{4}{7}$

d) **domain:** all real numbers x except for $x=-1$ and $x=-\frac{4}{7}$; **vertical asymptote:** $x=-\frac{4}{7}$; **horizontal asymptote:** $y=0$

e) **domain:** all real numbers x except for $x=-\frac{4}{7}$; **vertical asymptote:** $x=-\frac{4}{7}$; **horizontal asymptote:** $y=0$

84. Find the slope-intercept form of the equation of the line that passes through the given point and has the indicated slope.

point: (–5, 8) slope: $m = -5$

a) $y = 3x - 9$
b) $y = 3x + 23$
c) $y = 3x + 3$
d) $y = 3x - 4$
e) $y = 3x + 5$

85. If $\csc x = \dfrac{4\sqrt{3}}{3}$ and $\cos x < 0$, evaluate the function below.

$\sin x$

a)

$\sin x = -\dfrac{\sqrt{13}}{4}$

b)

$\sin x = -\dfrac{4\sqrt{13}}{13}$

c)

$\sin x = \dfrac{\sqrt{3}}{4}$

d)

$\sin x = -\dfrac{\sqrt{39}}{13}$

e)

$\sin x = -\dfrac{\sqrt{39}}{3}$

86. Find all solutions of the following equation in the interval $[0, 2\pi)$.

$\tan^2 x = \sec x - 1$

a)

$x = 0, \frac{3\pi}{4}, \frac{4\pi}{3}$

b)

$x = \frac{\pi}{2}, \frac{3\pi}{2}$

c)

$x = 0, \pi$

d)

$x = 0$

e)

$x = \frac{\pi}{4}, \frac{3\pi}{4}$

87. Find two solutions of the equation in the interval $[0°, 360°)$. Give your answers in degrees.

$\csc\theta = -2$

a) $\theta = 60°$ or $\theta = 240°$

b) $\theta = 30°$ or $\theta = 150°$

c) $\theta = 60°$ or $\theta = 120°$

d) $\theta = 150°$ or $\theta = 330°$

e) $\theta = 45°$ or $\theta = 225°$

88. Using half-angle formulas, find the exact value of $\cos\frac{x}{2}$ given the following constraints.

$\cos x = -\frac{4}{5}, \quad \pi < x < \frac{3\pi}{2}$

a) $\cos\frac{x}{2} = -\frac{\sqrt{10}}{10}$

b) $\cos\frac{x}{2} = \frac{3}{8}$

c) $\cos\frac{x}{2} = -\frac{\sqrt{10}}{12}$

d) $\cos\frac{x}{2} = \frac{\sqrt{5}}{10}$

e) $\cos\frac{x}{2} = -\frac{\sqrt{7}}{10}$

89. Find the exact value of $\csc\left(\arctan\dfrac{11}{60}\right)$.

a) $\dfrac{11}{60}$

b) $\dfrac{72}{11}$

c) $\dfrac{61}{11}$

d) $\dfrac{61}{72}$

e) $\dfrac{60}{11}$

90. Describe the right-hand and the left-hand behavior of the graph of $u(x) = -\dfrac{5}{12}\left(x^3 - 9x^2 + 5x + 1\right)$.

a) Because the degree is odd and the leading coefficient is positive, the graph falls to the left and falls to the right.

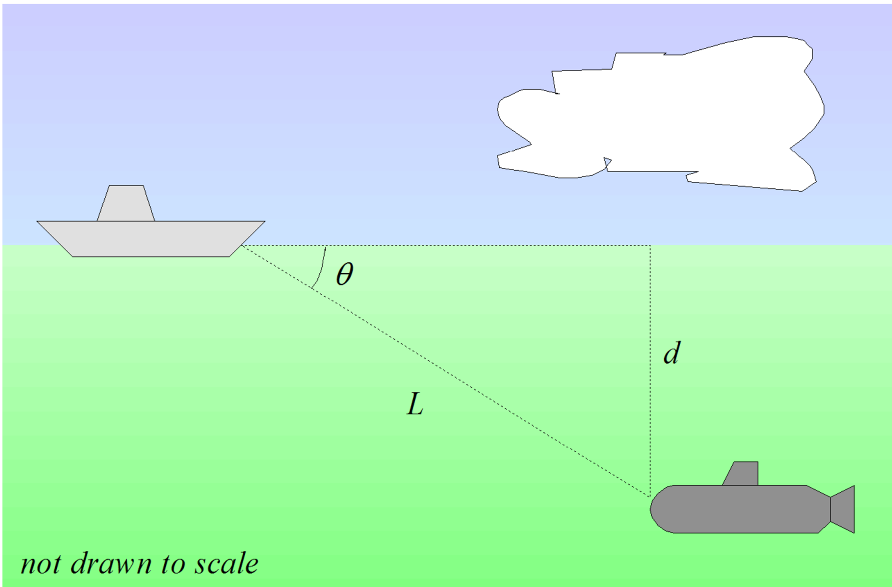
b) Because the degree is odd and the leading coefficient is negative, the graph rises to the left and falls to the right.

c) Because the degree is odd and the leading coefficient is negative, the graph falls to the left and rises to the right.

d) Because the degree is odd and the leading coefficient is positive, the graph rises to the left and rises to the right.

e) Because the degree is even and the leading coefficient is negative, the graph rises to the left and falls to the right.

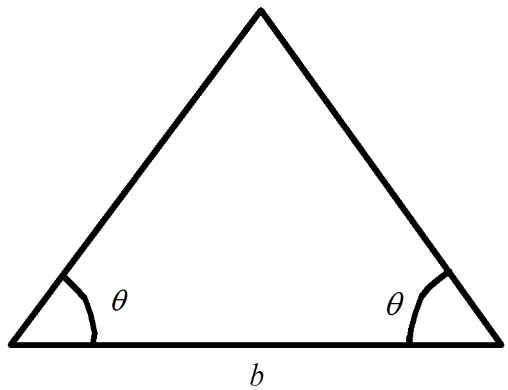
91. A submarine, cruising at a depth $d = 40$ meters, is on a trajectory that passes directly below a ship (see figure). If θ is the angle of depression from the ship to the submarine, find the distance L from the ship to the sub when $\theta = 60°$. Round to the nearest meter.



a) $L = 0$ meters
b) $L = 131$ meters
c) $L = 46$ meters
d) $L = 80$ meters
e) $L = 23$ meters

92. How long will it take an investment that pays 5% compounded annually to double in value? Round to the nearest tenth of a year.
a) 14.2 years
b) 16.4 years
c) 18.7 years
d) 20.4 years
e) 6.2 years

93. Find the altitude of the isosceles triangle shown below if $\theta = 45°$ and $b = 11$ meters. Round answer to two decimal places.



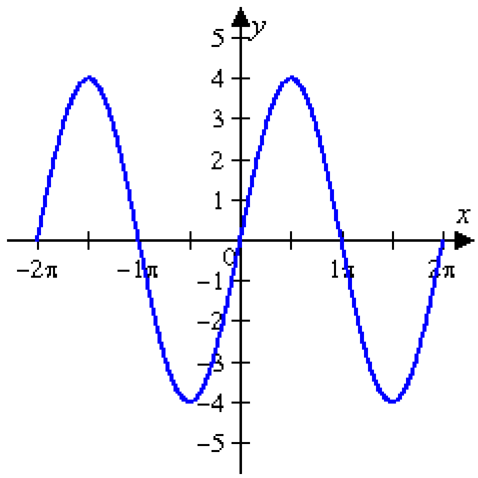
a) 6.62 meters
b) 1.56 meters
c) 2.95 meters
d) 4.90 centimeters
e) 12.76 meters

94. Given the graph of $f(x)$ below, sketch the graph of

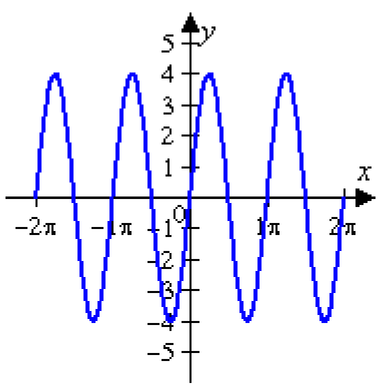
$$g(x) = 4\sin\left(2x + \frac{\pi}{2}\right)$$

without the use of a graphing utility.

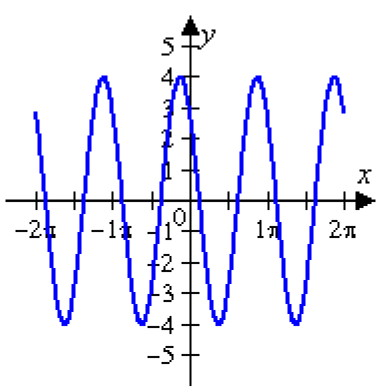
$$f(x) = 4\sin x$$



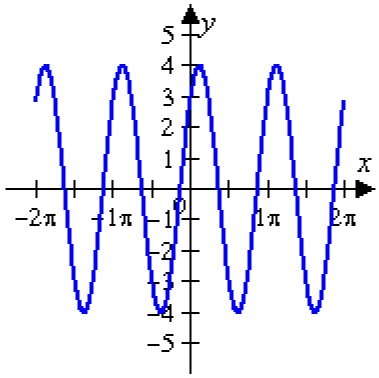
a)



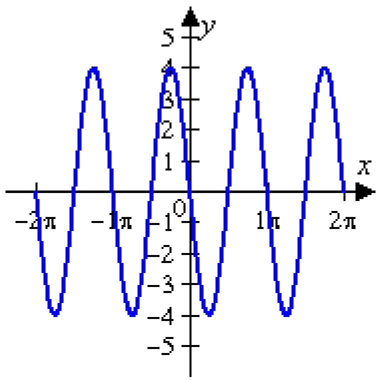
b)



c)


y
x
5
4
3
2
1
0
−1
−2
−3
−4
−5
−2π
−1π
1π
2π

d)


y
x
5
4
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1
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−1
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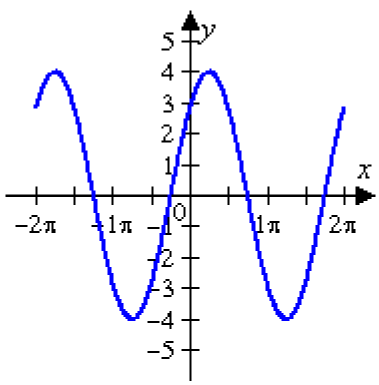
−3
−4
−5
−2π
−1π
1π
2π

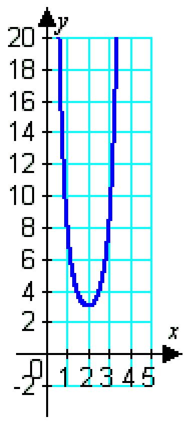
e)


y
x
5
4
3
2
1
0
−1
−2
−3
−4
−5
−2π
−1π
1π
2π

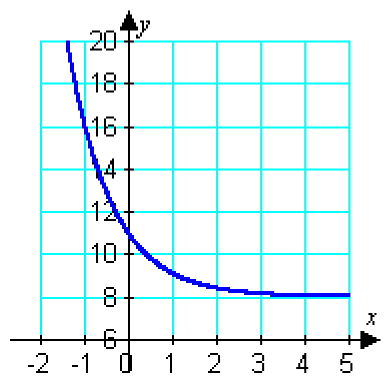
95. Identify the graph that represents the function.

$y = 3e^{-(x+2)^2}$

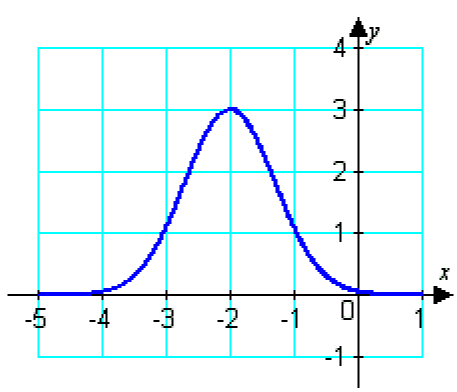
a)



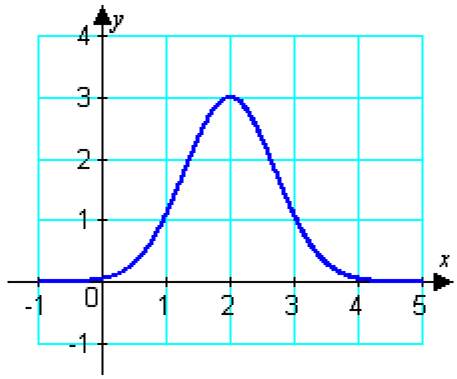
b)



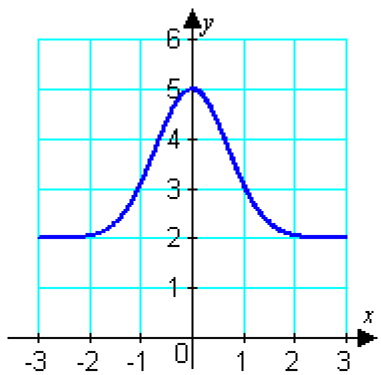
c)



d)



e)



96. Determine whether or not $x = \frac{3}{7}$ is a solution to $3^{3x-3} = 81$.

a) yes
b) no

97. Does the table describe a function?

Input value	2001	2002	2003	2004	2005
Output value	70	100	70	90	80

a) yes
b) no

98. Evaluate $\cos^{-1}\left(-\frac{\sqrt{3}}{2}\right)$ without using a calculator.

a) $-\frac{\pi}{6}$
b) $-\frac{2\pi}{3}$
c) $\frac{3\pi}{4}$
d) $-\frac{\pi}{3}$
e) $-\frac{5\pi}{6}$

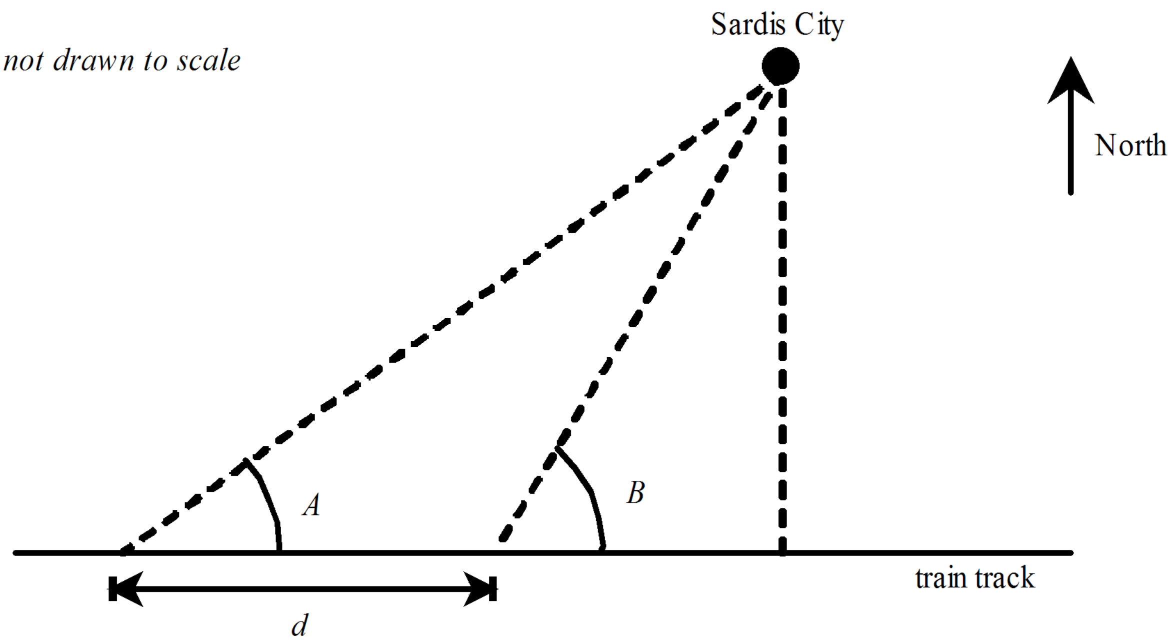
99. Find the indicated trigonometric value in the specified quadrant.

Function	*Quadrant*	*Trigonometric Value*
$\sin\theta = \frac{2}{5}$	II	$\cos\theta$

a) $\frac{\sqrt{7}}{4}$
b) $-\frac{2}{3}$
c) $-\frac{2\sqrt{6}}{5}$
d) $-\frac{2\sqrt{6}}{7}$
e) undefined

100. Downtown Sardis City is located due north of a straight segment of train track oriented in an east-west direction (see map below). A passenger on a train that is traveling from west to east notes that downtown Sardis City is visible at an angle $A = 47^{\circ}$ to the left of the tracks. After traveling a distance $d = 10$ kilometers, the passenger notes that the angle to Sardis city is $B = 53.5^{\circ}$. Estimate the distance from the track to downtown Sardis City. Round to the nearest kilometer.

not drawn to scale



a) 35 km
b) 33 km
c) 36 km
d) 37 km
e) 38 km

101. Given that $\cos\theta = \frac{5}{6}$, find $\csc\theta$.

[Hint: Sketch a right triangle corresponding to the trigonometric function of the acute angle θ, then use the Pythagorean Theorem to determine the third side.]

a) $\frac{\sqrt{7}}{4}$
b) $\frac{4}{3}$
c) $\frac{5}{\sqrt{11}}$
d) $24\sqrt{11}$
e) $\frac{4}{\sqrt{7}}$

102. Find the midpoint of the line segment joining the points.

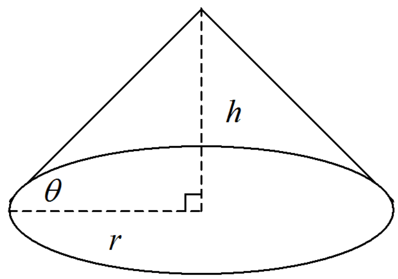
(3, –5), (–7, 3)
a) (2, 1)
b) (–1, –2)
c) (–4, 5)
d) (5, –4)
e) (–2, –1)

103. Given that $\sin\theta = \frac{3}{4}$, find $\sec\theta$.

[Hint: Sketch a right triangle corresponding to the trigonometric function of the acute angle θ, then use the Pythagorean Theorem to determine the third side.]

a) $\frac{\sqrt{7}}{4}$
b) $\frac{4}{3}$
c) $\frac{5}{\sqrt{11}}$
d) $24\sqrt{11}$
e) $\frac{4}{\sqrt{7}}$

104. A granular substance such as sand naturally settles into a cone-shaped pile when poured from a small aperature. Its height depends on the humidity and adhesion between granules. The angle of elevation of a pile, θ, is called the angle of repose. If the height of a pile of sand is 15 feet and its diameter is approximately 50 feet, determine the angle of repose. Round answer to nearest degree.



a) $32°$
b) $33°$
c) $34°$
d) $35°$
e) $36°$

105. Find real numbers *a* and *b* such that the equation $a + bi = 16 + 7i$ is true.
a) $a = 4,\ b = 12$
b) $a = -4,\ b = 12$
c) $a = 4,\ b = -12$
d) $a = -2,\ b = 2$
e) $a = -9,\ b = 7$

106. Factor; then use fundamental identities to simplify the expression below and determine which of the following is *not* equivalent.

$$\csc^3 x - \csc^2 x - \csc x + 1$$

a)

$$\csc x \cot^2 x - \cot^2 x$$

b)

$$\cos^2 x\left(\frac{1 - \sin x}{\sin^3 x}\right)$$

c)

$$\frac{\cos^4 x}{\sin^3 x + \sin^4 x}$$

d)

$$\frac{1 - \sin x - \sin^2 x + \sin^3 x}{\sin^3 x}$$

e)

$$\frac{\sec^2 x + \tan^2 x}{\csc x}$$

107. Find all real values of x such that $f(x) = 0$.

$f(x) = 9x^2 - 25$

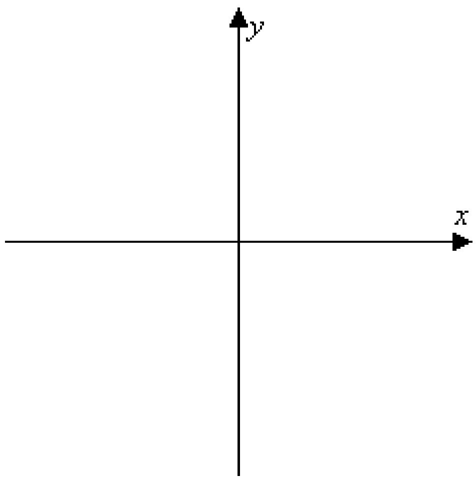
a) $\pm\frac{5}{3}$
b) $\pm\frac{3}{5}$
c) $\pm\frac{9}{25}$
d) $-\frac{9}{25}$
e) $\frac{3}{5}$

108. Simplify the rational expression, $\frac{x^4 - 2x^3 - 19x^2 + 68x - 60}{x^2 - 4x + 4}$, by using long division or synthetic division.

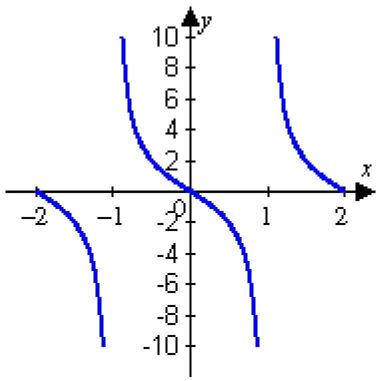
a) $x^2 + 2x - 15$
b) $-x^2 + 8x - 15$
c) $x^2 - 8x + 9$
d) $-x^2 + 10x + 9$
e) $x^2 + 3x - 10$

109. Sketch the graph of the given function. Make sure to include at least two periods.

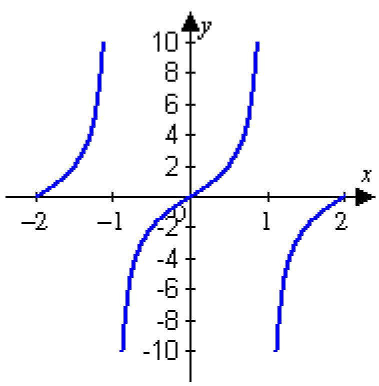
$$y = 2\tan\frac{\pi x}{2}$$



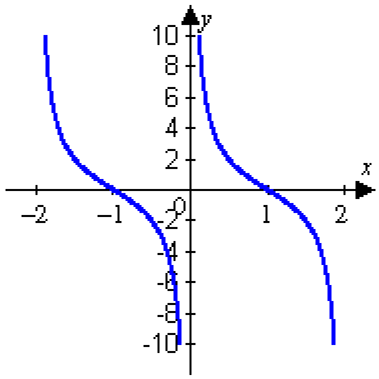
a)



b)



c)


y
10
8
6
4
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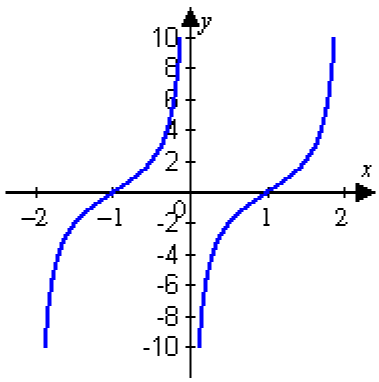
x
−2
−1
0
1
2
-2
-4
-6
-8
-10

d)


y
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x
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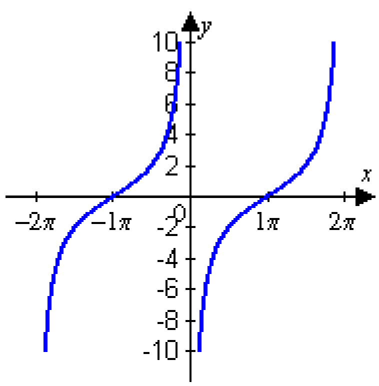
0
1
2
-2
-4
-6
-8
-10

e)


y
10
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4
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0
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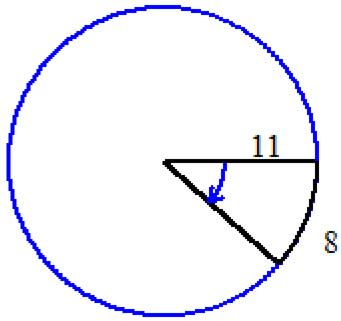
2π
-2
-4
-6
-8
-10

110. Find the angle in radians.



a) $-\frac{8}{11}$

b) $\frac{8}{11}$

c) $-\frac{11}{8}$

d) $\frac{11}{8}$

e) $-\frac{\pi}{4}$

111. Use the quadratic formula to solve $x^2 - 6x + 4 = 0$.

a) $x = -9 \pm \sqrt{13}$

b) $x = -4 \pm \sqrt{13}$

c) $x = 9 \pm \sqrt{13}$

d) $x = 4 \pm \sqrt{13}$

e) $x = -88 \pm \sqrt{13}$

112. Given $a = 5$, $b = 9$, and $c = 13$, use the Law of Cosines to solve the triangle for the value of C. Round answer to two decimal places.

a) 60.33°
b) 57.79°
c) 80.44°
d) 89.63°
e) 32.58°

113. Using a graphing utility, graph each side of the equation to determine whether the equation is an identity.

$$\frac{\csc\theta}{1+\csc\theta} - \frac{\csc\theta}{1-\csc\theta} = 2\sec^2\theta$$

a) identity
b) not an identity

114. The height, $h(x)$, of a punted rugby ball is given by $h(x) = -\frac{1}{64}x^2 + \frac{7}{16}x + 3$ where x is the horizontal distance in feet from the point where the ball is punted. How far, horizontally, is the ball from the kicker when it is at its highest point?

a) 10 feet
b) 15 feet
c) 22 feet
d) 13 feet
e) 20 feet

115. Given $a = 7$, $b = 14$, and $c = 8$, use the Law of Cosines to solve the triangle for the value of A. Round answer to two decimal places.

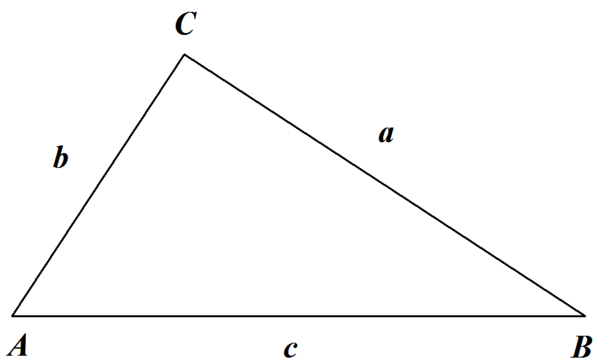


Figure not drawn to scale

a) 60.33°
b) 24.62°
c) 80.44°
d) 88.96°
e) 66.42°

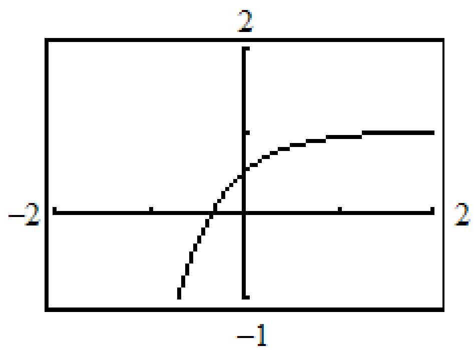
116. Two lifeguards, Tony and Sharon, are 18 kilometers apart and Tony is directly due south of Sharon on the beach. A stranded boat offshore is spotted by both lifeguards, and the bearings from Tony and Sharon, respectively, are $\mathrm{N}\ 30°\mathrm{E}$ and $\mathrm{S}\ 11°\mathrm{E}$. Determine the distance the stranded boat is from the beach. Round answer to nearest tenth of a kilometer.
a) 0.7 kilometer
b) 1.7 kilometers
c) 2.9 kilometers
d) 3.6 kilometers
e) 4.6 kilometers

117. Solve for x: $4^{-x/2} = 0.0052$. Round to 3 decimal places.
a) 7.587
b) 10.518
c) 13.291
d) –13.291
e) –3.794

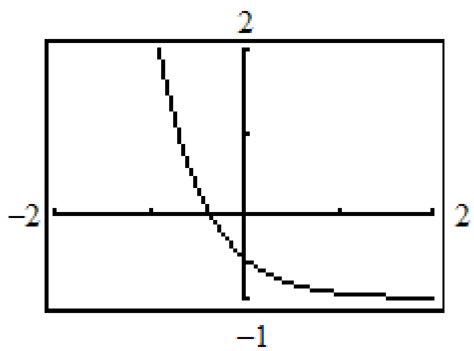
118. Use a graphing utility to determine which graph below is the graph of the function.

$g(x) = 0.5e^{-2x}$

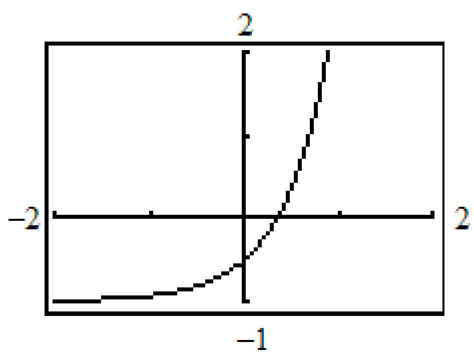
a)



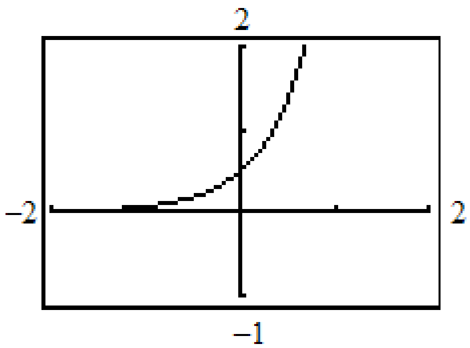
b)



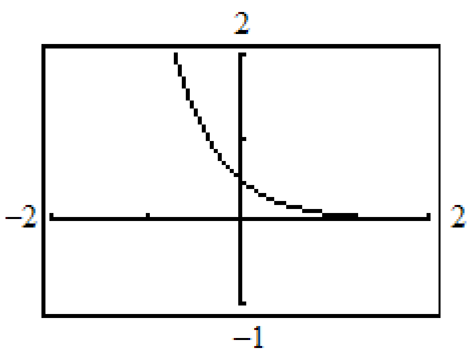
c)



d)



e)



119. Write $f(x) = x^4 - 10x^3 + 47x^2 - 118x + 130$ as a product of linear factors.

a) $(x-3-i)(x-2+3i)(x-2-3i)(x-2+i)$

b) $(x-3-i)(x-3+i)(x-2-i)(x-2+i)$

c) $(x-3-i)(x-3+i)(x-2-3i)(x-2+i)$

d) $(x-3+i)(x-3-i)(x+3+2i)(x+3-2i)$

e) $(x-3+i)(x-3-i)(x+2+3i)(x+2-3i)$

120. Find the constant of proportionality for the following situation:
"y is jointly proportional to x and w^4."
$w = 3$, $x = -7$, and $y = 6$

a) $k = -$

b) $k = -$

c) $k = -$

d) $k = -$

e) $k = -$

121. Assume that y is directly proportional to x. If $x = 12$ and $y = 9$, determine a linear model that relates y and x.

a) $y = \frac{4}{3}x$

b) $y = \frac{3}{5}x$

c) $y = \frac{3}{2}x$

d) $y = \frac{3}{4}x$

e) $y = \frac{2}{3}x$

122. Given $-2i$ is a root, determine all other roots of $f(x) = x^3 + 4x^2 + 4x + 16$.

a) $x = \pm 4, 2i$
b) $x = -2, \pm 4i$
c) $x = -4, \pm 2$
d) $x = -4, 2i$
e) $x = \pm 4, 2$

123. Given $C = 128°$, $a = 13.9$, and $c = 9.3$, use the Law of Sines to solve the triangle (if possible) for the value of b. If two solutions exist, find both. Round answer to two decimal places.

a) $b = 4.78$
b) $b = 2.34$ and 6.66
c) $b = 8.03$
d) $b = 1.41$ and 6.79
e) not possible

124. Solve the multiple-angle equation in the interval $[0, 2\pi)$.

$$\cos 2x = \frac{1}{2}$$

a)

$$x = \frac{\pi}{3}, \frac{2\pi}{3}, \frac{4\pi}{3}, \frac{5\pi}{3}$$

---

b)

$$x = \frac{\pi}{8}, \frac{7\pi}{8}, \frac{9\pi}{8}, \frac{15\pi}{8}$$

---

c)

$$x = \frac{\pi}{6}, \frac{5\pi}{6}, \frac{7\pi}{6}, \frac{11\pi}{6}$$

---

d)

$$x = \frac{\pi}{12}, \frac{5\pi}{12}, \frac{7\pi}{12}, \frac{11\pi}{12}$$

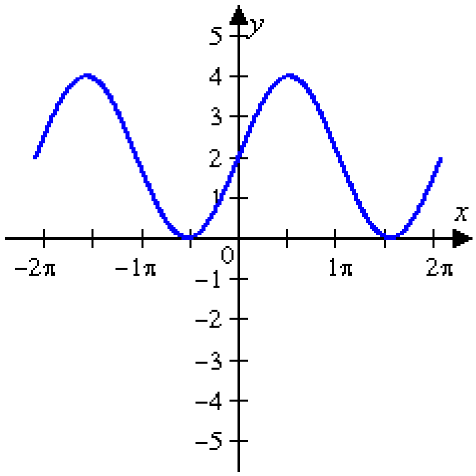
---

e)

$$x = \frac{\pi}{4}, \frac{3\pi}{4}, \frac{5\pi}{4}, \frac{7\pi}{4}$$

---

125. Find a and d for the function $f(x) = a\sin x + d$ such that the graph of $f(x)$ matches the graph below.



a)
$a = 4;\ d = 1$

b)
$a = 2;\ d = 2$

c)
$a = -2;\ d = 1$

d)
$a = 2;\ d = -1$

e)
$a = 4;\ d = -3$

126. Hooke's law states that the magnitude of force, F, required to stretch a spring x units beyond its natural length is directly proportional to x. If a force of 3 pounds stretches a spring from its natural length of 8 inches to a length of 8.7 inches, what force will stretch the spring to a length of 9.5 inches? Round answer to nearest hundredth.

a) $F = 5.52$
b) $F = 5.70$
c) $F = 6.14$
d) $F = 6.43$
e) $F = 7.29$

127. Factor; then use fundamental identities to simplify the expression below and determine which of the following is *not* equivalent.

$$\cot^2\alpha\cos^2\alpha - \cot^2\alpha$$

a)

$-\cos^2\alpha$

b)

$\sin^2\alpha - 1$

c)

$\sin^2\alpha - \cos^2\alpha$

d)

$-\dfrac{1}{\sec^2\alpha}$

e)

$-\dfrac{1}{\tan^2\alpha + 1}$

128. Use the product-to-sum formula to write the given product as a sum or difference.

$$12\sin\frac{\pi}{10}\sin\frac{\pi}{10}$$

a) $6\sin\frac{\pi}{12}$

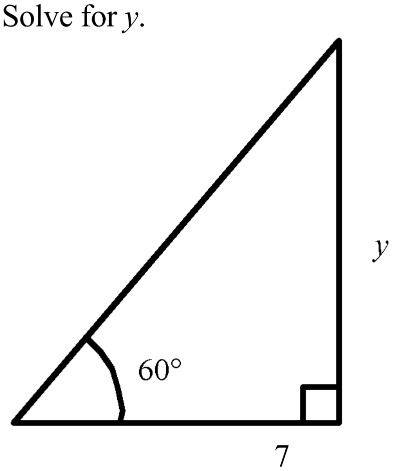
b) $6-6\cos\frac{\pi}{4}$

c) $6+6\cos\frac{\pi}{16}$

d) $-6\sin\frac{\pi}{12}$

e) $6\sin\frac{\pi}{10}+6\cos\frac{\pi}{10}$

129. Solve for y.



a) $y=17\sqrt{3}$

b) $y=\frac{17\sqrt{2}}{3}$

c) $y=\frac{\sqrt{3}}{17}$

d) $y=\frac{17}{\sqrt{3}}$

e) $y=17\sqrt{2}$

130. An initial investment of $1000 doubles in value in 10.7 years. Assuming continuous compounding, what was the interest rate? Round to the nearest tenth of a percent.

a) %
b) %
c) %
d) %
e) 100%

131. Solve the multiple-angle equation.

$$\tan\frac{x}{2} = \frac{\sqrt{3}}{3}$$

a)

$x = \dfrac{5\pi}{6} + n\pi$ and $\dfrac{7\pi}{6} + n\pi$, where n is an inte

b)

$x = \dfrac{2\pi}{3} + n\pi$, where n is an integer

c)

$x = \dfrac{7\pi}{6} + n\pi$ and $\dfrac{11\pi}{6} + n\pi$, where n is an int

d)

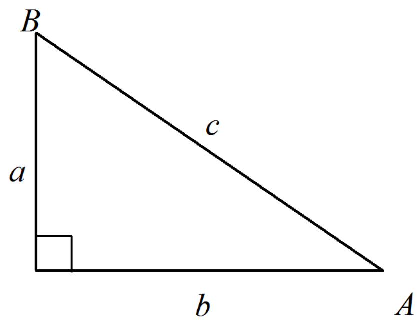
$x = \dfrac{5\pi}{3} + n\pi$, where n is an integer

e)

$x = \dfrac{\pi}{3} + 2n\pi$, where n is an integer

132. Convert the given angle measure from radians to degrees. Round to three decimal places.
4.95
a) 0.086°
b) 283.614°
c) 567.228°
d) 141.807°
e) 11.575°

133. If $B = 39°$ and $a = 11$, determine the value of b. Round to two decimal places.



a) 14.00
b) 7.55
c) 11.75
d) 10.73
e) 6.89

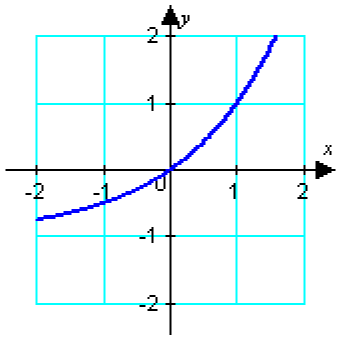
134. Given points (–8, –6), (0, 2). Find a third point so that the three points form the vertices of an isosceles triangle.
a) (–2, –5)
b) (–5, –3)
c) (–3, –1)
d) (–4, –2)
e) (–3, –3)

135. Evaluate the logarithm $\log_{1/3} 1.975$ using the change of base formula. Round to 3 decimal places.
a) 0.681
b) –0.748
c) –1.614
d) –0.619
e) 0.296

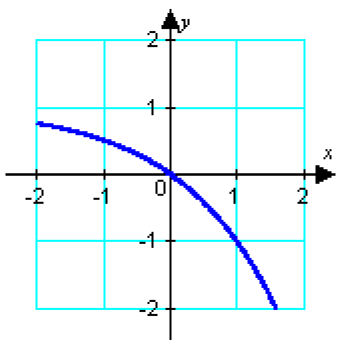
136. Identify the graph of the function.

$f(x) = 1 - 2^x$

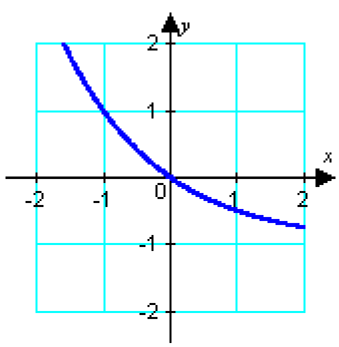
a)



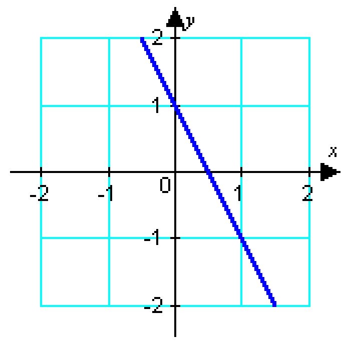
b)



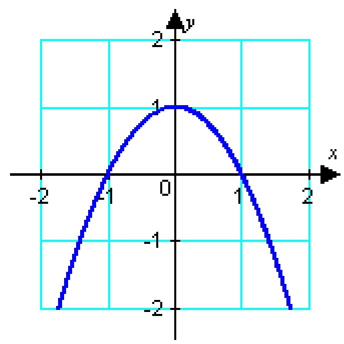
c)



d)



e)



137. Find all solutions of the following equation in the interval $[0, 2\pi)$.

$$\cot x - \tan x = 0$$

a)

$$x = \frac{\pi}{4}, \frac{3\pi}{4}, \frac{5\pi}{4}, \frac{7\pi}{4}$$

b)

$$x = \frac{\pi}{6}, \frac{5\pi}{6}, \frac{7\pi}{6}, \frac{11\pi}{6}$$

c)

$$x = \frac{\pi}{3}, \frac{2\pi}{3}, \frac{4\pi}{3}, \frac{5\pi}{3}$$

d)

$$x = 0, \frac{\pi}{2}, \pi, \frac{3\pi}{2}$$

e)

$$x = \frac{\pi}{3}, \frac{3\pi}{4}, \frac{3\pi}{2}, \frac{7\pi}{6}$$

138. Find the zeros (if any) of the rational function $f(x) = \dfrac{49x^2 - 9}{7x - 3}$.

a) $x = -\dfrac{1}{10}$

b) $x = -\dfrac{5}{8}$

c) $x = -\dfrac{7}{10}$ and $x = \dfrac{7}{10}$

d) $x = \dfrac{100}{49}$

e) There are no zeros.

139. If $x = 7\cos\theta$, use trigonometric substitution to write $\sqrt{49 - x^2}$ as a trigonometric function of θ, where $0 < \theta < \pi$.

a) $2\cos\theta$

b) $2\csc\theta$

c) $2\cot\theta$

d) $2\sec\theta$

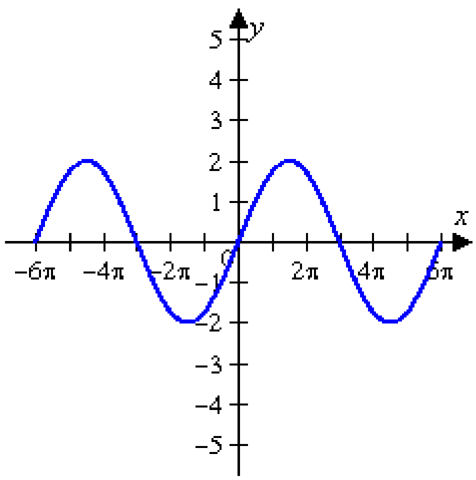
e) $2\sin\theta$

140. Given the graph of *f*(*x*) below, sketch the graph of

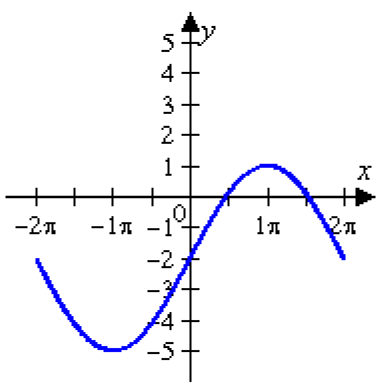
$$g(x) = 2\sin\frac{x}{3} - 2$$

without the use of a graphing utility.

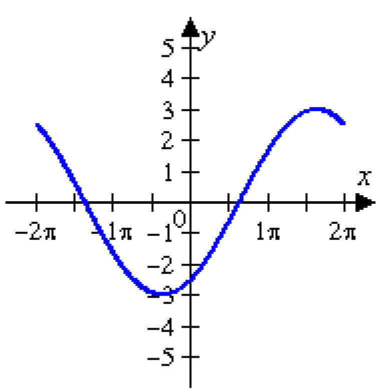
$$f(x) = 2\sin\frac{x}{3}$$



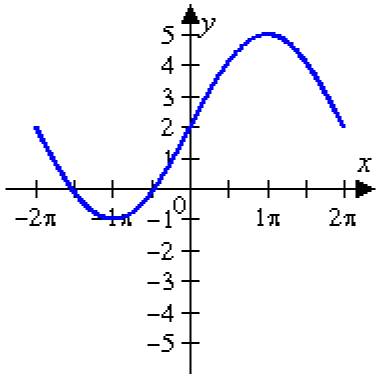
a)



b)



c)


y
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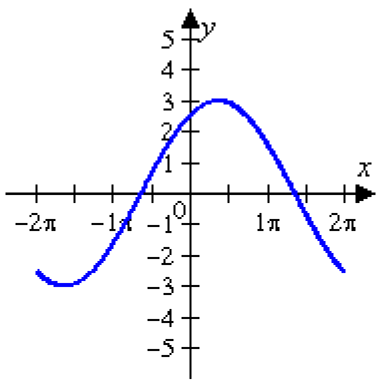
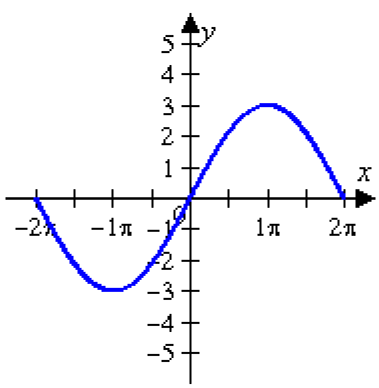
−3
−4
−5
−2π
−1π
1π
2π

d)


y
x
5
4
3
2
1
0
−1
−2
−3
−4
−5
−2π
−1π
1π
2π

e)


y
x
5
4
3
2
1
0
−1
−2
−3
−4
−5
−2π
−1π
1π
2π

141. Evaluate the trigonometric function using its period as an aid.

$\sin\left(-\frac{11\pi}{3}\right)$

a) $-\frac{\sqrt{3}}{2}$
b) $\frac{\sqrt{3}}{2}$
c) $\frac{1}{2}$
d) $-\frac{1}{2}$
e) $\frac{2\sqrt{3}}{3}$

142. A biologist studying the habits of African wildebeests discovers that the number of animals visiting a watering hole per hour can be modeled by

$N(t) = 23 + 3\cos\left(\frac{\pi t}{12}\right) + 17\cos\left(\frac{\pi t}{6}\right)$,

where $N(t)$ is the number of animals per hour and t is the time in hours after midnight (12:00 A.M. corresponds to $t = 0$). Estimate the number of wildebeests that visit the watering hole during the 11:00 P.M. hour. Round to the nearest integer. [Note that 11 P.M. corresponds to t = 23.]

a) 41 wildebeests
b) 9 wildebeests
c) 18 wildebeests
d) 42 wildebeests
e) 14 wildebeests

143. Simplify $\dfrac{8-5i}{7i}$ and write the answer in standard form.

a) $\dfrac{1}{4}+\dfrac{3i}{4}$

b) $-\dfrac{3}{7}+\dfrac{i}{7}$

c) $-\dfrac{1}{4}-\dfrac{3i}{4}$

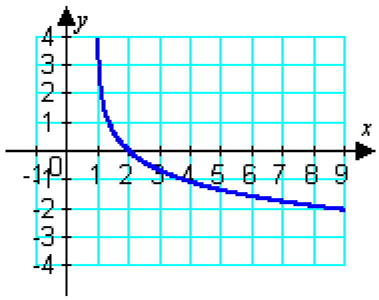
d) $-\dfrac{3}{4}-\dfrac{i}{4}$

e) $\dfrac{3}{4}-\dfrac{i}{4}$

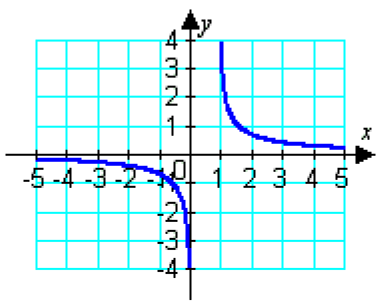
144. Identify the graph that represents the function.

$$y = \ln \frac{1}{x+1}$$

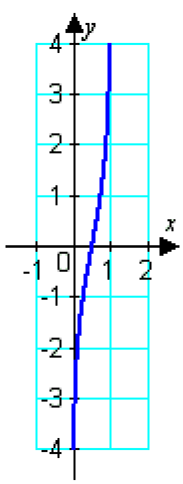
a)



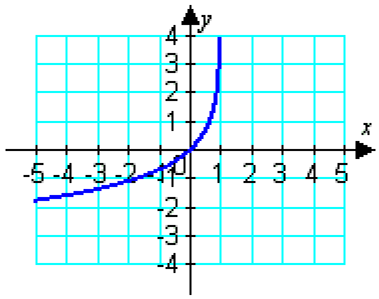
b)



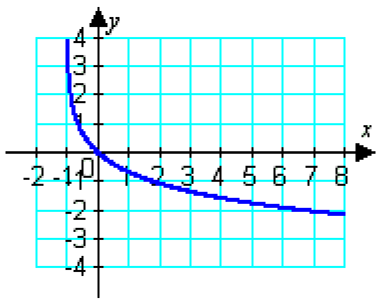
c)



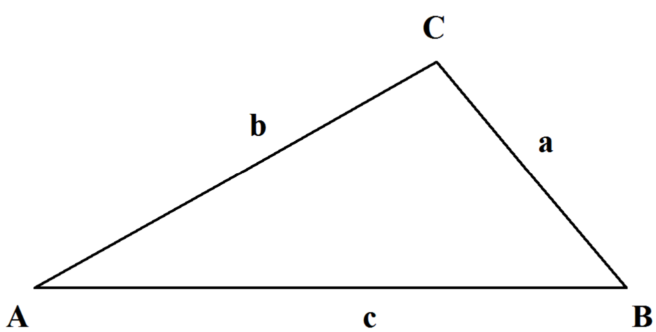
d)



e)



145. Given $A = 50°$, $B = 79°$, and $a = 5.1$, use the Law of Sines to solve the triangle for the value of b. Round answer to two decimal places.

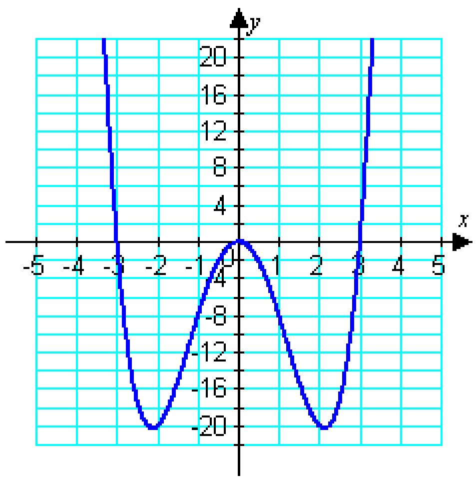


a) $b = 6.15$
b) $b = 6.85$
c) $b = 7.36$
d) $b = 7.90$
e) $b = 6.38$

146. Convert the given angle measure from degrees to radians. Round to three decimal places.
$303.5°$

a) 5.297
b) 5.821
c) 17389.269
d) 2.649
e) 10.594

147. Find the x- and y-intercepts of the graph of the equation $y = x^4 - 9x^2$.



a) x-intercepts: $(0,-9)$, $(0,9)$; y-intercept: $(0,0)$
b) x-intercepts: $(-9,0)$, $(0,0)$, $(9,0)$; y-intercept: $(0,0)$
c) x-intercepts: $(-9,0)$, $(9,0)$; y-intercept: $(0,0)$
d) x-intercepts: $(-9,0)$, $(0,0)$, $(9,0)$; y-intercepts: none
e) x-intercepts: $(0,-9)$, $(0,0)$, $(0,9)$; y-intercept: $(0,0)$

148. Use synthetic division to divide.
$\left(4x^3 + 18x^2 + 20x + 6\right) \div (x+3)$

a) $4x^2 + 7x + 3$
b) $4x^2 + 6x + 2$
c) $4x^2 + 5x + 6$
d) $4x^2 + 14x + 8$
e) $4x^2 + 6x + 4$

149. Find all solutions of the given equation in the interval $[0, 2\pi)$.

$$\sin\frac{x}{2} + \cos x = 0$$

a)

$x = \frac{\pi}{3}, \pi, \frac{5\pi}{3}$

b)

$x = \frac{\pi}{3}, \frac{5\pi}{3}$

c)

$x = \pi$

d)

$x = \pi, \frac{5\pi}{3}$

e)

$x = \frac{\pi}{3}, \pi$

150. Write an algebraic expression that is equivalent to $\tan\left(\arccos 3x\right)$.

a) $\dfrac{1}{7x}$

b) $\dfrac{\sqrt{1-25x^2}}{5x}$

c) $\sqrt{1-49x^2}$

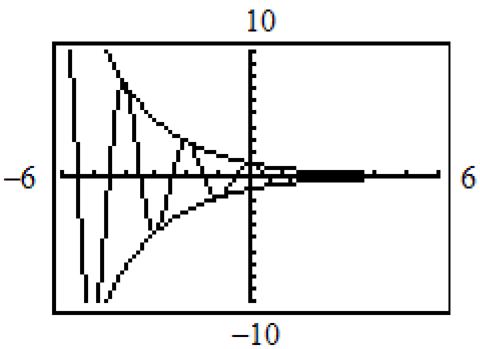
d) $\dfrac{1}{\sqrt{1-36x^2}}$

e) $5x$

151. Use a graphing utility to graph the damping factor and the function in the same viewing window. Describe the behavior of the function as x increases without bound.

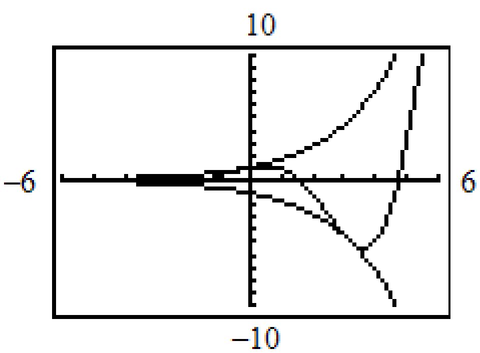
$f(x) = e^{-x^2/3} \cos x$

a)



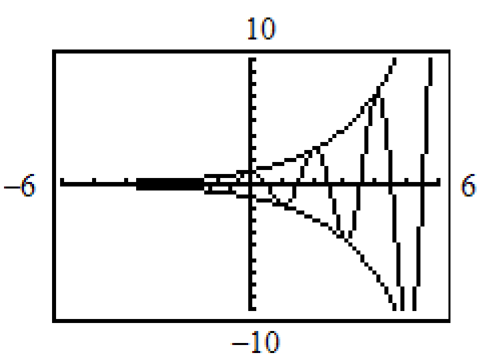
As $x \to \infty$, $f(x) \to 0$.

b)



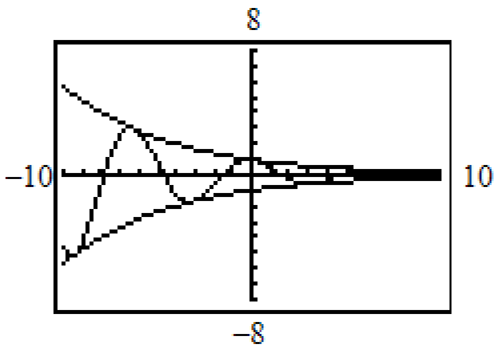
The function $f(x)$ is unbounded as $x \to \infty$.

c)



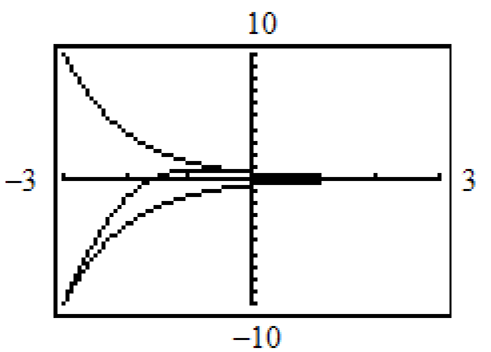
The function $f(x)$ is unbounded as $x \to \infty$.

d)



As $x \to \infty$, $f(x) \to 0$.

e)



As $x \to \infty$, $f(x) \to 0$.

163. Use synthetic division to divide.

$$\frac{-5x^3 - 37x^2 - 74x - 24}{x + \frac{2}{5}}$$

a) $-5x^2 + 35x + 60$

b) $-5x^2 - 39x - 60$

c) $5x^2 - 35x - 60$

d) $5x^2 + 39x + 60$

e) $-5x^2 - 35x - 60$

153. Find the exact value of the given expression.

$$\sin\left(\frac{4\pi}{3}-\frac{7\pi}{4}\right)$$

a) $\dfrac{-\sqrt{3}-1}{2\sqrt{2}}$

b) $\dfrac{\sqrt{3}-1}{2\sqrt{2}}$

c) $\dfrac{-\sqrt{3}+1}{2\sqrt{2}}$

d) $\dfrac{\sqrt{3}+1}{2\sqrt{2}}$

154. To find the distance between two points, A and B, that lie on opposite sides of the Potomac River, a surveyor lays off a line segment, AC, of length 110 yards along the same bank as point A. He determines that the measure of the angle at A is $63°30'$ and the measure of the angle at C is $59°16'$. Determine the distance from point A to point B. Round answer to two decimal places.

a) $AB = 125.00$ yards
b) $AB = 112.55$ yards
c) $AB = 107.51$ yards
d) $AB = 110.47$ yards
e) $AB = 96.80$ yards

155. Determine whether lines L_1 and L_2 passing through the pairs of points are parallel, perpendicular, or neither.

L_1 : (–8, –1), (–9, 5)
L_2 : (–6, 6), (–5, 0)

a) parallel
b) perpendicular
c) neither

156. Find the distance between the points. Round to the nearest hundredth, if necessary.

(3, 3), (4, –2)

a) 2
b) 14
c) 14.14
d) 2.83
e) 11.4

157. The population P of a bacteria culture is modeled by $P = 3100e^{kt}$, where t is the time in hours. If the population of the culture was 5800 after 40 hours, how long does it take for the population to double? Round to the nearest tenth of an hour.

a) 42.8 hours
b) 41.0 hours
c) 46.1 hours
d) 44.3 hours
e) 6.7 hours

158. Use a double-angle formula to find the exact value of $\tan 2u$ when $\cos u = -\frac{15}{17}$, where $\pi < u < \frac{3\pi}{2}$.

a) $\tan 2u = -\frac{5}{6}$
b) $\tan 2u = -\frac{40}{9}$
c) $\tan 2u = \frac{24}{7}$
d) $\tan 2u = \frac{30}{7}$
e) $\tan 2u = \frac{5}{12}$

159. While traveling across the flat terrain of Nevada, you notice a mountain directly in front of you. You calculate that the angle of elevation to the peak is $4°$, and after you drive 6 miles closer to the mountain it is $7°$. Approximate the height of the mountain peak above your position. Round your answer to the nearest foot.

a) 12000 feet
b) 12695 feet
c) 13234 feet
d) 14016 feet
e) 15690 feet

160. The angle of elevation of the sun is $26°$. Find the length, *l*, of a shadow cast by a tree that is 50 feet tall. Round answer to two decimal places.

a) $l = 84.57$ feet
b) $l = 73.97$ feet
c) $l = 46.88$ feet
d) $l = (\mathrm{dd}\,3)$ feet
e) $l = (\mathrm{dd}\,4)$ feet

161. Determine the *x*-intercept(s) of the quadratic function $f(x) = x^2 + 6x + 10$.

a) $(-7,0),(-4,0)$
b) $(-2,0),(2,0)$
c) $(0,0),(-5,0)$
d) $(-7,0),(-5,0)$
e) no *x*-intercept(s)

162. Find all real solutions of the polynomial equation $x^4 - 8x^3 + 56x - 49 = 0$.

a) $x = 1,\ 7, \pm\sqrt{7}$
b) $x = 1,\ 49$
c) $x = 1,\ -8, -7$
d) $x = 1, -49, 14$
e) $x = 1, \pm\sqrt{7}$

163. Use synthetic division to divide.

$$\frac{-5x^3 - 37x^2 - 74x - 24}{x + \frac{2}{5}}$$

a) $-5x^2 + 35x + 60$
b) $-5x^2 - 39x - 60$
c) $5x^2 - 35x - 60$
d) $5x^2 + 39x + 60$
e) $-5x^2 - 35x - 60$

164. Consider the function $f(x) = \frac{3x+7}{9x^2 - 49}$. Find the function's domain and identify any horizontal and vertical asymptotes.

a) **domain:** all real numbers x except for $x = -\frac{8}{9}$ and $x = \frac{8}{9}$; **vertical asymptote:** $x = -\frac{8}{9}$; **horizontal asymptote:** $y = 0$

b) **domain:** all real numbers x except for $x = \frac{1}{3}$; **vertical asymptote:** $x = \frac{1}{3}$; **horizontal asymptote:** $y = 0$

c) **domain:** all real numbers x except for $x = \frac{1}{3}$; **vertical asymptotes:** $x = \frac{1}{3}$ and $x = -\frac{1}{3}$; **horizontal asymptote:** none

d) **domain:** all real numbers x except for $x = \frac{1}{3}$ and $x = -\frac{1}{3}$; **vertical asymptotes:** $x = \frac{1}{3}$ and $x = -\frac{1}{3}$; **horizontal asymptote:** $y = 0$

e) **domain:** all real numbers x except for $x = \frac{3}{5}$ and $x = -\frac{3}{5}$; **vertical asymptote:** $x = \frac{3}{5}$; **horizontal asymptote:** none

165. Find all the real zeros of $f(x) = -2x^3 - 3x^2 - 2x - 3$.

a) $x = -\frac{8}{3}, \frac{3}{8}$
b) $x = -3, 1, -8$
c) $x = \pm 1, -\frac{8}{3}$
d) $x = -\frac{8}{3}$
e) $x = -\frac{1}{6}, -\frac{1}{4}$

166. Use the functions given by $f(x) = \frac{x}{8} - 2$ and $g(x) = x^3$ to find the indicated value.

$(f \circ g)^{-1}(5)$
a) $2\sqrt[3]{3}$
b) $2\sqrt[3]{7}$
c) $2\sqrt[3]{5} + 2$
d) $-\frac{3971}{512}$
e) undefined

167. The chemical acidity of a solution is measured in units of pH: $\text{pH} = -\log[\text{H}^+]$, where $[\text{H}^+]$ is the hydrogen ion concentration in the solution. What is $[\text{H}^+]$ if the $\text{pH} = 5.8$?
a) 1.58×10^{-4}
b) 6.31×10^{-4}
c) 6.31×10^{-3}
d) 1.58×10^{-3}
e) 3.800

168. Use a graphing utility to graph the function and find the zeroes of the function.

$f(x) = 7 - \dfrac{2}{x}$

a) $x = \dfrac{2}{7}$

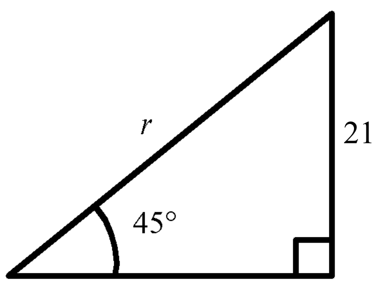
b) $x = \dfrac{7}{2}$

c) $x = -\dfrac{2}{7}$

d) $x = -\dfrac{7}{2}$

e) no real zeroes

169. Solve for *r*.



a) $r = \dfrac{21\sqrt{3}}{2}$

b) $r = \dfrac{21\sqrt{2}}{2}$

c) $r = \dfrac{21}{\sqrt{3}}$

d) $r = \dfrac{\sqrt{3}}{42}$

e) $r = 21\sqrt{2}$

170. Solve: $x^2 - 2x - 48 < 0$

a) $(-\infty, -2)$

b) $(-2, \infty)$

c) $(-3, 7)$

d) $(-\infty, 6)$

e) $(6, \infty)$

171. Find the slope and y-intercept of the equation of the line.

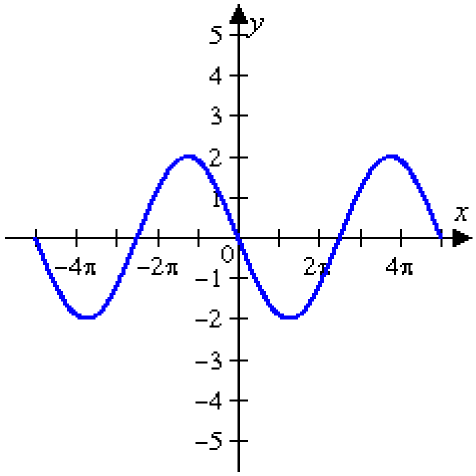
$y = -4x + 5$

a) slope: $-\frac{1}{8}$; y-intercept: –7
b) slope: $-\frac{1}{7}$; y-intercept: –8
c) slope: –8; y-intercept: –7
d) slope: –7; y-intercept: –8
e) slope: –8; y-intercept: 7

172. Find the exact value of $\ln e^{2.50} - \ln \sqrt{e}$ without using a calculator.
a) 0.75
b) 3
c) 1
d) 2
e) 1.5

173. Determine the period and amplitude of the following function.

$$y = 2\cos\left(\frac{2x}{5} + \frac{\pi}{2}\right)$$



a)

period : 2π; amplitude : 2

b)

period : 10π; amplitude : 2

c)

period : 5π; amplitude : 4

d)

period : $\frac{8\pi}{3}$; amplitude : 4

e)

period : 3π; amplitude : 4

174. Determine the center and radius of the circle represented by the equation
$\left(x+\frac{1}{6}\right)^2+\left(y+\frac{1}{3}\right)^2=\frac{1}{36}$.

a) center: $\left(-\frac{1}{3},-\frac{1}{6}\right)$; radius: $\frac{1}{6}$
b) center: $\left(\frac{1}{6},\frac{1}{3}\right)$; radius: $\frac{1}{36}$
c) center: $\left(\frac{1}{6},\frac{1}{3}\right)$; radius: $-\frac{1}{36}$
d) center: $\left(-\frac{1}{6},-\frac{1}{3}\right)$; radius: $\frac{1}{6}$
e) center: $\left(\frac{1}{3},\frac{1}{6}\right)$; radius: $-\frac{1}{6}$

175. Use the function value and constraint below to evaluate the given trigonometric function.

Function Value	*Constraint*	*Evaluate*:
$\tan\theta=8$	$\cos\theta>0$	$\csc\theta$

a) $\frac{1}{\sqrt{82}}$
b) –9
c) $\frac{\sqrt{26}}{5}$
d) 9
e) undefined

176. If $x=7\sin\theta$, use trigonometric substitution to write $\sqrt{49-x^2}$ as a trigonometric function of θ, where $-\frac{\pi}{2}<\theta<\frac{\pi}{2}$.

a) $9\csc\theta$
b) $9\sec\theta$
c) $9\tan\theta$
d) $9\sin\theta$
e) $9\cos\theta$

177. Does the table describe a function?

Input value	1	5	8	5	1
Output value	–14	–9	0	9	14

a) yes
b) no

178. Describe the sequence of transformations from the related common function $f(x) = x^3$ to g.

$g(x) = 5(x-2)^3$

a) horizontal shift 5 units right; then vertical stretch by a factor of 5
b) horizontal shift 5 units left; then vertical stretch by a factor of 5
c) horizontal shift 5 units left; then vertical shrink by a factor of 5
d) vertical shift 5 units up; then vertical shrink by a factor of 5
e) vertical shift 5 units down; then vertical shrink by a factor of 5

179. Carbon dating presumes that, as long as a plant or animal is alive, the proportion of its carbon that is ^{14}C is constant. The amount of ^{14}C in an object made from harvested plants, like paper, will decline exponentially according to the equation $A = A_o e^{-0.0001213t}$, where A represents the amount of ^{14}C in the object, A_o represents the amount of ^{14}C in living organisms, and t is the time in years since the plant was harvested. If an archeological artifact has 30% as much ^{14}C as a living organism, how old would you predict it to be? Round to the nearest year.

a) 30,411 years
b) 5715 years
c) 7554 years
d) 16,006 years
e) 87 years

180. A communications company erects a 87-foot tall cellular telephone tower on level ground. Determine the angle of depression, θ (in degrees), from the top of the tower to a point 53 feet from the base of the tower. Round answer to two decimal places.

a) 44.39°
b) 52.89°
c) 61.39°
d) 32.43°
e) 57.43°

181. Use inverse functions where needed to find all solutions (if they exist) of the given equation on the interval $[0, 2\pi)$.

$2\cos^2 x - \cos x - 1 = 0$

a)

$x = \frac{\pi}{3}, \pi, \frac{5\pi}{3}$

b)

$x = \frac{\pi}{2}, \frac{3\pi}{4}, \frac{3\pi}{2}, \frac{7\pi}{4}$

c)

$x = 0, \frac{\pi}{3}, \frac{2\pi}{3}$

d)

$x = 0, \frac{2\pi}{3}, \frac{4\pi}{3}$

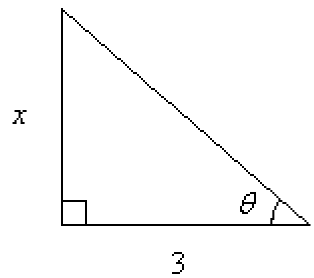
e) solution does not exist

182. Find the reference angle θ' for the given angle θ.

$\theta = -352°$

a) –262°
b) 442°
c) –342°
d) –352°
e) –362°

183. Use an inverse function to write θ as a function of x.



a)

$$\theta = \arctan \frac{\sqrt{x^2+9}}{3}$$

---

b)

$$\theta = \arctan \frac{3\pi}{x}$$

---

c)

$$\theta = \arctan \frac{x}{3}$$

---

d)

$$\theta = \arctan \frac{3}{\sqrt{x^2+9}}$$

---

e)

$\theta = \arctan \dfrac{3}{x}$

---

184. The rate of change of the function

$f(x) = -\csc x - \sin x$

is given by the expression

$\csc x \cot x - \cos x$.

Which of the following is its simplification?

a)

$-\csc x \sec^2 x$

---

b)

$\tan^2 x \cos x$

---

c)

$\cot^2 x \cos x$

---

d)

$-\cot x \cos^2 x$

---

e)

$\sec^2 x$

---

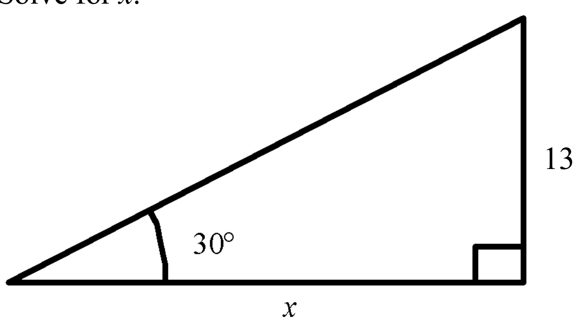
185. Find all real zeros of the polynomial $f(x) = x^4 - 41x^2 + 400$ and determine the mutiplicity of each.

a) $x = 4$, multiplicity 2; $x = 9$, multiplicity 2
b) $x = 2$, multiplicity 2; $x = -3$, multiplicity 2
c) $x = 4$, multiplicity 2; $x = -3$, multiplicity 1
d) $x = -2$, multiplicity 2; $x = 3$, multiplicity 2
e) $x = 2$, multiplicity 1; $x = -2$, multiplicity 1; $x = -3$, multiplicity 1; $x = 3$, multiplicity 1

186. Consider the function $f(x) = \dfrac{8x^3 - 5x^2 + 3x - 9}{x^2 - 5x + 3}$. Identify any slant asymptotes.

a) $y = 8$
b) $y = 8x$
c) $y = 8x + 3$
d) $y = 8x - 45$
e) $y = 8x + 35$

187. Solve for x.



a) $x = \dfrac{39}{\sqrt{3}}$
b) $x = \dfrac{13\sqrt{2}}{3}$
c) $x = \dfrac{13}{\sqrt{3}}$
d) $x = 13\sqrt{3}$
e) $x = 13\sqrt{2}$

188. Find the value(s) of x for which $f(x) = g(x)$.

$f(x) = x^2 + 7x - 7$ $g(x) = 6x - 1$

a) $12, 26, \frac{5}{6}$

b) $12, -14, \frac{5}{6}$

c) $1, 7$

d) $-1, -7$

e) $2, \frac{5}{6}$

189. Determine a value for b such that a triangle with $A = 60°$ and $a = 9$ has two solutions.

a) $b = 2$

b) $b = 13$

c) $b = 5$

d) $b = 8$

e) $b = 14$

190. Evaluate the cosine of the angle without using a calculator.

$150°$

a) $-\frac{\sqrt{2}}{2}$

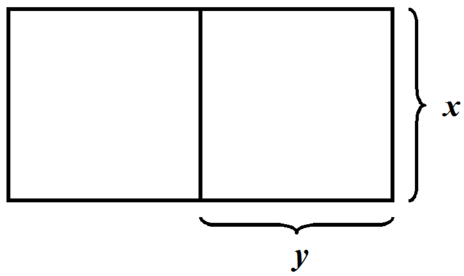
b) $\frac{\sqrt{2}}{2}$

c) $-\frac{\sqrt{3}}{2}$

d) $-\frac{1}{2}$

e) 0

191. A farmer has 288 feet of fencing and wants to build two identical pens for his prize-winning pigs. The pens will be arranged as shown. Determine the dimensions of a pen that will maximize its area.



a) $27' \times 36'$
b) $45' \times 120'$
c) $21' \times 52'$
d) $13' \times 224'$
e) $10' \times 120'$

192. Given $a = 10$, $b = 9$, and $c = 15$, use the Law of Cosines to solve the triangle for the value of A. Round answer to two decimal places.
a) 50.75°
b) 29.53°
c) 99.72°
d) 80.44°
e) 60.33°

193. Given $a = 4$, $b = 10$, and $c = 11$, use the Law of Cosines to solve the triangle for the value of C. Round answer to two decimal places.

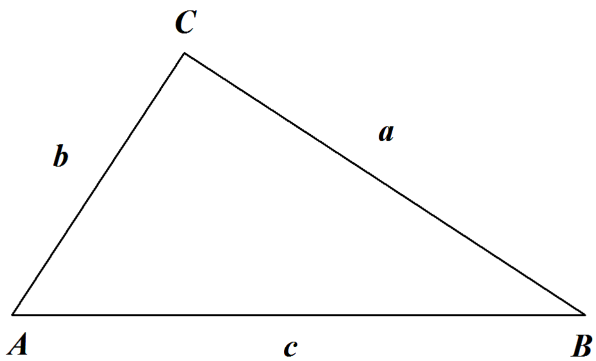


Figure not drawn to scale

a) 60.33°
b) 22.09°
c) 80.44°
d) 102.07°
e) 55.84°

194. State the quadrant in which θ lies.
$\sin(\theta) < 0$ and $\cos(\theta) < 0$
a) Quadrant IV
b) Quadrant II
c) Quadrant III
d) Quadrant I
e) Quadrant I or Quadrant III

195. You have \$6000 to invest in two accounts with simple interest rates of 5% and 4% per year, respectively. A model for the total interest I after the first year is

$$I = 0.05x + 0.04(6000 - x)$$

where x is the number of dollars invested in the account with an interest rate of 5%.

Find the inverse function, and determine the amount of money invested in the account with an interest rate of 5% when the total interest for the first year is \$276.
a) Inverse $x = 25I + 3075$, amount invested \$1000
b) Inverse $x = 100I - 24,000$, amount invested \$3600
c) Inverse $x = -20I + 1360$, amount invested \$1600
d) Inverse $x = -20I - 1360$, amount invested \$400
e) Inverse $x = -0.09I - 68$, amount invested \$1700

196. After leaving the runway, a plane's angle of ascent is $18°$ and its speed is 272 feet per second. How many minutes will it take for the airplane to climb to a height of 14,000 feet? Round answer to two decimal places.

a) 0.82 minutes
b) 2.67 minutes
c) 1.10 minutes
d) 1.53 minutes
e) 2.10 minutes

197. Find all solutions of the given equation in the interval $[0, 2\pi)$.

$\cos x = \cos 3x$

a)

$x = 0, \frac{\pi}{8}, \frac{\pi}{4}, \frac{3\pi}{8}, \frac{\pi}{2}, \frac{5\pi}{8},$

b)

$x = \frac{\pi}{8}, \frac{3\pi}{8}, \frac{5\pi}{8}, \frac{7\pi}{8}, \frac{9\pi}{8},$

c)

$x = 0, \frac{\pi}{8}, \frac{\pi}{4}, \frac{3\pi}{8}, \frac{\pi}{2}, \frac{5\pi}{8},$

d)

$x = 0, \frac{\pi}{2}, \pi, \frac{3\pi}{2}$

e)

$x = \frac{\pi}{8}, \frac{\pi}{4}, \frac{3\pi}{8}, \frac{\pi}{2}, \frac{13\pi}{8},$

198. Use long division to divide.

$\left(x^3+4x^2+36x+144\right)\div\left(x+4\right)$

a) x^2+24

b) $x^2+8x+26-\dfrac{122}{x+4}$

c) $x^2+8x+68+\dfrac{160}{x+4}$

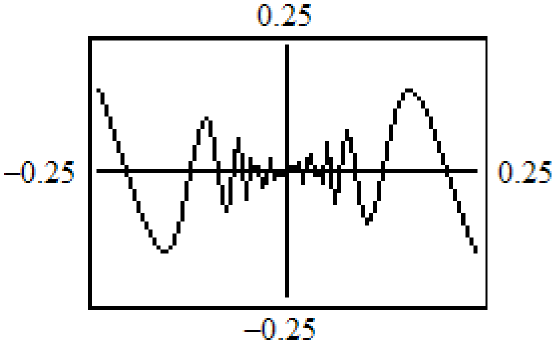
d) $x^2+8x+26$

e) x^2+36

199. Use a graphing utility to graph the function. Describe the behavior of the function as x approaches 0.

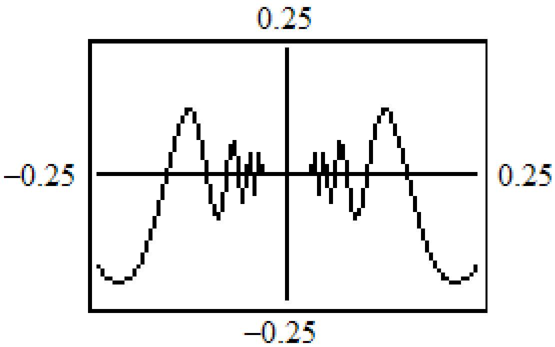
$f(x) = \frac{3}{x} + \cos 2x, x > 0$

a)



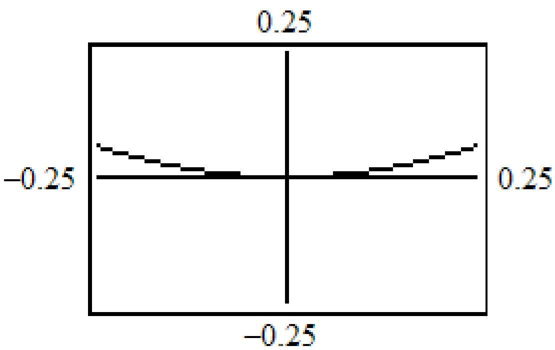
As $x \to 0, f(x) \to 0.$

b)



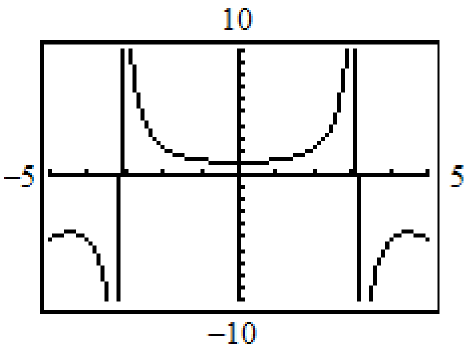
As $x \to 0, f(x) \to 0.$

c)



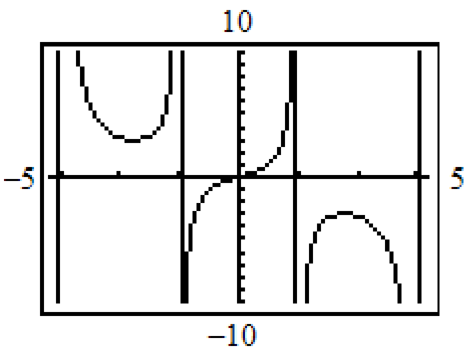
As $x \to 0, f(x) \to 0.$

d)



As $x \to 0, f(x) \to 1.$

e)



As $x \to 0, f(x) \to 0.$

200. What is the value of the function $f(x) = e^{x}$ at $x =$? Round to 3 decimal places.

a)
b)
c)
d)
e)

201. In the figure below, $a = 6$, $b = 10$, and $\theta = 44°$. Use this information to solve the parallelogram for *c*. The diagonals of the parallelogram are represented by *c* and *d*. Round answer to two decimal places.

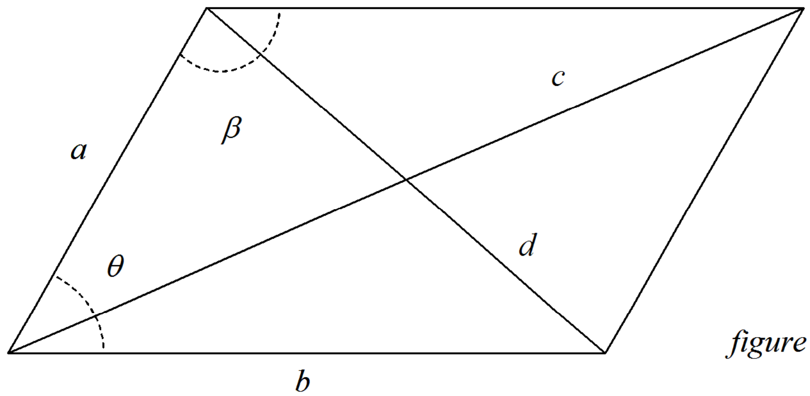


figure not drawn to scale

a) 8.62
b) 11.88
c) 10.25
d) 5.37
e) 9.03

202. The terminal side of θ lies on the given line in the specified quadrant. Find the value of the given trigonometric function of θ by finding a point on the line.

Line Quadrant Evaluate:

$y = 14x$ III $\cos\theta$

a) $-\sqrt{122}$

b) $-\dfrac{1}{5\sqrt{2}}$

c) $-\dfrac{1}{11}$

d) $\dfrac{15}{\sqrt{226}}$

e) $\dfrac{14}{\sqrt{197}}$

203. Use the given function values and the trigonometric identities (including the cofunction identities), to find the indicated trigonometric function.

$\csc\theta = \dfrac{\sqrt{113}}{7}, \cos\theta = \dfrac{8\sqrt{113}}{113}$; find $\csc(90° - \theta)$

a) $\dfrac{5}{9}$

b) $\dfrac{9}{5}$

c) $\dfrac{3\sqrt{34}}{34}$

d) $\dfrac{\sqrt{89}}{5}$

e) $\dfrac{\sqrt{34}}{3}$

204. Which of the following is equivalent to the given expression?

$$\frac{\cos^2 x}{1+\sin x}$$

a)

$\tan x + \cos x$

b)

$1 - \sin x$

c)

$\csc x + \cot x$

d)

$\tan x \cot x - \sin x$

e)

$\cot x \cos x + \tan x$

205. Solve the following equation.

$2\cos x - 1 = 0$

a)

$x = \frac{\pi}{6} + 2n\pi$ and $x = \frac{5\pi}{6} + 2n\pi$, where n is an integ

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b)

$x = \frac{\pi}{3} + 2n\pi$ and $x = \frac{5\pi}{3} + 2n\pi$, where n is an integ

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c)

$x = \frac{\pi}{4} + 2n\pi$ and $x = \frac{5\pi}{4} + 2n\pi$, where n is an integ

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d)

$x = \frac{\pi}{6} + 2n\pi$ and $x = \frac{7\pi}{6} + 2n\pi$, where n is an integ

---

e)

$x = \frac{2\pi}{3} + 2n\pi$ and $x = \frac{4\pi}{3} + 2n\pi$, where n is an inte

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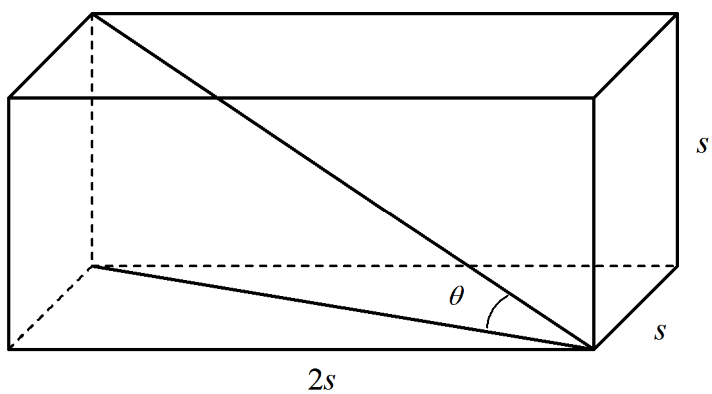
206. A rectangular field has a perimeter of 338 feet and is to have an area at least 6210 square feet. Within what bounds must the length, *x,* of the rectangular field lie?

a) $[58, 70]$
b) $[63, 65]$
c) $[68, 60]$
d) $[71, 75]$
e) $[73, 60]$

207. If the sides of a rectangular solid are as shown, and $s = 3$, determine the angle, θ, between the diagonal of the base of the solid and the diagonal of the solid. Round answer to two decimal places.



a) $17.21°$
b) $19.86°$
c) $21.91°$
d) $24.09°$
e) $26.28°$

208. Write $f(x) = x^3 - 11x^2 + 18x + 35$ in the form $f(x) = (x-k)q(x) + r$ when $k = 6 + \sqrt{6}$.

a) $f(x) = \left[x + \left(10 + \sqrt{10}\right)\right]\left[x^2 + \left(-9 + \sqrt{10}\right)x - \left(10 - \sqrt{10}\right)\right] + 4$
b) $f(x) = \left[x + \left(10 + \sqrt{10}\right)\right]\left[x^2 + \left(-9 + \sqrt{10}\right)x - \left(10 - \sqrt{10}\right)\right] - 4$
c) $f(x) = \left[x - \left(10 + \sqrt{10}\right)\right]\left[x^2 + \left(-9 + \sqrt{10}\right)x - \left(10 - \sqrt{10}\right)\right] - 4$
d) $f(x) = \left[x - \left(10 + \sqrt{10}\right)\right]\left[x^2 + \left(-9 + \sqrt{10}\right)x - \left(10 - \sqrt{10}\right)\right] + 4$
e) $f(x) = \left[x + \left(10 + \sqrt{10}\right)\right]\left[x^2 - \left(-9 + \sqrt{10}\right)x - \left(10 - \sqrt{10}\right)\right] + 4$

209. Determine the area of a triangle having the following measurements. Round your answer to two decimal places.

$C = 62°44'$, $a = 12$, and $b = 15$

a) 50.58 sq. units
b) 45.52 sq. units
c) 40.46 sq. units
d) 60.69 sq. units
e) 55.64 sq. units

210. Use the half-angle formula to simplify the given expression.

$$\sqrt{\frac{1 + \cos 8x}{2}}$$

a) $\cos 16x$
b) $\cos 1x$
c) $\cos 8x$
d) $\cos 40x$
e) $\cos x$

211. Simplify the expression $\log_5 100$.

a) $2 + \log_5 9$
b) $35 \log_5 2$
c) 7
d) $2 \log_5 3$
e) The expression cannot be simplified.

212. Given $C = 121°$, $B = 34°$, and $c = 15$, use the Law of Sines to solve the triangle for the value of a. Round answer to two decimal places.

a) $a = 27.68$
b) $a = 9.93$
c) $a = 16.06$
d) $a = 7.48$
e) $a = 8.70$

213. It is against the law in some municipalities to play a car stereo so loud that the level of the sound is 65 dB 25 feet from the source. The unit "dB" refers to decibels and is defined as $\text{dB} = 10\log\frac{P_2}{P_1}$, where P_2 is the power density of the sound in question, and P_1 is a reference sound which is just barely audible, 10^{-12}watt/m^2. What is the level of sound as measured in dBs if $P_2 = 4\times10^{-4}$ watts/m^2? Round to the nearest tenth.

a) 195.2 dB
b) 36.8 dB
c) 84.8 dB
d) 17.2 dB
e) 0.0 dB

214. Use fundamental identities to simplify the expression below and then determine which of the following is *not* equivalent.

$$\sin\left(\frac{\pi}{2} - x\right)\csc x$$

a) -1

b) $\dfrac{\cos x}{\sin x}$

c) $\cot x$

d) $\dfrac{1}{\tan x}$

e) $\cos x \csc x$

215. Which investment option will pay the most interest?

a) 9.6% compounded annually
b) 9.4% compounded semiannually
c) 9.2% compounded quarterly
d) 9.0% compounded continuously
e) These investments all pay the same amount of interest.

216. Expand the expression

$$\ln \frac{x^2}{y}$$

as a sum, difference, and/or constant multiple of logarithms.

a) $5(\log 6x - \log y)$

b) $30\log x - \log y$

c) $5\log 6x - \log y$

d) $\log 6 + 5\log x - \log y$

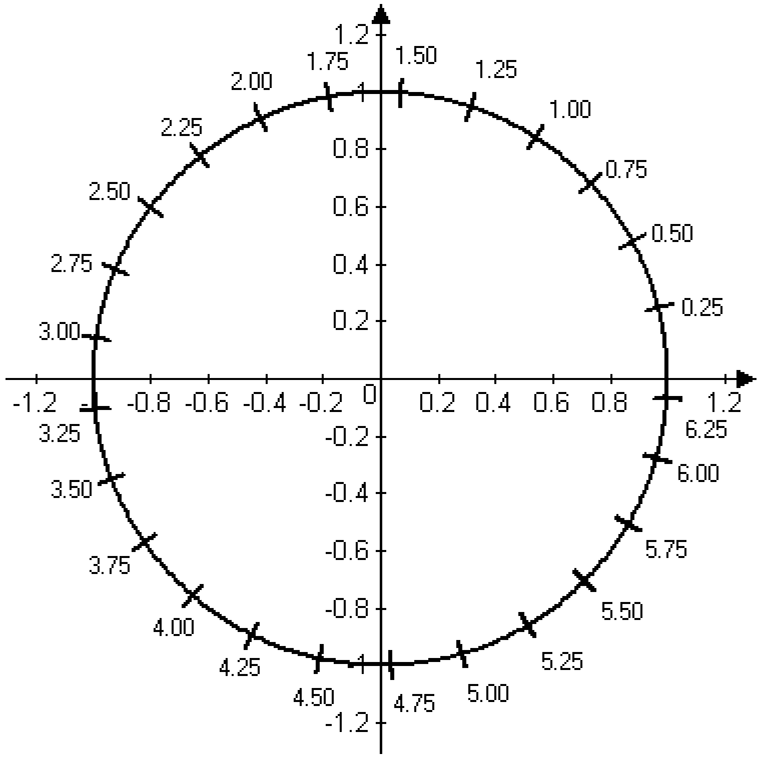
e) $\log \frac{6x^5}{y}$

217. Use a calculator to evaluate the function. Round your answers to four decimal places. (Be sure the calculator is in the correct angle mode.)

$\tan 38°9'47"$

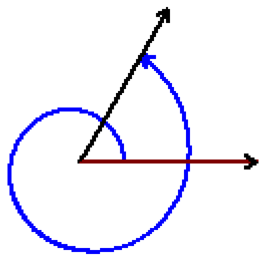
a) 0.5004
b) 0.0335
c) 0.7859
d) 1.2725
e) 1.6184

218. Use the figure and a straightedge to approximate the value of $\cos 0.5$



a) 1.00
b) 0.48
c) 0.88
d) 0.55
e) 1.14

219. Estimate the angle to the nearest one-half radian.



a)
1.0 radians

b)
7.0 radians

c)
6.5 radians

d)
3.5 radians

e)
420.0 radians

220. Use the function value and constraint below to evaluate the given trigonometric function.

Function Value *Constraint* *Evaluate*:

$\sin\theta = \frac{5}{13}$ θ lies in Quadrant II. $\tan\theta$

a)
$-\frac{5}{12}$

b)
$\frac{5}{12}$

c)
$-\frac{12}{5}$

d)
$-\frac{12}{13}$

e)
$\frac{5}{\sqrt{17}}$

Answer Key - HATT Sem1 Review

1. Answer: **a**
2. Answer: **c**
3. Answer: **a**
4. Answer: **b**
5. Answer: **b**
6. Answer: **b**
7. Answer: **b**
8. Answer: **d**
9. Answer: **d**
10. Answer: **d**
11. Answer: **c**
12. Answer: **e**
13. Answer: **a**
14. Answer: **d**
15. Answer: **e**
16. Answer: **c**
17. Answer: **d**
18. Answer: **a**
19. Answer: **d**
20. Answer: **d**
21. Answer: **b**
22. Answer: **b**
23. Answer: **a**
24. Answer: **b**
25. Answer: **d**
26. Answer: **b**
27. Answer: **c**
28. Answer: **e**
29. Answer: **a**
30. Answer: **d**
31. Answer: **e**
32. Answer: **d**
33. Answer: **a**
34. Answer: **d**
35. Answer: **e**
36. Answer: **c**
37. Answer: **b**
38. Answer: **d**
39. Answer: **c**
40. Answer: **a**
41. Answer: **d**

42. Answer: **b**
43. Answer: **d**
44. Answer: **c**
45. Answer: **c**
46. Answer: **b**
47. Answer: **a**
48. Answer: **c**
49. Answer: **d**
50. Answer: **b**
51. Answer: **c**
52. Answer: **c**
53. Answer: **e**
54. Answer: **c**
55. Answer: **e**
56. Answer: **c**
57. Answer: **b**
58. Answer: **c**
59. Answer: **b**
60. Answer: **a**
61. Answer: **a**
62. Answer: **d**
63. Answer: **b**
64. Answer: **b**
65. Answer: **b**
66. Answer: **c**
67. Answer: **c**
68. Answer: **c**
69. Answer: **e**
70. Answer: **e**
71. Answer: **b**
72. Answer: **c**
73. Answer: **e**
74. Answer: **e**
75. Answer: **a**
76. Answer: **d**
77. Answer: **b**
78. Answer: **a**
79. Answer: **c**
80. Answer: **c**
81. Answer: **a**
82. Answer: **b**
83. Answer: **c**
84. Answer: **c**

85. Answer: **c**
86. Answer: **d**
87. Answer: **a**
88. Answer: **a**
89. Answer: **c**
90. Answer: **b**
91. Answer: **c**
92. Answer: **a**
93. Answer: **d**
94. Answer: **d**
95. Answer: **c**
96. Answer: **b**
97. Answer: **a**
98. Answer: **a**
99. Answer: **d**
100. Answer: **b**
101. Answer: **e**
102. Answer: **e**
103. Answer: **e**
104. Answer: **e**
105. Answer: **d**
106. Answer: **e**
107. Answer: **b**
108. Answer: **a**
109. Answer: **b**
110. Answer: **a**
111. Answer: **c**
112. Answer: **e**
113. Answer: **a**
114. Answer: **a**
115. Answer: **e**
116. Answer: **b**
117. Answer: **a**
118. Answer: **e**
119. Answer: **e**
120. Answer: **c**
121. Answer: **d**
122. Answer: **d**
123. Answer: **e**
124. Answer: **c**
125. Answer: **b**
126. Answer: **d**
127. Answer: **c**

128. Answer: **b**
129. Answer: **a**
130. Answer: **d**
131. Answer: **e**
132. Answer: **b**
133. Answer: **a**
134. Answer: **e**
135. Answer: **d**
136. Answer: **b**
137. Answer: **a**
138. Answer: **b**
139. Answer: **b**
140. Answer: **a**
141. Answer: **a**
142. Answer: **a**
143. Answer: **b**
144. Answer: **e**
145. Answer: **d**
146. Answer: **a**
147. Answer: **b**
148. Answer: **b**
149. Answer: **c**
150. Answer: **b**
151. Answer: **d**
163. Answer: **e**
153. Answer: **a**
154. Answer: **e**
155. Answer: **a**
156. Answer: **c**
157. Answer: **d**
158. Answer: **c**
159. Answer: **c**
160. Answer: **b**
161. Answer: **e**
162. Answer: **a**
163. Answer: **e**
164. Answer: **a**
165. Answer: **d**
166. Answer: **b**
167. Answer: **a**
168. Answer: **a**
169. Answer: **e**
170. Answer: **c**

171. Answer: **c**
172. Answer: **c**
173. Answer: **d**
174. Answer: **d**
175. Answer: **c**
176. Answer: **b**
177. Answer: **b**
178. Answer: **a**
179. Answer: **c**
180. Answer: **c**
181. Answer: **d**
182. Answer: **d**
183. Answer: **c**
184. Answer: **c**
185. Answer: **e**
186. Answer: **e**
187. Answer: **d**
188. Answer: **c**
189. Answer: **d**
190. Answer: **c**
191. Answer: **a**
192. Answer: **a**
193. Answer: **b**
194. Answer: **c**
195. Answer: **b**
196. Answer: **b**
197. Answer: **d**
198. Answer: **e**
199. Answer: **a**
200. Answer: **a**
201. Answer: **b**
202. Answer: **b**
203. Answer: **d**
204. Answer: **b**
205. Answer: **b**
206. Answer: **b**
207. Answer: **d**
208. Answer: **d**
209. Answer: **a**
210. Answer: **b**
211. Answer: **a**
212. Answer: **e**
213. Answer: **c**

214. Answer: **a**
215. Answer: **b**
216. Answer: **d**
217. Answer: **c**
218. Answer: **c**
219. Answer: **b**
220. Answer: **a**