1. Convert $-200°$ to radians.

2. Convert $\frac{13\pi}{12}$ to degrees.

3. Convert the polar coordinates $\left(-3, \frac{5\pi}{6}\right)$ to rectangular coordinates.

4. Convert the rectangular coordinates $\left(-1, \sqrt{3}\right)$ to polar coordinates.

5. Evaluate $\sin^{-1}\left(-\frac{1}{2}\right)$.

6. Evaluate $\arccos(0)$.

7. Evaluate $\tan^{-1}(1)$.

8. Evaluate $\cos\left(\arcsin(-1)\right)$.

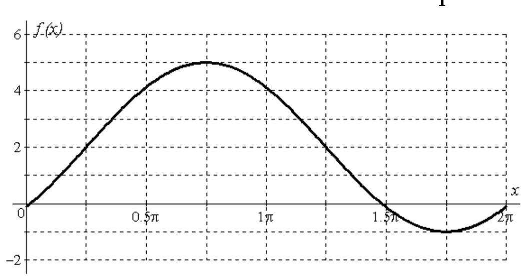
9. Evaluate $\tan^{-1}\left(2\cos\left(\frac{11\pi}{6}\right)\right)$.

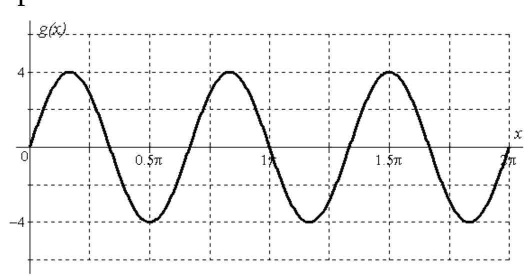
10. The wheel of a cart has a radius of 10 inches. If the wheel rotates 4 times in 15 seconds, how fast is the cart moving in feet per minute?

11. In an experiment, a particle is observed moving along a circular path. The path has a diameter of 24 millimeters and the particle completes one rotation in 0.2 seconds. What is the angular speed (in degrees per second) of the particle measured from the center of the path?

12. The minute hand on a clock tower has a length of 3.5 feet. How far will the tip of the minute hand travel in 5 minutes?

13. Use the sine function to write an equation for each graph shown.





14. Find the maximum value of the function $f(t) = 3 - 7\cos(2t + 5)$.

15. Describe the amplitude, period, phase shift, and vertical shift in the sinusoid $y = \frac{4}{5}\sin(2 - 4x) + 1$.

2^{nd} Quarter – Trigonometric Identities, Equations, and Applications

16. Simplify the expression $\frac{\sec\theta \cdot \cot\theta}{\sin\theta}$.

17. Simplify the expression $(\cos x - \sin x)^2 - 2\sin(-2x)$.

18. Solve $2\cos x + \sqrt{3} = 0$ for all values on the interval [0, 2π).

19. Solve $2\sin^2 x - 3\sin x + 1 = 0$ for all values on the interval [0, 2π).

20. Given the triangle ΔABC where $a = 13$, $b = 10$, and $c = 8$, find $\angle B$.

21. Given the triangle ΔMNP where $\angle M = 48°$, $n = 6$, and $p = 9$, find m.

22. Given the triangle ΔXYZ where $\angle X = 108°$, $\angle Y = 22°$, and $z = 42$, find y.

23. How many different triangles can be constructed such that $\angle S = 30°$, $s = 7$, and $t = 12$?

24. Find the area of triangle ΔRST where $r = 8$, $s = 12$, and $t = 14$.

25. A 20-ft tall antenna sits atop a building. From the ground a person measures the angle of elevation to the antenna's base to be 65° and the angle of elevation to the antenna's top to be 66°. How far away is the person from the building?

26. Suppose $\mathbf{a} = 3\mathbf{i} - 5\mathbf{j}$, $\mathbf{b} = 8\mathbf{j}$, and $\mathbf{c} = -13\mathbf{i} + 7\mathbf{j}$. Find the vector $2\mathbf{a} + \mathbf{b} - \mathbf{c}$.

27. Write the component form of the vector with initial point (6, –3) and terminal point (–7, –11).

28. Find the magnitude and direction angle for the vector $\mathbf{v} = -4\mathbf{i} + 8\mathbf{j}$.

29. Calculate $\mathbf{m} \cdot \mathbf{n}$ if $\mathbf{m} = \langle 4, 8 \rangle$ and $\mathbf{n} = \langle -3, 2 \rangle$.

3rd Quarter – Functions, Graphical Analysis, and Equations

30. For each function below, identify its parent function and then describe any transformations.

$y=(x+2)^3+5$ $\qquad$ $y=\frac{2}{3}|x|-8$ $\qquad$ $y=-\sqrt{8x}$

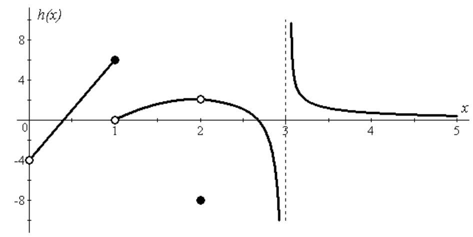
$y=\frac{1}{3-x}$ $\qquad$ $y=4(5)^{3x}$ $\qquad$ $y=\ln\left(\frac{x}{2}\right)$

31. Use the graph at the right to evaluate the following.

$\lim_{x\to 1^+} h(x)$ $\qquad$ $\lim_{x\to 3^-} h(x)$

$\lim_{x\to 1} h(x)$ $\qquad$ $\lim_{x\to 3} h(x)$

$\lim_{x\to 2} h(x)$ $\qquad$ $\lim_{x\to \infty} h(x)$



32. Classify each of the following parent functions as even, odd, or neither.

$y=x$ $\qquad$ $y=x^2$ $\qquad$ $y=x^3$

$y=\sqrt{x}$ $\qquad$ $y=\sqrt[3]{x}$ $\qquad$ $y=|x|$

$y=\frac{1}{x}$ $\qquad$ $y=\sin x$ $\qquad$ $y=\cos x$

$y=\tan x$ $\qquad$ $y=\sec x$ $\qquad$ $y=\csc x$

$y=\cot x$ $\qquad$ $y=e^x$ $\qquad$ $y=\log x$

33. Find the inverse of each function. Include the inverse's domain in your answer.

$f(x)=x^3+8$ $\qquad$ $f(x)=\sqrt{x-5}$ $\qquad$ $f(x)=(x+3)^2,\ x\ge -3$

$f(x)=3-\ln x$ $\qquad$ $f(x)=e^{4x+9}$ $\qquad$ $f(x)=\frac{2}{x-7},\ x>7$

34. Identify the absolute and relative maximum and minimum values of $f(x)=x^4-3x^3-2x^2+4x$.

35. For what values of x on the interval $0 < x < 2\pi$ does the graph of $y=\cos x$ have downward concavity?

36. On what intervals is the function $h(x)=|x-2|+|x+3|$ increasing, decreasing, and constant?

37. Find the real zeros of the polynomial function $f(x)=2x^3+9x^2-18x-81$.

38. Find the exact solutions to the equation $x^4-19x^2+48=0$.

39. Using interval notation, solve the inequality $x^3+x^2-6x\ge 0$.

40. Identify all intercepts in the rational function $y = \dfrac{x(x-4)(x+2)}{(x+2)(x+3)}$.

41. Describe the location and types of discontinuities in the rational function $g(x) = \dfrac{x^2-16}{x^2-2x-8}$.

42. Determine the end-behavior asymptote (horizontal, slant, etc.) for each function below.

$f(x) = \dfrac{3-x^2}{5x^2+4}$ $\qquad g(x) = \dfrac{x^2+6}{x-2}$ $\qquad h(x) = \dfrac{7x}{3x^2+8}$

43. Given $f(x) = \begin{cases} 3x-9, & x<0 \\ \cos x, & x=0 \\ 2^x + x^2, & 0<x\le 3 \end{cases}$, evaluate $f(-2)$, $f(0)$, $f(3)$, and $f(5)$.

44. Solve $15 - \log(9x+19) = 13$.

45. Solve $\ln(x^2-12) = \ln x$.

46. Solve $\frac{2}{3}e^{5x+8} = 24$.

47. Solve $27^{x+2} = \left(\frac{1}{3}\right)^x$.

48. Solve $4^{x+3} = 5^{2-x}$.

49. The population of a country increases according to the model $P(t) = 24.1e^{0.0178t}$, where P is the population in millions and t is the number of years since 2000. Use this model to predict the population in 2020.

50. The value of a particular piece of industrial machinery depreciates according to the model $v(x) = 36(0.849)^x$, where v is the value in thousands of dollars and x is the age of the machine in years. When will the machine be worth less than \$20,000?

4th Quarter – Modeling, Sequences and Series, and Conics

51. The table at the right shows values for four different functions. Determine which type of model equation (linear, quadratic, exponential, or inverse) best fits each function's values.

x	$a(x)$	$b(x)$	$c(x)$	$d(x)$
1	1	16	3	60
2	8	8	10	30
3	13	4	17	20
4	16	2	24	15
5	17	1	31	12

52. Find a sinusoidal model for the data in the table below.

t	0	1	2	3	4	5	6
$f(t)$	5	1	–3	1	5	1	–3

53. The data in the table at the right shows a small company's insurance costs per employee (in dollars) based on the number of employees. Use an exponential model to predict the cost for 40 employees.

number of employees	*cost per employee*
5	370
10	300
15	245
20	200
25	165

54. Refer to the insurance cost data used in Problem #53. How many employees would there need to be to have a cost of $125 per employee?

55. Determine the sum for each of the following series.

$$\sum_{n=1}^{18}(3n+7) \qquad \sum_{k=2}^{5}75(1.2)^k$$

$$\sum_{j=1}^{\infty}\frac{3}{2}\left(\frac{1}{4}\right)^{j-1} \qquad \sum_{i=0}^{\infty}24\left(\frac{5}{2}\right)^i$$

56. Write an explicit and recursive formula for the sequence $a_n = \{32.4,\ 29.7,\ 27.0,\ 24.3,\ \ldots\}$.

57. Write an explicit and recursive formula for the sequence $a_n = \{120,\ -96,\ 76.8,\ -61.44,\ \ldots\}$.

58. A new "super bouncy ball" has the ability to bounce upward 90% from an initial dropped height. If this ball is dropped from 2 meters and bounces vertically, how far will it have traveled when it hits the ground on the 4th time?

59. Write an equation for the parabola with a vertex at (1, 3) and a focus at (0, 3).

60. Write an equation for the circle that has a diameter with endpoints (–1, 1) and (5, –11).

61. Write an equation for the ellipse with foci at (–4, 3) and (–4, 9) and one vertex at (–2, 6).

62. Write an equation for the hyperbola with vertices at (0, 0) and (0, –4) and one foci at (0, 1).

63. Where applicable, find the center, vertices, foci, and radius for each conic.

$$y-1=\frac{1}{8}(x+5)^2 \qquad 4(x+7)^2-9(y-2)^2=36$$

$$\frac{x^2}{6}+(y-9)^2=1 \qquad x^2+6x+y^2=3$$

Answers with Sample Solutions

1. $-200° \cdot \frac{\pi}{180°} = -\frac{10}{9}\pi$

2. $\frac{13\pi}{12} \cdot \frac{180°}{\pi} = 195°$

3. $x = -3 \cdot \cos\left(\frac{5\pi}{6}\right) = \frac{3\sqrt{3}}{2}$; $y = -3 \cdot \sin\left(\frac{5\pi}{6}\right) = -\frac{3}{2}$; $\left(\frac{3\sqrt{3}}{2}, -\frac{3}{2}\right)$

4. $r^2 = (-1)^2 + \left(\sqrt{3}\right)^2 \Rightarrow r = \pm 2$; $\tan\theta = \frac{\sqrt{3}}{-1} \Rightarrow \theta = \frac{2\pi}{3} + k\pi$;

   Any combination of r and θ in Quadrant 2 will work, for example $\left(2, \frac{2\pi}{3}\right)$ or $\left(-2, -\frac{\pi}{3}\right)$.

5. $\sin^{-1}\left(-\frac{1}{2}\right) = -\frac{\pi}{6}$

6. $\arccos(0) = \frac{\pi}{2}$

7. $\tan^{-1}(1) = \frac{\pi}{4}$

8. $\cos(\arcsin(-1)) = \cos\left(-\frac{\pi}{2}\right) = 0$

9. $\tan^{-1}\left(2\cos\left(\frac{11\pi}{6}\right)\right) = \tan^{-1}\left(2 \cdot \frac{\sqrt{3}}{2}\right) = \tan^{-1}\left(\sqrt{3}\right) = \frac{\pi}{3}$

10. $\text{linear speed} = \frac{(10 \text{ in}) \cdot (4 \text{ rev})}{15 \text{ sec}} \cdot \frac{1 \text{ ft}}{12 \text{ in}} \cdot \frac{2\pi}{1 \text{ rev}} \cdot \frac{60 \text{ sec}}{1 \text{ min}} = \frac{80\pi}{3} \text{ ft/min}$

11. $\text{angular speed} = \frac{1 \text{ rev}}{0.2 \text{ sec}} \cdot \frac{360°}{1 \text{ rev}} = 1800°/\text{sec}$

12. $\text{arc length} = (3.5 \text{ ft}) \cdot \left(\frac{\pi}{6}\right) = \frac{7\pi}{12} \text{ ft}$

13. In the graph of $f(x)$, the amplitude is 3, the period is 2π, the phase shift is right $\pi/4$, and the vertical shift is up 2. One possible equation is $f(x) = 3\sin\left(x - \frac{\pi}{4}\right) + 2$.

In the second graph of $g(x)$, the amplitude is 4, the period is $2\pi/3$, there is no phase shift or vertical shift. One possible equation is $g(x) = 4\sin(3x)$.

14. Since the vertical shift is up 3 and the amplitude is 7, the maximum value must be 10.

15. Rewrite as $y = \frac{4}{5}\sin(-4x+2)+1 = \frac{4}{5}\sin\left[-4\left(x - \frac{1}{2}\right)\right]+1$.

$\text{amplitude} = |a| = \frac{4}{5}$; $\text{period} = \left|\frac{2\pi}{-4}\right| = \frac{\pi}{2}$; $\text{phase shift} = c = \text{right } \frac{1}{2}$; $\text{vertical shift} = d = \text{up } 1$

16. $$\frac{\sec\theta \cdot \cot\theta}{\sin\theta} \Rightarrow \frac{\frac{1}{\cos\theta} \cdot \frac{\cos\theta}{\sin\theta}}{\sin\theta} \Rightarrow \frac{1}{\sin\theta \cdot \sin\theta} \Rightarrow \csc^2\theta$$

17. Use the Pythagorean, negative, and double angle identities:

$$(\cos x - \sin x)^2 - 2\sin(-2x) \Rightarrow (\cos^2 x - 2\sin x\cos x + \sin^2 x) - (-2\sin 2x)$$
$$\Rightarrow \cos^2 x - \sin 2x + \sin^2 x + 2\sin 2x \Rightarrow 1 + \sin 2x$$

18. $$\cos x = -\frac{\sqrt{3}}{2} \Rightarrow x = \frac{5\pi}{6}, \frac{7\pi}{6}$$

19. $$(2\sin x - 1)(\sin x - 1) = 0 \Rightarrow \begin{cases} \sin x = \frac{1}{2} \\ \sin x = 1 \end{cases} \Rightarrow x = \frac{\pi}{6}, \frac{\pi}{2}, \frac{5\pi}{6}$$

20. $$10^2 = 13^2 + 8^2 - 2 \cdot 13 \cdot 8 \cdot \cos B \Rightarrow \cos B = \frac{133}{208} \Rightarrow B = 50.251°$$

21. $$m^2 = 6^2 + 9^2 - 2 \cdot 6 \cdot 9 \cdot \cos 48° \Rightarrow m^2 = 44.734 \Rightarrow m = 6.688$$

22. $$\frac{\sin 50°}{42} = \frac{\sin 22°}{y} \Rightarrow y = \frac{42 \cdot \sin 22°}{\sin 50°} \Rightarrow y = 20.539$$

23. This is the SSA, so start by testing for two solutions. Since $12\cdot\sin 30° < 7 < 12 \quad\Rightarrow\quad 6 < 7 < 12$ is a true statement, there can be two different triangles constructed.

24. $s = \dfrac{8+12+14}{2} = 17 \quad\Rightarrow\quad Area = \sqrt{17(17-8)(17-12)(17-14)} \quad\Rightarrow\quad Area = 47.906$

25. Let h be the height of the building and d the desired distance. Two equations can be written as $\tan 65° = \dfrac{h}{d}$ and $\tan 66° = \dfrac{h+20}{d}$. Solve each for h, substitute, and solve:

$$\frac{h}{\tan 65°} = \frac{h+20}{\tan 66°} \quad\Rightarrow\quad h = 196.986 \text{ ft}$$

26. $2\mathbf{a}+\mathbf{b}-\mathbf{c} = 2(3\mathbf{i}-5\mathbf{j})+(8\mathbf{j})-(-13\mathbf{i}+7\mathbf{j}) = 6\mathbf{i}-10\mathbf{j}+8\mathbf{j}+13\mathbf{i}-7\mathbf{j} = 19\mathbf{i}-9\mathbf{j}$

27. $\langle -7-6,\ -11-(-3)\rangle \quad\Rightarrow\quad \langle -13,\ -8\rangle$

28. $\|\mathbf{v}\| = \sqrt{(-4)^2+(8)^2} = \sqrt{80} = 4\sqrt{5}$; $\quad \theta_{\mathbf{v}} = \tan^{-1}\left(\dfrac{8}{-4}\right)+\pi = 2.034$

29. $\mathbf{m}\cdot\mathbf{n} = \langle 4,\ 8\rangle\cdot\langle -3,\ 2\rangle = (4)(-3)+(8)(2) = 4$

30. $y = (x+2)^3+5$; $\quad y = x^3$ shifted left 2 units and up 5 units

$y = \dfrac{2}{3}|x|-8$; $\quad y = |x|$ compressed vertically by a factor of 2/3 and shifted down 8 units

$y = -\sqrt{8x}$; $\quad y = \sqrt{x}$ compressed horizontally by a factor of 8 and reflected vertically about the x-axis

$y = \dfrac{1}{3-x}$; $\quad y = \dfrac{1}{x}$ reflected horizontally about the y-axis and shifted right 3 units

$y = 4(5)^{3x}$; $\quad y = 5^x$ stretched vertically by a factor of 4 and compressed horizontally by a factor of 3

$y = \ln\left(\dfrac{x}{2}\right)$; $\quad y = \ln x$ stretched horizontally by a factor of 1/2

31. $\lim_{x\to 1^+} h(x) = 0$ $\qquad \lim_{x\to 3^-} h(x) = -\infty$

$\lim_{x\to 1} h(x)$ does not exist $\qquad \lim_{x\to 3} h(x)$ does not exist

$\lim_{x\to 2} h(x) = 2$ $\qquad \lim_{x\to \infty} h(x) = 0$

32. $y=x$ odd | $y=x^2$ even | $y=x^3$ odd

$y=\sqrt{x}$ neither | $y=\sqrt[3]{x}$ odd | $y=|x|$ even

$y=\dfrac{1}{x}$ odd | $y=\sin x$ odd | $y=\cos x$ even

$y=\tan x$ odd | $y=\sec x$ even | $y=\csc x$ odd

$y=\cot x$ odd | $y=e^x$ neither | $y=\log x$ neither

33. $f(x)=x^3+8 \;\Rightarrow\; f^{-1}(x)=\sqrt[3]{x-8},\ x\in\mathbb{R}$

$f(x)=\sqrt{x-5} \;\Rightarrow\; f^{-1}(x)=x^2+5,\ x\geq 0$

$f(x)=\left(x+3\right)^2,\ x\geq -3 \;\Rightarrow\; f^{-1}(x)=\sqrt{x}-3,\ x\geq 0$

$f(x)=3-\ln x \;\Rightarrow\; f^{-1}(x)=e^{3-x},\ x\in\mathbb{R}$

$f(x)=e^{4x+9} \;\Rightarrow\; f^{-1}(x)=\dfrac{1}{4}\left(\ln x-9\right),\ x>0$

$f(x)=\dfrac{2}{x-7},\ x>7 \;\Rightarrow\; f^{-1}(x)=\dfrac{2}{x}+7,\ x>0$

34. absolute maximum: none — relative maximum: (0.525, 1.191)

absolute minimum: $f(2.490)=-10.314$ — relative minimum: (–0.765, –2.545)

35. $\left(0,\ \dfrac{\pi}{2}\right)\cup\left(\dfrac{3\pi}{2},\ 2\pi\right)$

36. increasing: $(2, \infty)$; decreasing: $(-\infty, -3)$; constant: $(-3, 2)$

37. $\left\{-\dfrac{9}{2},\ -3,\ 3\right\}$

38. $x=\pm\sqrt{3},\ \pm 4$

39. $[-3,\ 0]\cup[2,\ \infty)$

40. x-intercept: (0, 0) and (4, 0) — y-intercept: (0, 0)

41. vertical asymptote: $x=-2$ — removable (hole): $\left(4,\ \dfrac{4}{3}\right)$

42. $f(x)$ has a horizontal asymptote at $y=-\dfrac{1}{5}$ (degrees are the same, so use the lead coefficients).

$g(x)$ has a slant asymptote at $y=x+2$ (degree of numerator is greater, so use division).

$h(x)$ has a horizontal asymptote at $y=0$ (degree of denominator is greater).

43. $f(-2) = 3(-2) - 9 = -15$ $\quad$ $f(3) = 2^{(3)} + (3)^2 = 17$

$f(0) = \cos(0) = 1$ $\quad$ $f(5)$ is undefined

44. $15 - \log(9x+19) = 13 \;\Rightarrow\; \log(9x+19) = 2 \;\Rightarrow\; 9x + 19 = 100 \;\Rightarrow\; x = 9$

45. $\ln(x^2 - 12) = \ln x \;\Rightarrow\; x^2 - 12 = x \;\Rightarrow\; x^2 - x - 12 = 0 \;\Rightarrow\; x = -3,\, 4 \;\Rightarrow\; x = 4$

46. $\frac{2}{3}e^{5x+8} = 24 \;\Rightarrow\; e^{5x+8} = 36 \;\Rightarrow\; 5x + 8 = \ln 36 \;\Rightarrow\; x = \frac{1}{5}(\ln 36 - 8) = -0.883$

47. $27^{x+2} = \left(\frac{1}{3}\right)^x \;\Rightarrow\; 3^{3(x+2)} = 3^{-x} \;\Rightarrow\; 3(x+2) = -x \;\Rightarrow\; x = -\frac{3}{2}$

48. $4^{x+3} = 5^{2-x} \;\Rightarrow\; (x+3)\ln 4 = (2-x)\ln 5 \;\Rightarrow\; x\ln 4 + 3\ln 4 = 2\ln 5 - x\ln 5$

$\Rightarrow\; x(\ln 4 + \ln 5) = 2\ln 5 - 3\ln 4 \;\Rightarrow\; x = \frac{\ln(25/64)}{\ln(20)} = -0.314$

49. $P(20) = 24.1e^{0.0178(20)} = 34.405342$; 34,405,342 people

50. $20 = 36(0.849)^x \;\Rightarrow\; x = 3.591$; about 3 years, 7 months

51. $a(x)$ is quadratic; $b(x)$ is exponential; $c(x)$ is linear; $d(x)$ is inverse

52. $f(t) = 4\sin\left[\frac{\pi}{2}(x-1)\right] + 1$ or $f(t) = 4\sin\left(\frac{\pi}{2}x - \frac{\pi}{2}\right) + 1$

53. $C(t) = 450.670(0.960)^t \;\Rightarrow\; C(40) = 89.503$; \$89.50

54. $C(t) = 450.670(0.960)^t \;\Rightarrow\; 125 = 450.670(0.960)^t \;\Rightarrow\; t = 31.734$; 32 employees

55. $\sum_{n=1}^{18}(3n+7) = \frac{18}{2}(10+61) = 639$ $\quad$ $\sum_{j=1}^{\infty}\frac{3}{2}\left(\frac{1}{4}\right)^{j-1} = \frac{3/2}{1-1/4} = 2$

$\sum_{k=2}^{5}75(1.2)^k = \frac{108(1-1.2^4)}{1-1.2} = 579.744$ $\quad$ $\sum_{i=0}^{\infty}24\left(\frac{5}{2}\right)^i$ diverges

56. explicit: $a_n = 32.4 + (n-1)(-2.7)$ $\quad$ recursive: $a_n = a_{n-1} - 2.7,\; a_1 = 32.4$

57. explicit: $a_n = 120(-0.8)^{n-1}$ $\quad$ recursive: $a_n = a_{n-1}(-0.8),\; a_1 = 120$

58. falling down distance: $\sum_{i=1}^{4} 2(0.9)^{i-1} = \frac{2(1-0.9^4)}{1-0.9} = 6.878$

bouncing up distance: $\sum_{i=1}^{3} 1.8(0.9)^{i-1} = \frac{1.8(1-0.9^3)}{1-0.9} = 4.878$

total distance: 11.756 meters

59. Note that the focus is 1 unit to the left of the vertex, so $p = -1$.

$(y-k)^2 = 4p(x-h) \quad \Rightarrow \quad (y-3)^2 = -4(x-1)$

60. Note that the diameter's midpoint gives the center as (2, –5) and the radius as $\sqrt{45}$.

$(x-h)^2 + (y-k)^2 = r^2 \quad \Rightarrow \quad (x-2)^2 + (y+5)^2 = 45$

61. Note that the center is (–4, 6) and the length of the minor axis is 4 (so $b = 2$).

Since $c = 3$ and $a^2 = b^2 + c^2$, then $a^2 = 2^2 + 3^2 \quad \Rightarrow \quad a = \sqrt{13}$.

$\frac{(y-k)^2}{a^2} + \frac{(x-h)^2}{b^2} = 1 \quad \Rightarrow \quad \frac{(y-6)^2}{13} + \frac{(x+4)^2}{4} = 1$

62. Note that the center is (0, –2). Since $a = 2$, $c = 3$ and $c^2 = a^2 + b^2$, then $3^2 = 2^2 + b^2 \quad \Rightarrow \quad b = \sqrt{5}$.

$\frac{(y-k)^2}{a^2} - \frac{(x-h)^2}{b^2} = 1 \quad \Rightarrow \quad \frac{(y+2)^2}{4} - \frac{x^2}{5} = 1$

63. $y - 1 = \frac{1}{8}(x+5)^2 \quad \Rightarrow \quad (x+5)^2 = 8(y-1)$; vertex is (–5, 1); focus is (–5, 3)

$4(x+7)^2 - 9(y-2)^2 = 36 \quad \Rightarrow \quad \frac{(x+7)^2}{9} - \frac{(y-2)^2}{4} = 1$; center is (–7, 2);

vertices are (–10, 2) and (–4, 2); foci are $\left(-7-\sqrt{13},\ 2\right)$ and $\left(-7+\sqrt{13},\ 2\right)$

$\frac{x^2}{6} + (y-9)^2 = 1$; center is (0, 9); vertices are $\left(-\sqrt{6},\ 9\right)$, $\left(\sqrt{6},\ 9\right)$, (0, 10), and (0, 8);

foci are $\left(-\sqrt{5},\ 9\right)$ and $\left(\sqrt{5},\ 9\right)$

$x^2 + 6x + y^2 = 3 \quad \Rightarrow \quad (x+3)^2 + y^2 = 12$; center is (–3, 0); radius is $2\sqrt{3}$