Accelerated 65 - 95 HW 26 (R 6.3) Quadratic Equations 2

Name: ______________________________

Concepts and Vocabulary:

6. If the graph of $f(x) = ax^2 + bx + c$ intersects the x-axis twice, how many solutions does the equation $ax^2 + bx + c = 0$ have? Explain.

Solving Quadratic Equations:

In exercises 21 and 23, a graph of $f(x) = ax^2 + bx + c$ is given in the text. Use this graph to solve $ax^2 + bx + c = 0$, if possible.

21.

23.

In exercises 25 and 27, a table of $f(x) = ax^2 + bx + c$ is given in the text. Use this table to solve $ax^2 + bx + c = 0$.

25.

27.

In exercises 31 - 39, set up a function to represent each side of the equation. Then solve the quadratic equation numerically, graphically, and symbolically. State your conclusion using a complete sentence and set notation.

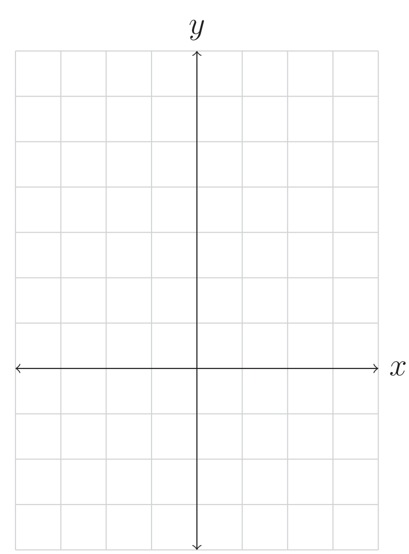
31. $x^2 + 2x = 3$

a. Numerically:

b. Symbolically:

c. Graphically:

Name of point	x	$f(x)$
Vertex		
y-intercept		
y-int mirror		
x-intercept		
x-intercept		



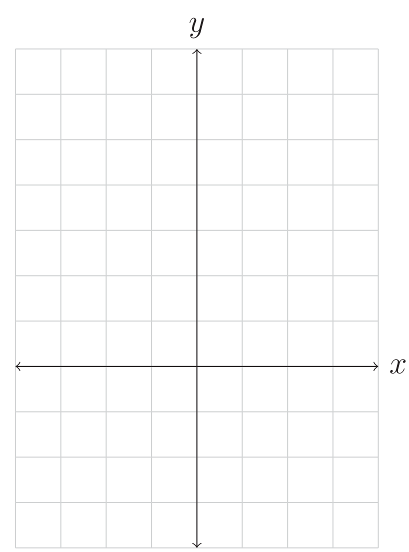
35. $4x^2 - 4x = 3$

a. Numerically:

b. Symbolically:

c. Graphically:

Name of point	x	$f(x)$
Vertex		
y-intercept		
y-int mirror		
x-intercept		
x-intercept		



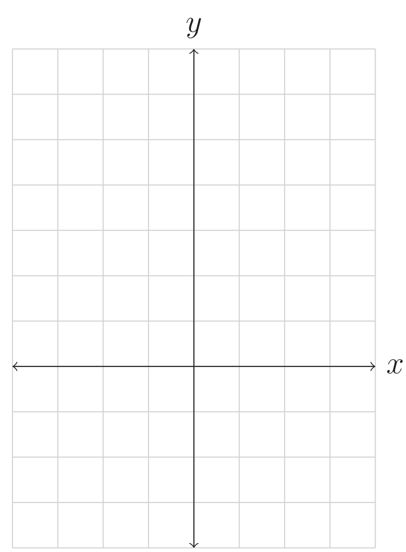
37. $x^2 + 2x = -1$

a. Numerically:

b. Symbolically:

c. Graphically:

Name of point	x	$f(x)$
Vertex		
y-intercept		
y-int mirror		
x-intercept		
x-intercept		



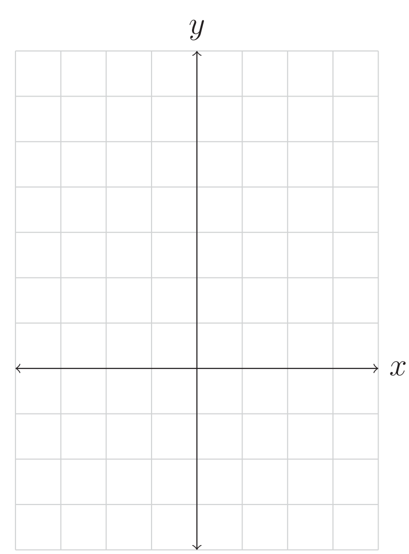
39. $x^2 + 2 = 0$

a. Numerically:

b. Symbolically:

c. Graphically:

Name of point	x	$f(x)$
Vertex		
y-intercept		
y-int mirror		
x-intercept		
x-intercept		



In exercises 41 and 45, solve by factoring.

41. $x^2 + 2x - 35 = 0$

45. $4x^2 + 13x + 9 = 6x$

In exercises 51 - 61 odd, use the square root property to solve.

51. $x^2 = 144$

57. $(x-1)^2 = 64$

53. $5x^2 - 64 = 0$

59. $(2x-1)^2 = 5$

55. $(x+1)^2 = 25$

61. $10(x-5)^2 = 50$

Completing the Square:

In exercises 71 - 85 odd, solve by completing the square.

71. $x^2 - 2x = 24$

73. $x^2 + 6x - 2 = 0$

75. $x^2 - 3x = 5$

79. $x^2 - 4 = 2x$

81. $2x^2 - 3x = 4$

83. $4x^2 - 8x - 7 = 0$

In exercise 101, set up a function to represent each side of the equation. Then solve the equation numerically, symbolically, and graphically. State your conclusion using a complete sentence and set notation.

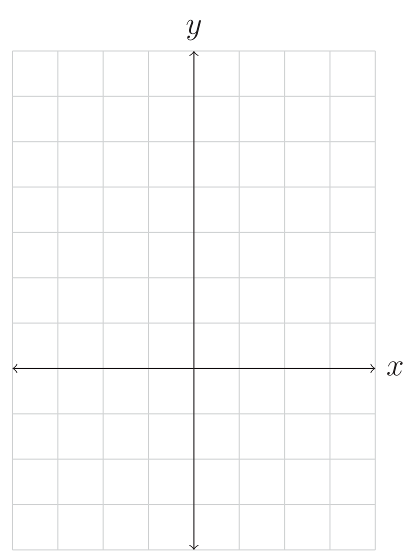
101. $x^2 - 8x + 15 = 0$

a. Numerically:

b. Symbolically:

c. Graphically:

Name of point	x	$f(x)$
Vertex		
y-intercept		
y-int mirror		
x-intercept		
x-intercept		



Applications:

113. Find a safe speed limit x for an airport taxiway curve with the given radius R by using $R = \frac{1}{2}x^2$.

a. $R = 450$ feet.

b. $R = 800$ feet.

121. A rectangular plot of land has an area of 520 square feet and is 6 feet longer than it is wide.

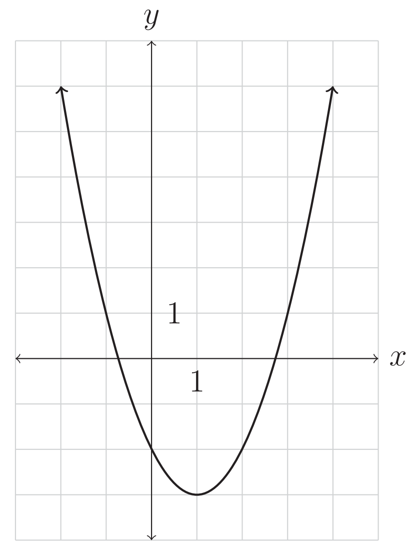
a. Write a quadratic equation in the form $ax^2 + bx + c = 0$ whose solution gives the width of the plot of land.

b. Solve the equation and state a conclusion.

Supplemental Problems:

S1. The graph of $y = w(x)$ is given in the figure to the right. Use it to do the following exercises.

a. Solve $w(x) < 1$.



b. Solve $w(x) \geq -2$.

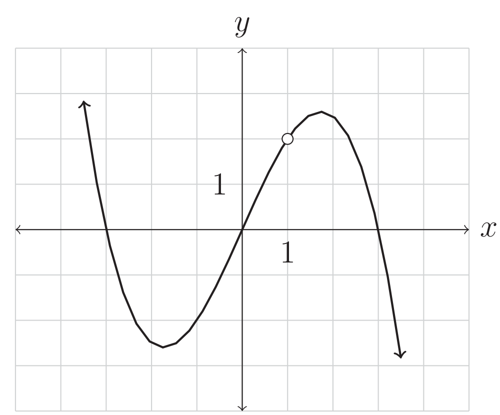
c. Solve $-2 < w(x) \leq 6$.

d. Solve $w(x) < -3$.

e. Determine the domain and range of w. State your answer using interval notation.

S2. Use the graph of $y = f(x)$ to answer the following.

a. Evaluate $f(-1)$.



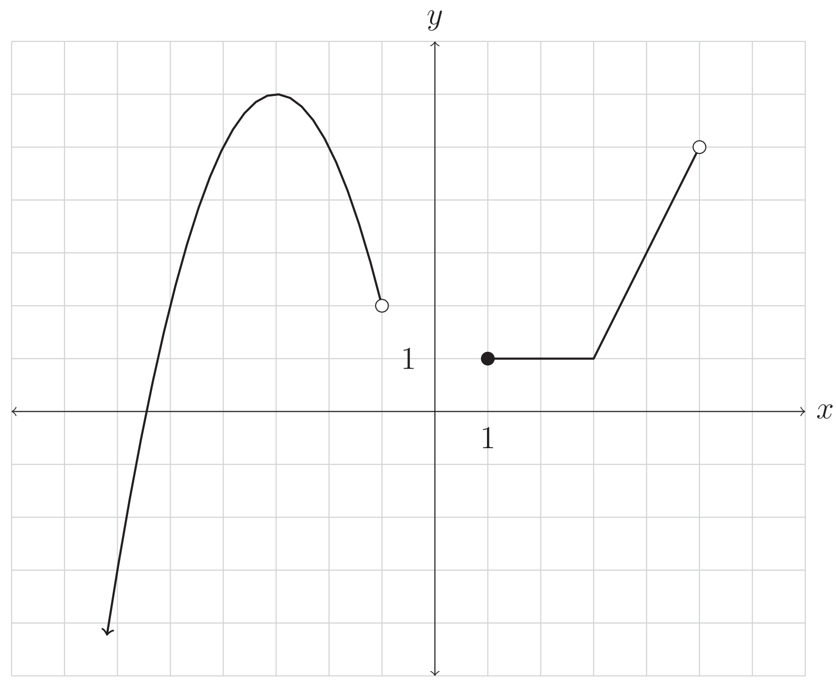
b. Solve $f(x) = 0$.

c. Solve $f(x) > 0$.

d. Estimate solutions to $f(x) = 1$.

e. What are the domain and range of f. Use interval notation.

S3. Use the graph of $y = m(x)$ to answer the following questions.



a. Evaluate $m(-5)$.

b. Evaluate $m(3)$.

c. Solve $m(x) = 2$.

d. Solve $m(x) = 6$.

e. Solve $m(x) > 0$.

f. Evaluate $m(-1)$.

g. Solve $m(x) = -3$.

h. Solve $m(x) = 3$.

i. Solve $m(x) \leq -3$.

j. Solve $m(x) > 5$.

k. State the domain and range of m using interval notation.

S4. The function $f(t) = -t^2 + 2t + 3$ models the depth of water in feet in a large drainage ditch, where t is measured in hours and $t = 0$ corresponds to the moment that a summer storm has ended.

a. Evaluate and interpret $f(2)$ in the context of the real world function.

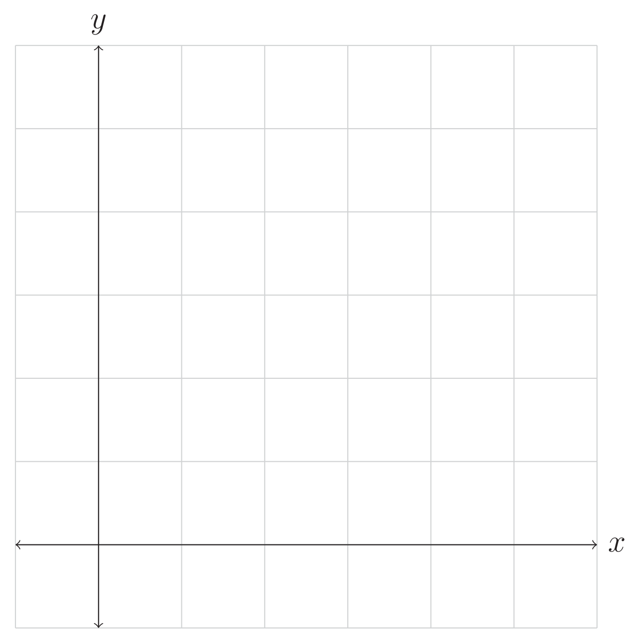
b. Write $f(t)$ in vertex form by completing the square. State the meaning of the vertex as a maximum or minimum in context of the situation.

c. Using the vertex form of $f(t)$ you found in part (b), solve the equation $f(t) = 0$ using the square root method.

d. What is the domain of and range of f in context of the situation? Write your answer in interval notation and explain your answer using a complete sentence.

e. At what time(s) will the water in the ditch be 1 feet deep? Round your solutions to three decimal places. Interpret your solutions in the context of the problem.

f. Make a graph the parabola $y = f(t)$ **on its implied domain** without using your calculator. Scale and label your axes.



S5. A television is launched with a trebuchet. Suppose that the function $h(d) = -\frac{1}{100}d^2 + \frac{6}{5}d + 28$ models the television's height in feet above ground when its horizontal distance from the trebuchet is d feet.

a. Find and interpret the vertical intercept.

b. Find and interpret the horizontal intercept(s).

c. Find and interpret the vertex.

d. What are the horizontal distances at which the TV is 40 feet above the ground?

e. What are the horizontal distances at which the TV is 75 feet above the ground?

f. A six foot tall pole is positioned 130 feet from the trebuchet. How high above the pole is the TV as it passes over?

g. What is the domain based on the context of the problem? Explain your reasoning.

h. What is the range based on the context of the problem? Explain your reasoning.

Solutions to Supplemental Problems:

S1. a. The solutions are in the interval $(-1, 3)$.

b. The solutions are in the interval $(-\infty, 0] \cup [2, \infty)$.

c. The solutions are in the interval $[-2, 0) \cup (2, 4]$.

d. There are no solutions. The solution set is $\{\}$.

e. The domain is $(-\infty, \infty)$ and the range is $[-3, \infty)$.

S2. a. $f(-1) = -2$

b. The solution set is $\{-3, 0, 3\}$.

c. The solution set is $(-\infty, -3) \cup (0, 1) \cup (1, 3)$.

d. The solution set is $\{x | x \approx -3.2 \text{ or } x \approx 0.5 \text{ or } x \approx 2.8\}$.

e. The domain is $(-\infty, 1) \cup (1, \infty)$ and the range is $(-\infty, \infty)$.

S3. a. $m(-5) = 2$

b. $m(3) = 1$

c. The solution set is $\{-5, 3.5\}$.

d. The solution set is $\{-3\}$.

e. The interval of solutions is $(-5.5, -1) \cup [1, 5)$.

f. $m(-1)$ is not defined.

g. The solution set is $\{-6\}$.

h. The solution set is $\{x|x \approx -4.8 \text{ or } x \approx -1.3 \text{ or } x = 4\}$.

i. The interval of solutions is $(-\infty, -6]$.

j. The interval of solutions is $(-4, -2)$.

k. The domain is $(-\infty, -1) \cup [1, 5)$. and the range is $(-\infty, 6]$.

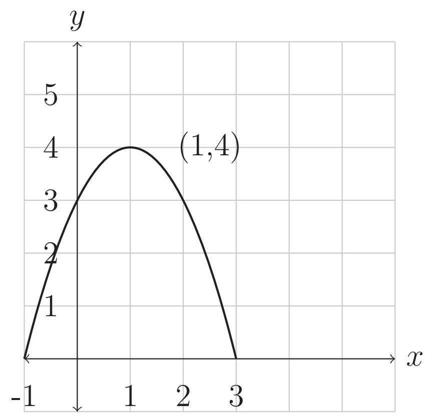
S4. a. $f(2) = 3$. Two hours after the storm ended, the water in the ditch was 3 feet deep.

b. $f(t) = -(t-1)^2 + 4$. The vertex is $(1, 4)$. One hour after the storm ended, the water in the ditch reached its maximum depth of 4 feet.

c. The solution set is $\{-1, 3\}$.

d. The domain is $[-1, 3]$. Since one hour before the storm ended the ditch was empty and 3 hours after the storm ended, the ditch was empty again, having drained completely. The range is $[0, 4]$ since the minimum water depth is 0 feet and the maximum water depth is 4 feet deep.

e. The water in the ditch will be 1 foot deep at approximately 0.732 hours before the storm ended and approximately 2.732 hours after the storm ended.

f. 

S5. a. The vertical intercept is $(0, 28)$. The TV is 28 feet up in the air when at the point of launch.

b. The horizontal intercepts are $(-20, 0)$ and $(140, 0)$. Only the second point makes sense in context and it represents the TV being 140 feet from the trebuchet when it hits the ground.

c. The vertex is $(60, 64)$. The TV reaches its maximum height of 64 feet when it is 60 feet horizontally from the trebuchet.

d. The TV is 40 feet above the ground when it is approximately 11.01 feet and approximately 108.99 feet horizontally away from the trebuchet.

e. The TV never reaches 75 feet above the ground.

f. The TV is 9 feet above the pole when it passes over it.

g. The domain is $[0, 140]$ since the TV traveled from 0 feet to 140 feet where it hit the ground.

h. The range is $[0, 64]$ since the TV's heights went from 28 feet to 64 feet and then back down all the way to 0 feet.