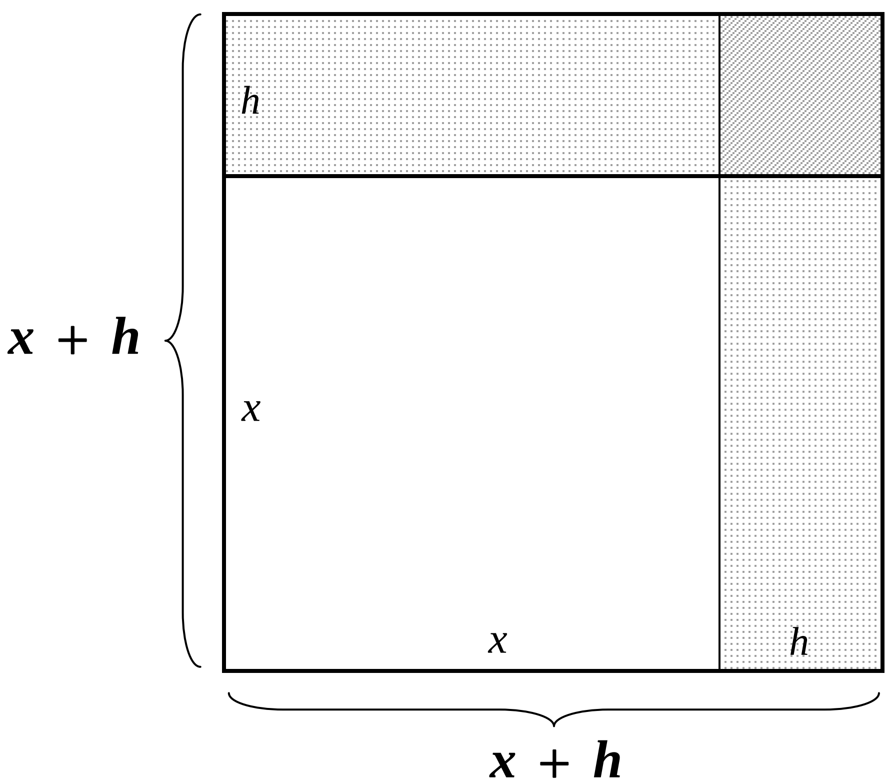
Portland Community College

MTH 95

and MTH 91/92

SUPPLEMENTAL PROBLEM SETS



$$(x+h)^2 = x^2 + xh + xh + h^2$$
$$= x^2 + 2xh + h^2$$

SUPPLEMENT TO §2.1

EXERCISES:

1. Determine whether one quantity is a function of another within real life contexts by applying the definition of a function

a. Is *height* a function of *age*?

b. Is *age* a function of *height*?

c. Is *name* a function of *G#* (i.e., PCC ID number)?

d. Is *G#* a function of *name*?

e. Is the *cost per person* a function of the *number of people sharing a $20 pizza*?

2. The function $y = p(x)$ graphed in Figure 1.

a. Find $p(0)$.

b. Find $p(1.5)$.

c. Find $p(5)$.

d. Find $p(-7)$.

e. Find $p(2)$.

f. Solve $p(x) = -2$.

g. Solve $p(x) = 1$.

h. Solve $p(x) = -4$.

i. Solve $p(x) = 3$.

j. Solve $p(x) = 0$.

k. State the domain p in interval notation.

l. State the range of p in interval notation.

m. Find all x for which $p(x) > 1$.

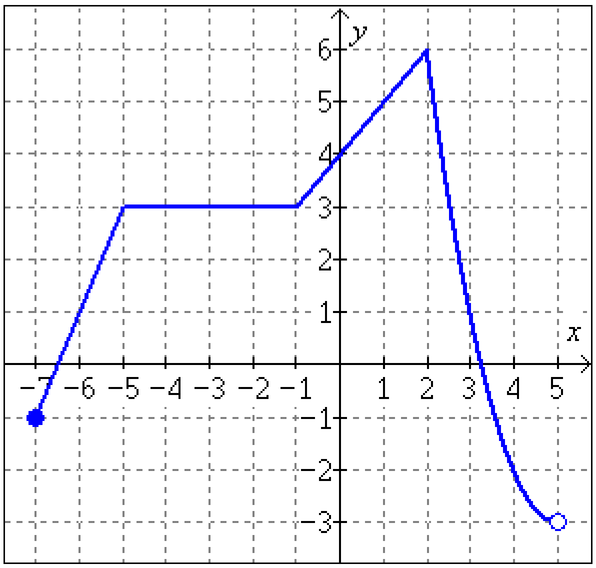


Figure 1: The graph of $y = p(x)$.

3. A group of rafters take a 15 day rafting trip down the Colorado River through the Grand Canyon. The distance in miles, $K(t)$, that the group has floated is a function of the number of days traveled, t. The table below gives some data about the trip.

t	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
$K(t)$	0	20	35	45	58	75	100	125	135	145	158	175	211	230	258	277

a. Find and interpret $K(8)$. (Hint: After 8 days of rafting....)

b. Find and interpret $K(35)$.

c. Solve $K(t) = 125$ and interpret your answer.

d. Find the average rate of change between $t = 11$ and $t = 13$. Explain your answer.

e. Find and interpret the vertical intercept of the function K.

f. What is the domain of the function K? Explain your answer.

g. What is the range of the function K? Explain your answer.

4. The value of a computer, in dollars, is given by $c(t) = 600 - 150t$, where t is the number of years since the computer was purchased.

a. Find and interpret the vertical intercept of the function c.

b. Find and interpret the horizontal intercept of c.

c. Find the domain and range of c. (Use interval notation.)

5. The historic Arlene Schnitzer Concert Hall originally opened in 1928 as the Portland Publix Theatre. The Theatre seated 2776 people and it cost 60 cents per ticket. Let $r(x)$ be the revenue, in dollars, from selling x tickets for an event at the Theatre.

a. Find the algebraic formula for $r(x)$.

b. Find the domain and range of r.

6. The recorded low temperature in Portland, in degrees Fahrenheit, is a function, f, of the number of days after January 1, 2009. Interpret $f(29) = 30$.

7. Consider the linear function $f(x) = 4 - 0.5x$.

a. Find and simplify the expressions for $y = f(x+6)$ and $y = f(x) + 6$.

b. Graph $y = f(x)$, $y = f(x+6)$, and $y = f(x) + 6$ on the same set of coordinate axes. Scale the axes and label each function on the graph. (Linear functions should be straight: use a ruler and graph paper.)

8. If $p(x) = x^2$, find and simplify expressions for $p(x+2)$ and $p(x) + 2$. Are the resulting expressions equivalent?

9. Let $j(t) = 4 - t + 2t^2$. Find and simplify the expressions below.

a. $j(3t)$

b. $j(3-t)$

c. $3j(t)$

d. $3 - j(t)$

10. Suppose that $y = g(x)$ is a linear function and that $g(0) = -150$ and $g(50) = 2000$. Find the algebraic formula for $g(x)$.

11. Suppose that $y = h(x)$ is a linear function and that $h(-5) = 2$ and $h(5) = 20$. Find an algebraic formula for $h(x)$.

12. Suppose that $y = j(t)$ is a linear function and that $j(-6) = 5$ and $j(10) = -1$. Find an algebraic formula for $j(x)$.

13. Figure 2 shows a graph of the total net income, y, in millions of dollars, x years after 1995 for Yahoo! Inc.

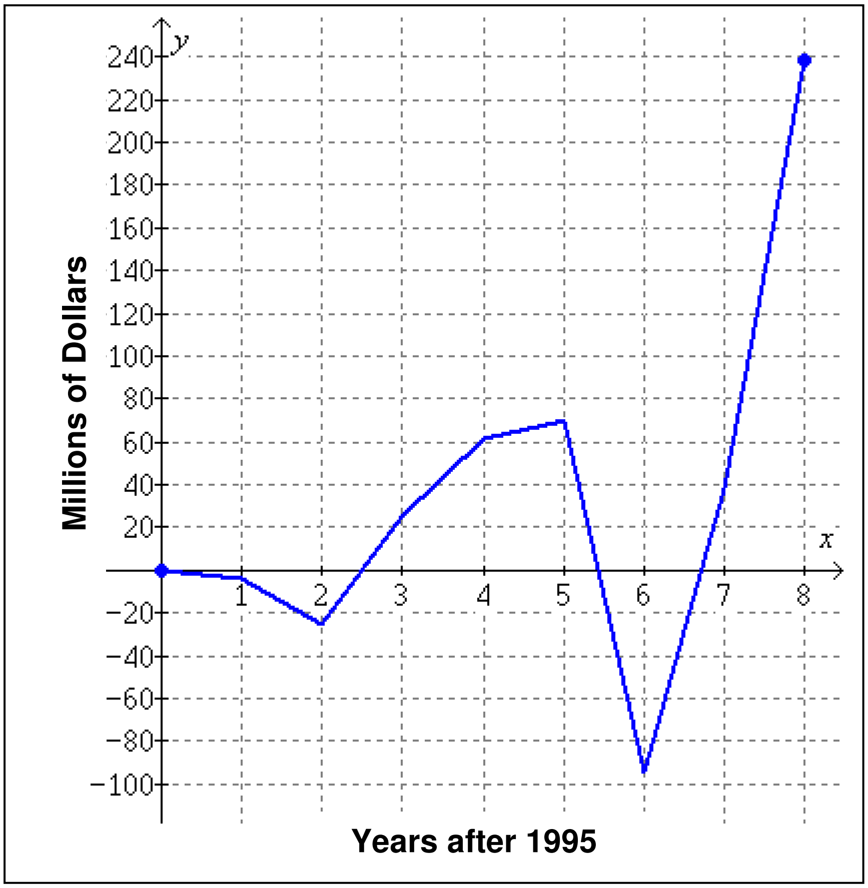


Figure 2: Total net income for Yahoo! Inc.

a. If $y = f(x)$ evaluate $f(6)$ and state the practical significance of this value.

b. Estimate a solution to the equation $f(x) = 120$ and state the practical significance of this solution.

c. Estimate the solutions to the equation $f(x) = 60$ and state the practical significance of this solution.

d. Estimate the solutions to the equation $f(x) = -100$ and state the practical significance of this solution.

SUPPLEMENT TO §3.3

EXERCISES:

1. Solve the following inequalities.

a. $3(2x - 5) + 2x > 2(4x + 1)$.

b. $-3(x - 7) + 7x \leq 4(x + 6)$.

c. $2(3x + 9) < 6(3 + x)$.

SUPPLEMENT TO §3.4

EXERCISES:

1. The graph of $y = w(x)$ is given in Figure 3.

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

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

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

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

e. Find the domain and range of w.
(Use interval notation.)

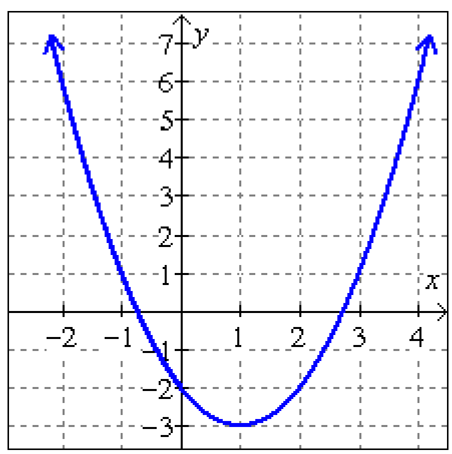


Figure 3: The graph of $y = w(x)$.

2. The graph of $y = f(x)$ is given in Figure 4.

a. Evaluate $f(-1)$.

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

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

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

e. Find the domain and range of f. (Use interval notation.)

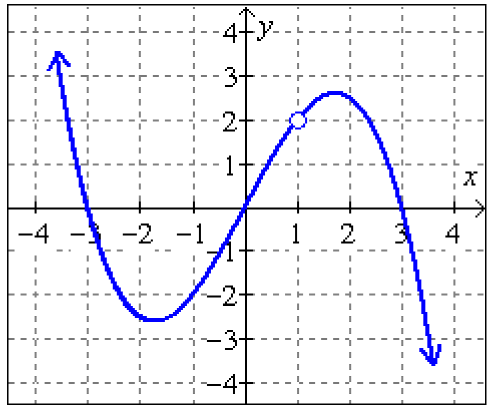


Figure 4: The graph of $y = f(x)$.

3. The graph of $y = m(x)$ is given in Figure 5.

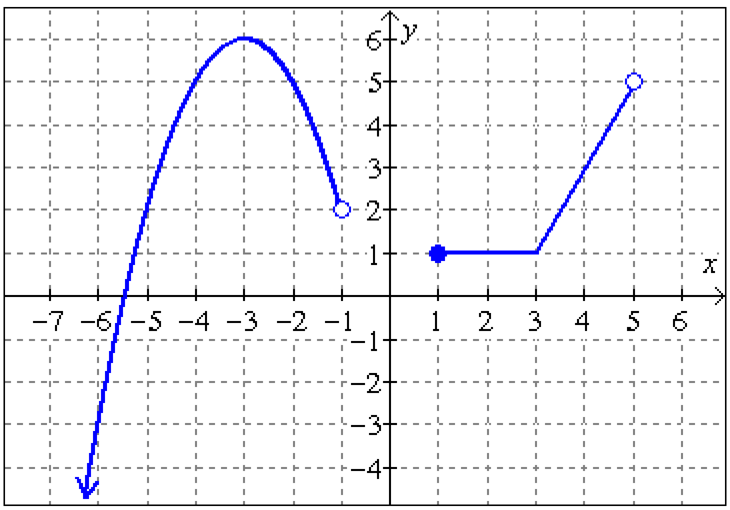


Figure 5: The graph of $y = m(x)$.

a. Evaluate $m(-5)$.

b. Evaluate $m(-1)$.

c. Evaluate $m(3)$.

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

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

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

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

h. Solve $m(x) \le -3$.

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

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

k. Find the domain and range of m. (Use interval notation.)

4. The graph of $y = F(x) = |x|$ is given in Figure 6.

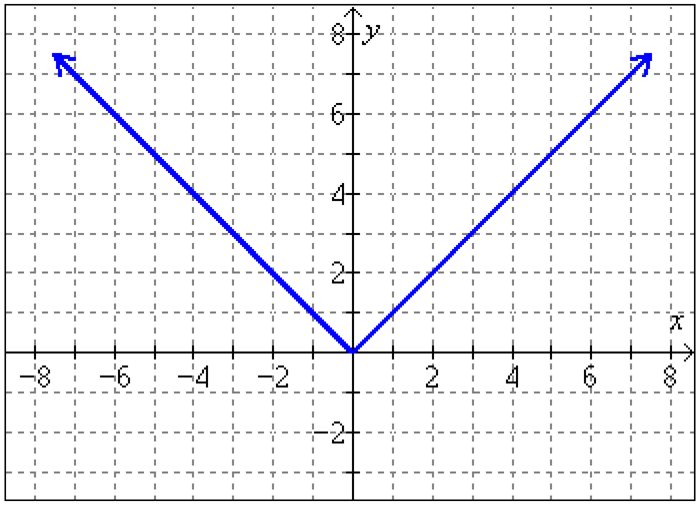


Figure 6: The graph of $y = F(x)$.

a. Find the domain and range of F. (Use interval notation.)

b. Solve the equation $F(x) = 4$.

c. Solve the inequality $F(x) < 5$. Express the solution in interval notation.

d. Solve the inequality $F(x) \geq 3$. Express the solution in interval notation.

e. Using a graphing calculator, graph $y = G(x) = |x - 3| + 2$ and then sketch the graph onto the grid in Figure 6 above. State the domain and range of G using interval notation. Do the graphs of F and G appear to be related? If so, explain.

f. Use your graph of $y = G(x)$ to solve $G(x) = 4$.

g. Use your graph of $y = G(x)$ to solve $G(x) = 1$.

h. Use your graph of $y = G(x)$ to solve $G(x) \leq 6$.

5. Let $Q(x) = x^3 + 7x^2 + 8x - 13$ and $P(x) = x + 2$. Use the graphing capabilities of your graphing calculator to solve the following:

a. $P(x) = Q(x)$

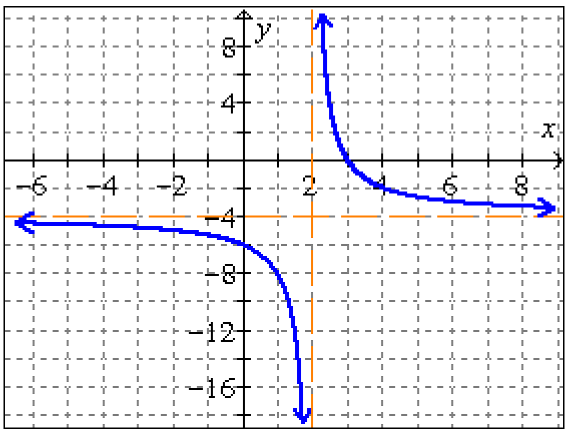
b. $P(x) < Q(x)$.

SUPPLEMENT TO §6.1

EXERCISES:

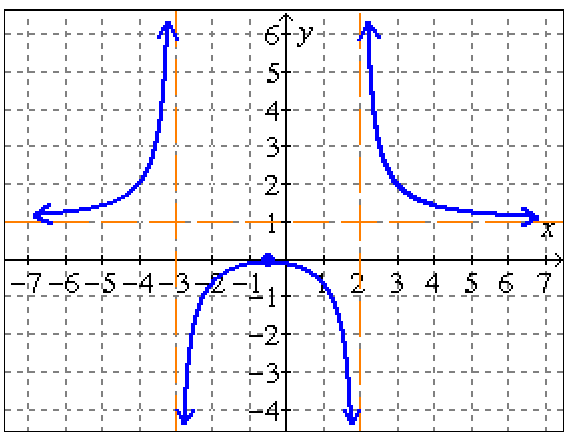
1. Find the domain and range of the functions graphed below. (Use interval notation.)

a.



The graph of $y = k(x)$.

b.



The graph of $y = j(x)$.

2. Let $f(x) = \dfrac{2x+1}{5-x}$. Simplify the expressions below.

a. $f(x) + 2$

b. $f(x + 2)$

c. $3f(x)$

d. $f(3x)$

SUPPLEMENT TO §6.2

When we simplify the algebraic formula for a function we can lose information about the domain. We need to communicate hidden domain restrictions after we cancel factors in the denominator.

EXAMPLE: Simplify the algebraic formula for $p(x) = \dfrac{3x+3}{4x^2-4x-8}$.

$$
\begin{aligned}
p(x) &= \frac{3x+3}{4x^2-4x-8} \\
&= \frac{3(x+1)}{4(x^2-x-2)} \\
&= \frac{3(x+1)}{4(x+1)(x-2)} \\
&= \frac{3\cancel{(x+1)}}{4\cancel{(x+1)}(x-2)} \\
&= \frac{3}{4(x-2)}, \quad x \neq -1
\end{aligned}
$$

(we write "$x \neq -1$" since we canceled the factor in the denominator that makes this restriction obvious)

EXERCISES:

1. Simplify the algebraic formulas for the following rational functions. Be sure to communicate domain restrictions hidden after you cancel factors in the denominator.

a. $f(x) = \dfrac{2x^2+6x}{3x+9}$

b. $T(x) = \dfrac{x^2+6x+9}{x^2-9}$

c. $g(x) = \dfrac{2x^2-x-6}{x^2+x-6}$

d. $L(x) = \dfrac{x^3-4x^2-5x}{2x^2-13x+15}$

e. $d(x) = \dfrac{x^2-16}{12-3x}$

f. $A(x) = \dfrac{12x^2-23x+10}{12x^2-23x+10}$

SUPPLEMENT TO §6.3

EXERCISES:

1. Let $S(x) = \frac{x+1}{x-3}$ and $R(x) = \frac{2}{x+2}$.

a. If $a(x) = S(x) + R(x)$, find a simplified expression for $a(x)$ and find the domain of a.

b. If $b(x) = S(x) - R(x)$, find a simplified expression for $b(x)$ and find the domain of b.

c. If $c(x) = S(x) \cdot R(x)$, find a simplified expression for $c(x)$ and find the domain of c.

d. If $d(x) = \frac{S(x)}{R(x)}$, find a simplified expression for $d(x)$.

SUPPLEMENT TO §7.1

EXERCISES:

1. Let $Y(x) = \sqrt{x-5} + 3$.

a. Find the domain of Y algebraically. (Use interval notation.)

b. Create a graph of $y = Y(x)$ on your graphing calculator.

c. Find the range of Y using your graph. (Use interval notation.)

2. Let $Z(x) = \sqrt{7-2x} - 5$.

a. Find the domain of Z algebraically. (Use interval notation.)

b. Create a graph of $y = Z(x)$ on your graphing calculator.

c. Find the range of Z using your graph. (Use interval notation.)

3. Let $U(t) = 2 - \sqrt{3 + 2t}$.

a. Find the domain of U algebraically. (Use interval notation.)

b. Create a graph of $y = U(x)$ on your graphing calculator.

c. Find the range of U using your graph. (Use interval notation.)

4. Let $V(x) = \sqrt[3]{x + 2}$.

a. Find the domain of V algebraically. (Use interval notation.)

b. Create a graph of $y = V(x)$ on your graphing calculator.

c. Find the range of V using your graph. (Use interval notation.)

5. Let $T(k) = 3 - \sqrt[4]{3k - 7}$.

a. Find the domain of T algebraically. (Use interval notation.)

b. Create a graph of $y = T(k)$ on your graphing calculator.

c. Find the range of T using your graph. (Use interval notation.)

SUPPLEMENT TO §7.6

EXERCISES:

1. Let $f(x) = \sqrt{8 - 4x}$.

a. Evaluate $f(-2)$.

b. State the domain of f using interval notation. (If you determine the domain algebraically, show these steps; if you determine the domain graphically, include a graph to justify your conclusion.)

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

2. **a.** Solve the equation $1 + \sqrt{x} = \sqrt{3x - 3}$ algebraically.

b. Now solve the equation $1 + \sqrt{x} = \sqrt{3x - 3}$ graphically using your calculator.

c. Check the solutions you found in part (a) to eliminate extraneous solutions.

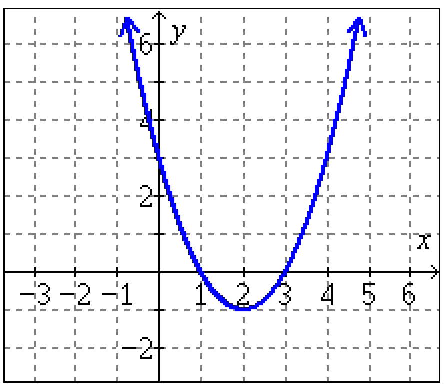
d. What is the connection between what you found in parts **b** and **c**?

SUPPLEMENT TO §8.2

EXERCISES:

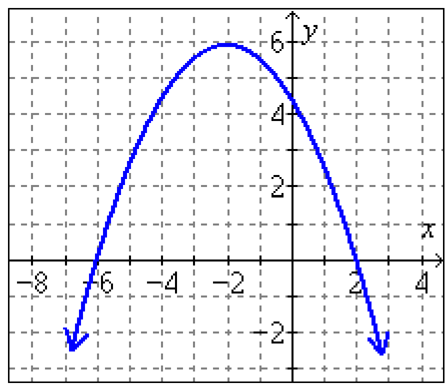
1. Use interval notation to express domain and range of the quadratic functions graphed below.

a.



The graph of $y = m(x)$.

b.



The graph of $y = n(x)$.

2. Graph of the quadratic function $f(x) = -0.4x^2 + 5x + 15$ on your graphing calculator. Be sure to find a viewing window that allows you to see the vertex and all intercepts.

a. Use either the min or max key to estimate the coordinates of the vertex of $y = f(x)$.

b. Use function notation to compose an equation that communicates the information contained in the vertex.

c. Use the zero/root key to estimate both horizontal intercepts of $y = f(x)$.

d. Use the trace key and substitute $x = 0$ to find the vertical intercept of $y = f(x)$.

e. Use interval notation to express the domain and range of f.

SUPPLEMENT TO §8.3

EXERCISES:

1. 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.

c. State and interpret the vertex of $y = F(t)$ as a maximum or minimum of the real life situation.

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

e. What is the domain of the real world function F ? Write your answer in interval notation. Explain your answer in a sentence.

f. What is the range of the real world function $F(t)$? Write your answer in interval notation. Explain your answer in a sentence.

g. At what time(s) will the water in the ditch be 1 foot deep? Round your solutions to three decimal places. Interpret your solutions in the context of the real world application.

h. At what time(s) will the water in the ditch be 6 feet deep? Round your solutions to three decimal places. Interpret your solutions in the context of the real world application.

i. Make a graph the parabola $y = F(t)$ **on its implied domain** without using your calculator. Scale and label your axes. (Start by plotting the vertex; then use what you learned in parts **a – h** to plot a few other points; finally, use the symmetry of a parabola to find at least one more point, and then connect all of your points.)

2. 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 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 is the horizontal distance at which the TV is 40 feet above the ground?

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

f. A six foot tall woman is positioned 130 feet from the trebuchet. How high above her head is the TV when it passes over her?

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.

ANSWERS

SUPPLEMENT TO §2.1:

1. **a.** Answers may vary. You could answer, "Yes," since, at a particular time, you can only be only one height. Or you could answer, "No," since, during a given year, you can grow and thus be more than one height at that age.

b. No. You can be the same height for many years.

c. Yes. Each G# is associated with only one name.

d. No. There can be more than one person with the same name attending PCC, so there can more than one G# associated with a particular name.

e. Yes, if you split the cost evenly. The cost per person, c, can be a function of the number of people splitting the pizza, n, given by $c = f(n) = \frac{20}{n}$. For each positive integer number, n, the cost c will be unique.

2. **a.** $p(0) = 4$.

b. $p(1.5) = 5.5$.

c. $p(5)$ is undefined.

d. $p(-7) = -1$.

e. $p(2) = 6$.

f. The solution set is $\{4\}$.

g. The solution set is $\{-6, 3\}$.

h. There is no solution.

i. The solution set is $\{x \mid -5 \le x \le -1 \text{ or } x \approx 2.5\}$.

j. The solution set is $\{x \mid x \approx -6.5 \text{ or } x \approx 3.2\}$.

k. The domain is $[-7, 5)$.

l. The range is $(-3, 6]$.

m. $\{x \mid -6 < x < 3\}$.

3. **a.** $K(8) = 135$. After 8 days of rafting, the group has floated 135 miles down the Colorado River.

b. $K(35)$ is undefined. The rafting trip was finished after 15 days, so the group was no longer rafting 35 days after starting the trip.

c. The solution to $K(t) = 125$ is $t = 7$ since the group had floated down 125 miles of the Colorado River 7 days after staring the trip.

d. The average rate of change is 27.5 mi/day. This means that each day between days 11 and 13 the rafting group traveled an average of 27.5 mi.

e. The vertical intercept is $(0, 0)$, so the vertical and horizontal intercepts are the same. This point means that after 0 days of rafting, the group had floated 0 miles down the Colorado River.

f. The domain is $[0, 15]$. The input values for this function represent the number-of-days of the rafting trip and the trip was 15 days long, so all time periods between (and including) 0 and 15 days must be in the domain.

g. The range is $[0, 277]$. The rafters floated all 277 miles of the Grand Canyon so at some moment during the 15 day trip, the rafters had floated each unique distance between (and including) 0 and 277 miles, so all of these values must be in the range.

4. **a.** $(0, 600)$ is the vertical intercept. It means that when the computer is brand new, it is worth \$600.

b. $(4, 0)$ is the horizontal intercept. It means that when the computer is 4 years old, it is worth nothing.

c. Domain: $[0, 4]$. Range: $[0, 600]$.

5. **a.** $r(x) = 0.6x$

b. Domain: $\{0, 1, 2, ..., 2775, 2776\}$.

Range: $\{0.00, 0.60, 1.20, 1.80, ... ,1664.40, 1665.00, 1665.60\}$.

6. $f(29) = 30$ means that on January 30, 2009, the recorded low temperature in Portland was 30° F.

7. **a.** $y = f(x+6) = 1 - 0.5x$ and $y = f(x) + 6 = 10 - 0.5x$

b. Check your graph by graphing these functions on your graphing calculator.

8. $p(x+2) = x^2 + 4x + 4$

$p(x) + 2 = x^2 + 2$

} Not Equal

9. **a.** $j(3t) = 18t^2 - 3t + 4$

b. $j(3-t) = 2t^2 - 11t + 19$

c. $3j(t) = 6t^2 - 3t + 12$

d. $3 - j(t) = -2t^2 + t - 1$

10. $g(x) = 43x - 150$

11. $h(x) = \frac{9}{5}x + 11$

12. $j(x) = -\frac{3}{8}x + \frac{11}{4}$

13. **a.** $f(6) \approx -95$. This means that in 2001 Yahoo lost about 95 million dollars.

b. The solution is approximately 7.5, which means that about 7.5 years after 1995, i.e., somewhere in the middle of 2002, Yahoo made 120 million dollars.

c. A set of approximate solutions is $\{4, 5.1, 7.1\}$. These solutions mean that in 1999, 2000, and 2002 Yahoo made about 60 million dollars.

d. $f(x) = -100$. There is no solution to this, which means that Yahoo has never lost 100 million dollars after 1995.

SUPPLEMENT TO §3.3:

1. **a.** No solution.

b. The solution set is $(-\infty, \infty)$.

c. No solution.

SUPPLEMENT TO §3.4:

1. **a.** The solution set is $(-1, 3)$.

b. The solution set is $(-\infty, 0] \cup [2, \infty)$.

c. The solution set is $[-2, 0) \cup (2, 4]$.

d. No solution.

e. Domain: $(-\infty, \infty)$. Range: $[-3, \infty)$.

2. **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 $\{x \mid x \approx -3.2$ or $x \approx 0.5$ or $x \approx 2.8\}$.

e. Domain: $(-\infty, 1) \cup (1, \infty)$. Range: $(-\infty, \infty)$.

3. **a.** $m(-5) = 2$.

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

c. $m(3) = 1$.

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

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

f. The solution set is $\{x \mid x \approx -4.8$ or $x \approx -1.3$ or $x = 4\}$.

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

h. The solution set is $(-\infty, -6]$.

i. The solution set is $(-5.5, -1) \cup [1, 5)$.

j. The solution set is $(-4, -2)$.

k. Domain: $(-\infty, -1) \cup [1, 5)$. Range: $(-\infty, 6]$.

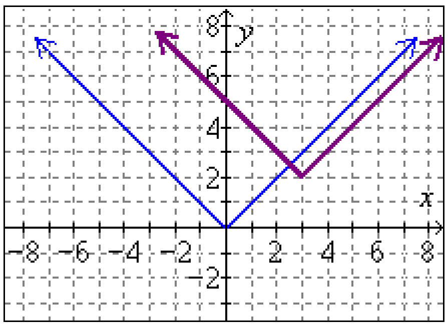
4. a. Domain: $(-\infty, \infty)$. Range: $[0, \infty)$.

b. The solution set is $\{-4, 4\}$.

c. The solution set is $(-5, 5)$.

d. The solution set is $(-\infty, -3] \cup [3, \infty)$.

e.



Domain: G $(-\infty, \infty)$. Range: $[2, \infty)$.

Compared with the graph of $F(x) = |x|$, the graph of $G(x) = |x - 3| + 2$ appears to be shifted right 3 units and shifted up 2 units.

f. The solution set is $\{1, 5\}$.

g. No solution.

h. The solution set is $[-1, 7]$.

5. a. The solution set is $\{-5, -3, 1\}$.

b. The solution set is $(-5, -3) \cup (1, \infty)$.

SUPPLEMENT TO §6.1:

1. a. Domain: $(-\infty, 2) \cup (2, \infty)$.
Range: $(-\infty, -4) \cup (-4, \infty)$.

b. Domain: $(-\infty, -3) \cup (-3, 2) \cup (2, \infty)$.
Range: $(-\infty, 0] \cup (1, \infty)$.

2. a. $f(x)+2=\dfrac{11}{5-x}$.

b. $f(x+2)=\dfrac{2x+5}{3-x}$.

c. $3f(x)=\dfrac{6x+3}{5-x}$.

d. $f(3x)=\dfrac{6x+1}{5-3x}$.

SUPPLEMENT TO §6.2:

1. a. $$f(x)=\frac{2x^2+6x}{3x+9}=\frac{2x}{3},\quad x\neq -3$$

b. $$T(x)=\frac{x^2+6x+9}{x^2-9}=\frac{x+3}{x-3},\quad x\neq -3$$

c. $$g(x)=\frac{2x^2-x-6}{x^2+x-6}=\frac{2x+3}{x+3},\quad x\neq 2$$

d. $$L(x)=\frac{x^3-4x^2-5x}{2x^2-13x+15}=\frac{x(x+1)}{2x-3},\quad x\neq 5$$

e. $$d(x)=\frac{x^2-16}{12-3x}=-\frac{x+4}{3},\quad x\neq 4$$

f. $$A(x)=\frac{12x^2-23x+10}{12x^2-23x+10}=1,\quad x\neq \tfrac{5}{4},\ x\neq \tfrac{2}{3}$$

SUPPLEMENT TO §6.3:

1. a. $a(x)=\dfrac{x^2+5x-4}{(x+2)(x-3)}$; Domain: $\{x \mid x\neq -2 \text{ and } x\neq 3\}$

b. $b(x)=\dfrac{x^2+x+8}{(x+2)(x-3)}$; Domain: $\{x \mid x\neq -2 \text{ and } x\neq 3\}$

c. $c(x) = \dfrac{2(x+1)}{(x+2)(x-3)}$; Domain: $\{x \mid x \neq -2 \text{ and } x \neq 3\}$

d. $d(x) = \dfrac{(x+1)(x+2)}{2(x-3)}$

SUPPLEMENT TO §7.1:

1. **a.** $[5, \infty)$

c. $[3, \infty)$

2. **a.** $\left(-\infty, \frac{7}{2}\right]$

c. $[-5, \infty)$

3. **a.** $\left[-\frac{3}{2}, \infty\right)$

c. $(-\infty, 2]$

4. **a.** $(-\infty, \infty)$

c. $(-\infty, \infty)$

5. **a.** $\left[\frac{7}{3}, \infty\right)$

c. $(-\infty, 3]$

SUPPLEMENT TO §7.6:

1. **a.** $f(-2) = 4$

b. $(-\infty, 2]$

c. $x = 1$

2. **a.** Algebraically, we get two solutions: $x = 1, \quad x = 4$.

b. Graphically, we get one solution: $x = 4$.

c. $x = 1$ does not satisfy the original equation, leaving $x = 4$ as the only solution.

d. We see that the algebraic solutions which do not work in the original equation also do not show up as solutions when solving graphically.

SUPPLEMENT TO §8.2:

1. **a.** Domain: $(-\infty, \infty)$. Range: $(-1, \infty)$.

b. Domain: $(-\infty, \infty)$. Range: $(-\infty, 6]$.

2. **a.** The coordinates of the vertex are approximately $(-6.25, 30.625)$.

b. $f(-6.25) = 30.625$.

c. The horizontal intercepts are approximately $(-2.5,0)$ and $(15,0)$.

d. The vertical intercept is $(0, 15)$.

e. Domain: $(-\infty, \infty)$. Range: $(-\infty, 30.625]$.

SUPPLEMENT TO §8.3:

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

b. $F(t) = -(t-1)^2 + 4$.

c. The vertex is $(1, 4)$. One hour after the storm ended, the water in the ditch reached its maximum depth of 4 feet.

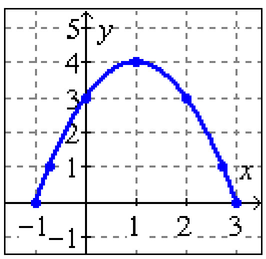
d. The solution set is $\{-1, 3\}$.

e. Domain: $[-1, 3]$. 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, and between these two times there was always water in the ditch, so all values between (and including) -1 and 3 need to be in the domain.

f. Range: $[0, 4]$. The range represents all possible water depths in the ditch. Since the maximum depth is 4 feet and the minimum depth is 0 feet (when the ditch is dry), and since all depths between these are possible, all values between (and including) 0 and 4 need to be in the range.

g. 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.

h. The solution set contains only non-real solutions, which indicates that the water level is never 6 feet deep in the ditch.

i. 

2. a. $(0, 28)$. The TV is launched from a height of 28 feet.

b. $(-20, 0)$ and $(140, 0)$. Only the second point makes sense in context. The TV lands 140 feet horizontally from where it was launched.

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 gets 75 feet above the ground.

f. The TV is 9 feet above her head when it passes over her.

g. $[0, 140]$ because, at some point during its trip, the TV's horizontal distance was each unique value between (and including) 0 and 140 feet, so all of these values must be in the domain.

h. $[0, 64]$ because, at some point during its trip, the TV's height was each unique value between (and including) 0 and 64 feet, so all of these values must be in the range.