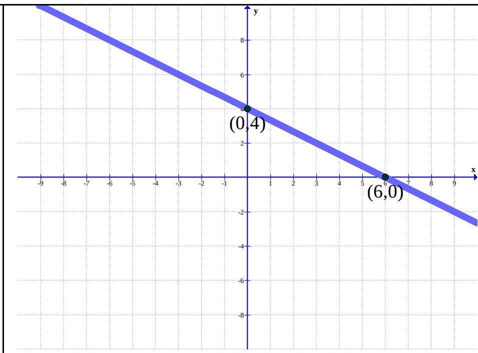
Chapter 3: Introduction to Functions and Relations
Solutions to Selected Odd Problems

Section 3.1

1) $2x + 3y = 12$

x-intercepts (let $y = 0$)
$2x + 3(0) = 12$
$2x = 12$
$x = 6$

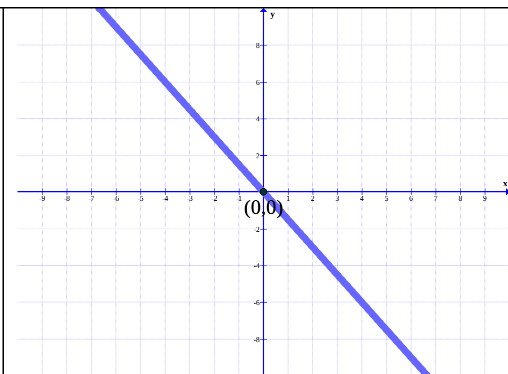
y-intercept (let $x = 0$)
$2(0) + 3y = 12$
$3y = 12$
$y = 4$
Solution: x-intercept (6,0) y-intercept (0,4)



5) $3x + 2y = 0$

x-intercept (let $y = 0$)
$3x + 2(0) = 0$
$3x = 0$
$x = 0/3$
$x = 0$

y-intercept (let $x = 0$)
$3(0) + 2y = 0$
$2y = 0$
$y = 0/2$
$y = 0$
Solution: x-intercept (0,0) y-intercept (0,0)

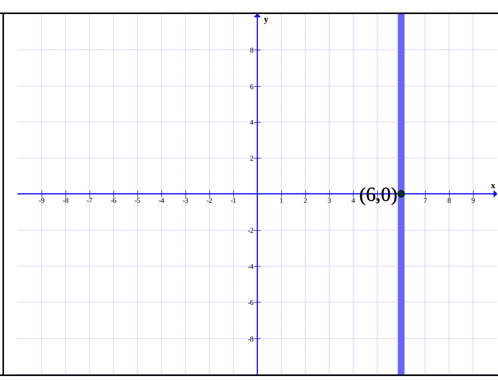


9) $x = 6$

There is no algebra needed to find the intercepts. The equation only has an x, so the graph is a vertical line. It does not have a y-intercept because the graph is parallel to the y-axis.

The graph crosses the x-axis at x=6.

Solution: x-intercept (6,0) y-intercept (none)



Chapter 3: Introduction to Functions and Relations
Solutions to Selected Odd Problems

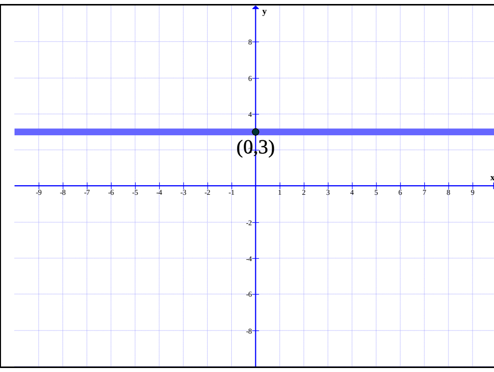
Section 3.1

13) y = 3

There is no algebra needed to find the intercepts. The equation only has an y, so the graph is a horizontal line. It does not have a x-intercept because the graph is parallel to the x-axis.

The graph crosses the x-axis at x=3.

Solution: x-intercept (none) y-intercept (0,3)



19) x – y = 1
subtract x from both sides to get: -y = -x + 1
Multiply each term by (-1) :
(-1)(-y) = (-1)(-x) + (-1)(1)
This gives: y= x – 1
Solution: slope intercept form y = x – 1
slope = 1, y-intercept = (0,-1)

21) 2x + 4y = 16
First subtract 2x from both sides to get:
4y = -2x + 16
Then divide each term by 4. $\frac{4y}{4} = \frac{-2x}{4} + \frac{16}{4}$
This gives $\boldsymbol{y = -\frac{1}{2}x + 4}$
Solution: Slope intercept form $\boldsymbol{y = -\frac{1}{2}x + 4}$
Slope = $-\frac{1}{2}$**, y-intercept = (0,4)**

23) x – 2y = 0
Add x to both sides to get: -2y =- x
Then divide by (-2): $\frac{-2y}{-2} = \frac{-x}{-2}$
This gives: $\boldsymbol{y = \frac{1}{2}x}$
Solution: Slope intercept form $\boldsymbol{y = \frac{1}{2}x}$
Slope = $\frac{1}{2}$**, y-intercept = (0, 0)**

27) $\frac{1}{3}x + \frac{2}{5}y = 4$
Multiply by 15 to clear the fractions:
$15 \cdot \frac{1}{3}x + 15 \cdot \frac{2}{5}y = 15 \cdot 4$
This gives: 5x + 6y = 60
Subtract 5x from both sides to get: 6y = - 5x + 60
Divide each term by 6: $\frac{6y}{6} = \frac{-5x}{6} + \frac{60}{6}$
This gives: $\boldsymbol{y = -\frac{5}{6}x + 10}$
Solution: $\boldsymbol{y = -\frac{5}{6}x + 10}$
Slope = $-\frac{5}{6}$**, y-intercept =** $\boldsymbol{(0, 10)}$

Chapter 3: Introduction to Functions and Relations
Solutions to Selected Odd Problems

Section 3.1

29) (1,4) and (3,5)

$m = \frac{5-4}{3-1} = \frac{1}{2}$

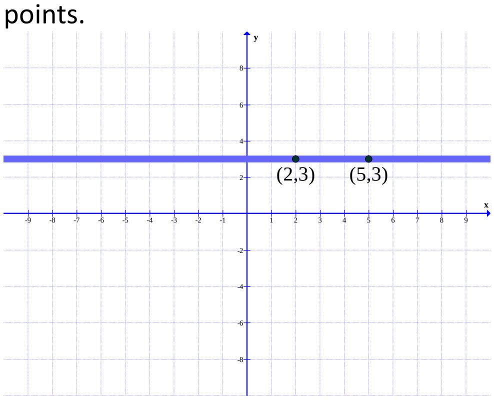
Solution: Slope = $\mathbf{\frac{1}{2}}$

33) $\left(\frac{1}{2}, \frac{2}{3}\right)$ *and* $\left(\frac{3}{2}, \frac{5}{6}\right)$

$m = \frac{\frac{5}{6} - \frac{2}{3}}{\frac{3}{2} - \frac{1}{2}} = \frac{\frac{5}{6} - \frac{4}{6}}{\frac{2}{2}} = \frac{\frac{1}{6}}{1} = \frac{1}{6}$

Solution: Slope = $\frac{1}{6}$

35) Given the points (2,3) and (5,3),
a) Graph the points and the line through the points.



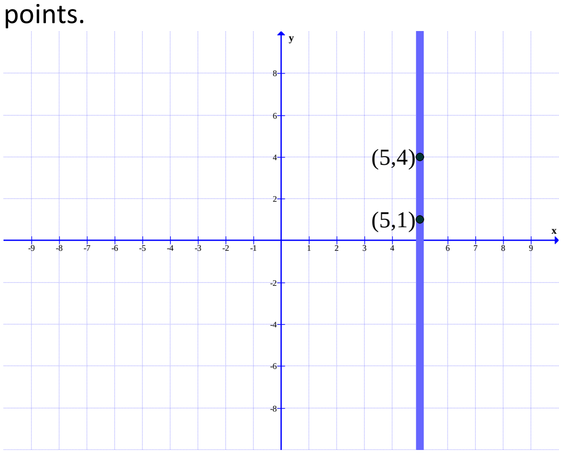
35 b) Find the slope of the line.

$m = \frac{3-3}{5-2} = \frac{0}{3} = 0$
(any fraction with a
zero in the numerator equals 0)

Solution: Slope = 0

35 c) Fill in the blank:
The slope of a horizontal line is **<u>Solution: 0</u>**

37) Given the points (5,1) and (5,4),
a) Graph the points and the line through the points.



37 b) Find the slope of the line

$m = \frac{4-1}{5-5} = \frac{3}{0} = undefined$

(any fraction with zero in the denominator is undefined)

Slope = undefined

37c) Fill in the blank:
The slope of a vertical line is: **<u>Solution: undefined</u>**

Chapter 3: Introduction to Functions and Relations
Solutions to Selected Odd Problems

Section 3.1

43) The slope is -3 and the line passes through (5, 6)

$y - 6 = -3(x - 5)$

$y - 6 = 3x + 15$

$y = 3x + 21$

Solution: y = -3x + 21

45) The slope is $\frac{2}{3}$ and the line passes through (-2,5)

$y - 5 = \frac{2}{3}(x - (-2))$

$y - 5 = \frac{2}{3}x + \frac{4}{3}$

$y = \frac{2}{3}x + \frac{4}{3} + 5$

$y = \frac{2}{3}x + \frac{4}{3} + \frac{15}{3}$

Solution: $\boldsymbol{y = \frac{2}{3}x + \frac{19}{3}}$

47) The slope is 0 and the line passes through (1,5)

$y - 5 = 0(x - 1)$
$y - 5 = 0$

$y = 5$

(of course, I could have done this without algebra, if slope is zero the equation will only have a y, and the answer had to be y = 5 (as 5 is the only y in the problem))

Solution: y = 5

49) The line passes through the points (4,5) and (5,1)

First find slope: $m = \frac{1-5}{5-4} = \frac{-4}{1} = -4$

Second us e point slope form with the slope and either point.

It doesn't matter which point you choose.
I will use m = -4 and point = (4,5)

$y - 5 = -4(x - 4)$

$y - 5 = -4x + 16$

$y = -4x + 21$

Solution: y = -4x + 21

53) The line passes through the point (1,5) and is perpendicular to the line y = 3.

The line must be a vertical line to be perpendicular to the given horizontal line y = 3.

Hence the equation of the perpendicular line must only have an x. The equation must be x =1.

Solution: x = 1

Chapter 3: Introduction to Functions and Relations
Solutions to Selected Odd Problems

Section 3.1

55) The line passes through the point (-3,4) and is parallel to the line y = 2.

The given line y = 2, is a horizontal line. The line I need to find must also be horizontal to be parallel to the given line. The line I need to find can only have a y in the equation to be horizontal. The equation must be y = 4.

Solution: y = 4

57) The line passes through the points (1,2) and (1,3)

First find the slope: $m = \frac{3-2}{1-1} = \frac{1}{0} = undefined$ (fraction with zero in the denominator is undefined)

I am asked to find the equation of a line with undefined slope. Therefore my equation can only have an x. My answer must be: x = 1 (as 1 is the only x value in the problem)

Solution: x = 1

59) The line passes through the points (1,2) and (3,2)

First find the slope: $m = \frac{2-2}{3-1} = \frac{0}{2} = 0$ (fractions with 0 in the numerator are equal to zero)

I am asked to find the equation of a line with zero slope. Therefore my equation can only have a y. My answer must be y =2 (as 2 is the only y value in the problem)

Solution: y = 2

Chapter 3: Introduction to Functions and Relations
Solutions to Selected Odd Problems

Section 3.2

3) Write each relation as a set of ordered pairs, then list the domain and the range.

x	3	4	5	6	7
y	1	1	3	5	8

To write the relation as a set of ordered pairs just make points putting the x first and y second.

The domain is all the x values of any point.

The range is all the y values of any point. I don't have to write the 1 twice, even though it occurs twice.

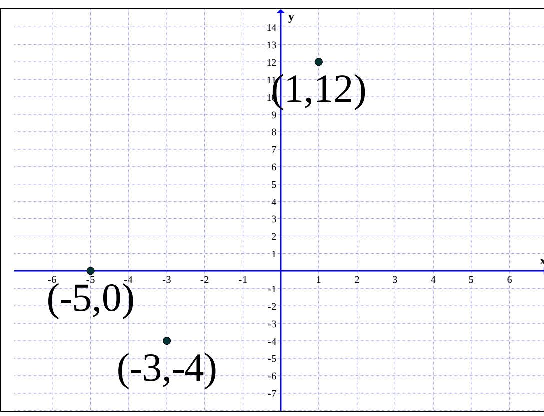
Solution: { (3,1) (4,1) (5,3) (6,5) (7,8)}

Domain {3,4,5,6,7} Range {1,3,5,8}

5) Domain is all the x values of the points in the relation.

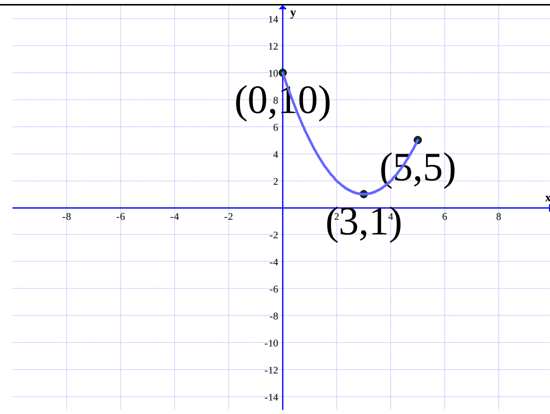
Range is all the y values of the points in the relation.

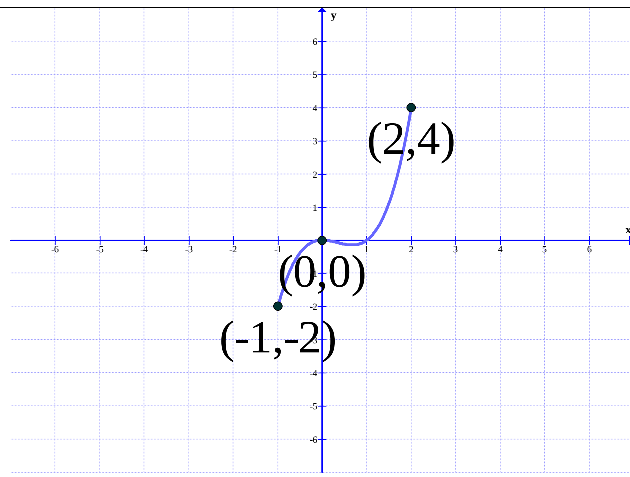
Solution: Domain {-5,-3,1} Range {-4,0,12}



Chapter 3: Introduction to Functions and Relations
Solutions to Selected Odd Problems

Section 3.2

7) To find the domain I have to identify: Far left point: (0, 10) Far right point (5, 5) The domain is the interval formed from the x coordinate of these points, with the left point written first. These points are actually on the graph so they get square brackets. **Solution: Domain = [0, 5]** To find the range I have to identify: Bottom point (3,1) Top point (0, 10) The range is the interval made from the y coordinates of these points with the bottom written first. These points are actually on the graph so they get square brackets. **Solution: Range [1, 10]**	

9) To find the domain I have to identify: Far left point: (-1, -2) Far right point (2,4) The domain is the interval formed from the x coordinate of these points, with the left point written first. These points are actually on the graph so they get square brackets. **Solution: Domain = [-1, 2]** To find the range I have to identify: Bottom point (-1,-2) Top point (2,4) The range is the interval made from the y coordinates of these points with the bottom written first. These points are actually on the graph so they get square brackets. **Solution: Range [-2, 4]**	

Chapter 3: Introduction to Functions and Relations
Solutions to Selected Odd Problems

Section 3.2

11) To find the domain I have to identify:
Far left point: $(-\infty, \infty)$
Far right point (∞, ∞)

The graph doesn't have periods at the end so I assume it goes on forever.
The domain is the interval formed from the x coordinate of these points, with the left point written first. These points aren't actually on the graph so they get round brackets.

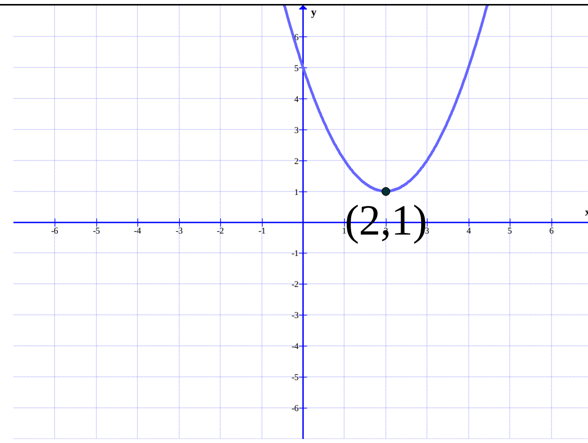
Solution: Domain = $(-\infty, \infty)$

To find the range I have to identify:
Bottom point (2,1)

Top point $(-\infty, \infty)$ $\boldsymbol{or}$ (∞, ∞)

The range is the interval made from the y coordinates of these points with the bottom written first. These bottom point is actually on the graph and gets a square bracket, the top point is not actually on the graph and gets a round bracket.

Solution: Range = $[\mathbf{1}, \infty)$



Chapter 3: Introduction to Functions and Relations
Solutions to Selected Odd Problems

Section 3.3

1) { (1,2) (3,2) (4,2) (5,2)}

All of the points have different x's, so the answer is yes.

Solution: yes, y is a function of x

3) { (1,2) (3,4) (5,6) (7,8) (9,10)}

All of the points have different x's, so the answer is yes.

Solution: yes, y is a function of x

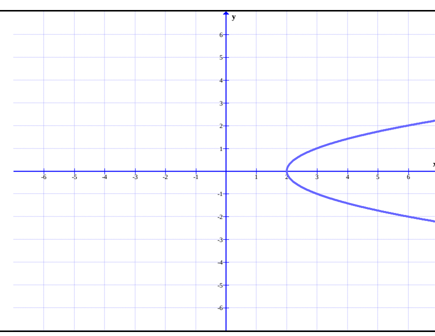
5) { (3,1) (4,5) (3,6) }

There are two points that have the same x value, so the answer is no.

Solution: no, y is not a function of x

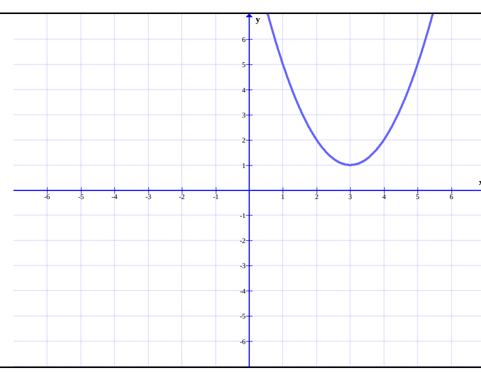
7) A vertical line can be drawn to touch the graph in more than one place. The graph fails the vertical line test.

Solution: y is not a function of x



9) NO vertical line can be drawn to touch the graph in more than one place. The graph passes the vertical line test.

Solution: y is a function of x



Chapter 3: Introduction to Functions and Relations
Solutions to Selected Odd Problems

Section 3.3

13) $f(3) = 3(3) + 4$
$= 9 + 4$
$= 13$
Solution: f(3) = 13

17) $h(2) = 4$
I would like to replace an x with the number 4.
The function has no x.
The answer will just be the right side o
f the equation which is 4.

Solution: h(2) = 4

23) $f(b+1) = 3(b+1) + 4$

$= 3b + 3 + 4 = 3b + 7$

Solution: f(b+1) = 3b + 7

27) $g(x-2)= (x-2)^2 + 5(x-2) + 6$
$= (x-2)(x-2) + 5(x-2) + 6$
$= x^2 - 2x - 2x + 4 + 5x - 10 + 6$
$= x^2 - x$

Solution: $g(x-2) = x^2 + x$

31) Identify the domain of f.
The domain is all of the x-coordinates of
the points in the f function.

Solution: Domain {1,2,3,9}

33) Identify the range of f

The range is all of the y values of
the points in the f function.

Solution: Range {2,3,5}

35) For what value(s) of x is f(x) = 3?

This is asking for the x coordinate of
any point in the f function that has
a y coordinate of 3.

Solution: x = 2 and x = 9

37) For what value(s) of x is g(x) = -2

This is asking for the x coordinate of any
point in the g function that
has a y coordinate of -2.

Solution: x = 1 and x = 4

39) Find f(3)
This is asking for the y coordinate of
the point in the f function that has an x of 3.

Solution: f(3) = 5

Chapter 3: Introduction to Functions and Relations
Solutions to Selected Odd Problems

Section 3.3

41) Find g(6)

This is asking for the y coordinate of
the point in the g function that has an x of 6.

Solution: g(6) = 4

47) $m(x) = \frac{x+2}{x-3}$
To find the domain, ignore the numerator.
Then solve the equation the denominator = 0.
Exclude the answer to this in your solution.

x – 3 = 0

x = 3 (I must exclude x = 3 in my solution)

Solution: $\boldsymbol{domain}\ (-\infty, \mathbf{3}) \cup (\mathbf{3}, \infty)$

49) f(x) = x + 2

There is no algebra needed to find the domain.

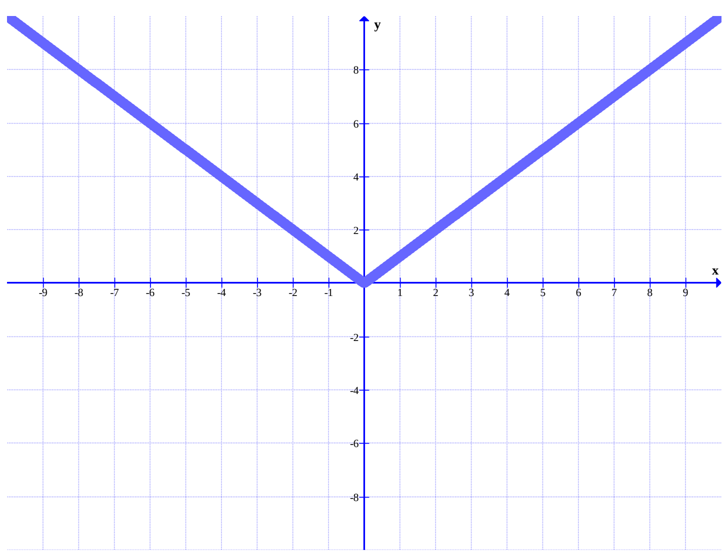
The function is defined for every real number.

Solution: domain $(-\infty, \infty)$

Section 3.4

1) $f(x) = |x|$ **Solutions written in the table**

x	f(x)	computations
-2	2	$f(-2) = \|-2\| = 2$
-1	1	$f(-1) = \|-1\| = 1$
0	0	$f(0) = \|0\| = 0$
1	1	$f(1) = \|1\| = 1$
2	2	$f(2) = \|2\| = 2$



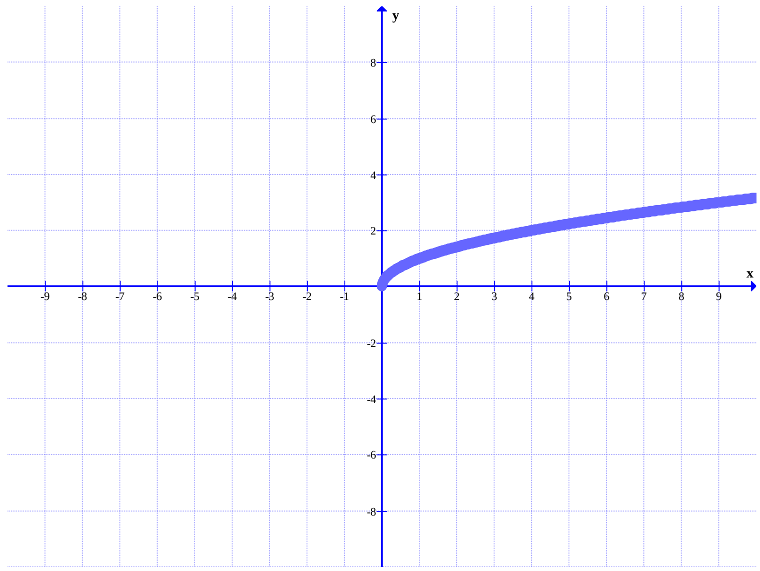
Chapter 3: Introduction to Functions and Relations
Solutions to Selected Odd Problems

Section 3.4

3) $h(x) = \sqrt{x}$ **Solutions written in the table**

x	h(x)	computations
0	0	$h(0) = \sqrt{0} = 0$
1	1	$h(1) = \sqrt{1} = 1$
4	2	$h(4) = \sqrt{4} = 2$
9	3	$h(9) = \sqrt{9} = 3$
16	4	$h(16) = \sqrt{16} = 4$

(ask me why I don't have any negative values in the x column if you do not know why)



5) f(x) = 2x – 6

x- intercept (replace f(x) with 0)
0=2x-6
6 = 2x
3 = x

y- intercept (find f(0))
f(0) = 2(0)-6
f(0) = -6

Solution: x-intercept (3,0) y-intercept (0,-6)

7) h(x) = -3x

x- intercept (replace h(x) with 0)
0 = -3x
0/-3 = x
0 = x

y- intercept (find h(0))
h(0) = -3(0)
h(0) = 0

Solution: x-intercept (0,0) y-intercept (0,0)

13) h(x) = 2x(x – 3)(x – 4)

x-intercept (replace h(x) with 0)
0=2x(x – 3)(x – 4)
2x = 0 or x- 3 = 0 or x – 4 = 0
x = 0 or x = 3 or x = 4

y-intercept (find h(0))
h(0) = 2(0)(0- 3)(0 – 4)
h(0) = 0(-3)(-4)
h(0) = 0

Solution: x-intercepts (0,0) (3,0) (4,0) y-intercept (0,0)

Chapter 3: Introduction to Functions and Relations
Solutions to Selected Odd Problems

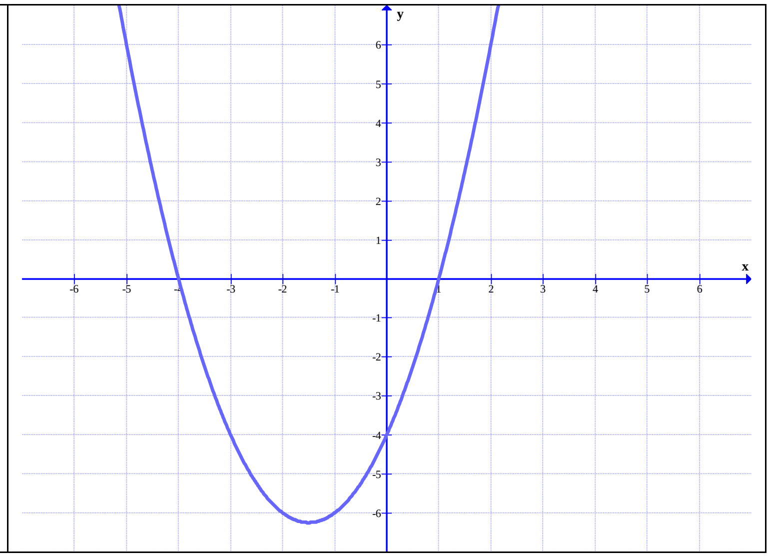
Section 3.4

19) $f(x) = x^2 + 3x - 4$

The x-intercepts are the two points where the graph crosses the x-axis.

The y-intercepts is the point where the graph crosses the y-axis.

Solution: x intercepts (-4,0) and (1,0)
y-intercept (0,-4)



Section 3.5

1) W varies directly as the square of x.

You should think of this as W is some number multiplied by the square of x.

Solution: $W = kx^2$

5) Q is inversely proportional to the square root of x

You should think divide.

Solution: $Q = \frac{k}{\sqrt{x}}$

Chapter 3: Introduction to Functions and Relations
Solutions to Selected Odd Problems

Section 3.5

7) M varies jointly as the square of x and the cube of y.

You should think of this as M is some number times the product of the square of x and cube of y.

Solution: $M=kx^2y^3$

9) y varies directly as the square of x and y is 45 when x is 3.

First write a variation model:
$y= kx^2$

Then plug in 45 for y and 3 for x and solve for k.

$45=k(3)^2$
$45 = 9k$
$k = 5$

Solution: $k = 5$

13) N varies jointly as x and y. When x is 2 and y is 3, N is 42.

First write a variation model:
$N = kxy$

Then substitute the given values and solve for k.

$42 = k(2)(3)$
$42 = 6k$
$7 = k$

Solution: $k = 7$

15) Y varies directly as the cube of x. Y is 24 when x = 2. Find Y when x = 5.

First write a variation model:
$Y=kx^3$

Then substitute 24 for Y and 2 for x and solve for k.

$24=k(2)^3$
$24 = 8k$
$3 = k$
Then substitute 5 for x, 3 for k and find Y.

$Y = 3(5)^3$
$Y= 3(125)$
$Y = 375$

Solution: $y = 375$

Chapter 3: Introduction to Functions and Relations
Solutions to Selected Odd Problems

Section 3.5

19) Y varies jointly as x and the square of z.
Y is 48 when z is 2 and x is 3.
Find Y when x is 3 and z is 4.

First write a variation model:
$Y = kxz^2$

Then substitute 48 for Y and 2 for z,
3 for x and solve for k.

$48 = k(3)(2)^2$
$48 = 12k$
$4 = k$

Then substitute 3 for x,
4 for z, 4 for k and find Y.
$Y = 4(3)(4)^2$

$Y = 4(3)(16)$
$Y = 192$

Solution: Y=192

21) The number of days required to build a bridge is varies inversely to the number of workers. A bridge can be built in 12 days with 20 workers. How long will it take to build with 30 workers?

Let D = number of days to build a bridge
Let W = number of workers

Now write a variation model.

$D = \frac{k}{W}$

Substitute D = 12, W = 20 and solve for k

$12 = \frac{k}{20}$
$240 = k$

Lastly, substitute k =240, W = 30 into the variation model and solve for D.

$D = \frac{240}{30}$

Solution: 8 days

Chapter 3: Introduction to Functions and Relations
Solutions to Selected Odd Problems

Section 3.5

23) The distance a ball rolls down an inclined plane is directly proportional to the square of the time it rolls. During the first second, the ball rolls 8 feet. How far will the ball roll during the first 3 seconds?

Let D = distance ball rolls
Let t = time in seconds

Write a variation model.

$D = kt^2$

Substitute 8 for d, and 1 for t, then solve for k.
$8 = k(1)^2$
8 = k

Substitute 3 for t and solve for D

$D = 8(3^2)$
D = 8*9

Solution: 72 feet

Chapter 3: Introduction to Functions and Relations
Solutions to Selected Odd Problems

Section 3.5

27. The simple interest (I) on an investment varies directly to the amount of the investment (A). An investment of $2500 yields interest of $125. How much interest will a $4000 investment yield?

The variables are defined. I can start by writing a variation model.

$I = kA$

Substitute $I = 125$, $A = 2{,}500$ and solve for k.

$125 = k(2500)$

$.05 = K$

Substitute $k=.05$,and $A = 4{,}000$ and solve for I.

$I = .05(4{,}000)$

$I = 200$

Solution: $200