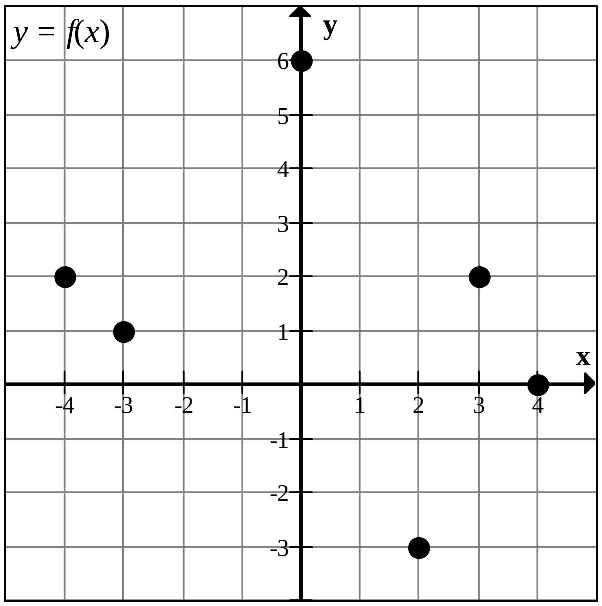
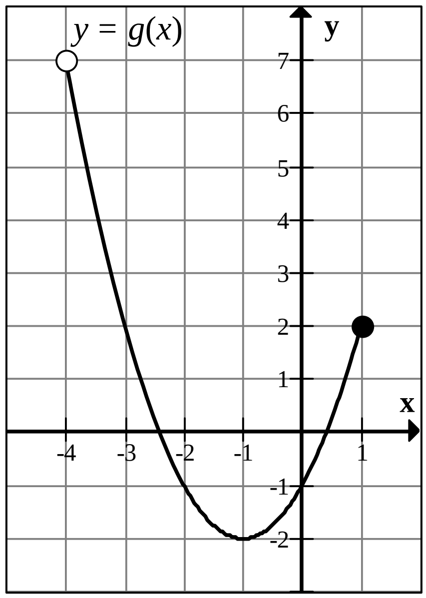
Mth65 Required Course Supplement

Supplement to §10.6

1.) Functions *f*, *g*, *h* and *j* are defined below. Use them to answer the questions.





x	$y = h(x)$
-7	-3
0	64
1	64
-5	-4
17	0
20	3

$j(x) = 3x - 7$

a.) Evaluate $f(-3)$.

b.) Evaluate $g(-3)$.

c.) Evaluate $h(0)$.

d.) Evaluate $j(-3)$.

e.) Evaluate $f(1)$.

f.) Evaluate $h(-3)$.

For parts g-o, write your solutions in a solution set.

g.) Solve $j(x) = 11$

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

i.) Solve $h(x) = 64$.

j.) Solve $g(x) = -2$.

k.) Solve $h(x) = 0$.

l.) Solve $g(x) = 2$.

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

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

o.) Estimate the solution: $g(x) = 4$.

p.) State the domain of f.

q.) State the range of f.

r.) State the domain of g.

s.) State the range of g.

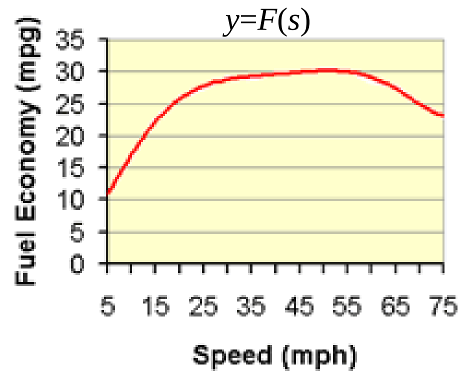
t.) State the domain of h.

u.) State the range of h.

v.) State the domain of j.

w.) State the range of j.

2.) Speeding, rapid acceleration and braking wastes gas. These bad habits can lower your gas mileage by 33% at highway speeds and by 5% around town. The graph below gives the Fuel Economy F (in miles per gallon) for the speed driven s (in miles per hour) for a specific model car. Use the graph to answer the questions below. (http://www.fueleconomy.gov/feg/driveHabits.shtml)



a.) The x value 0 is not shown on the graph above. Can you reason out what $F(0)$ must be? Explain your answer in a complete sentence including units.

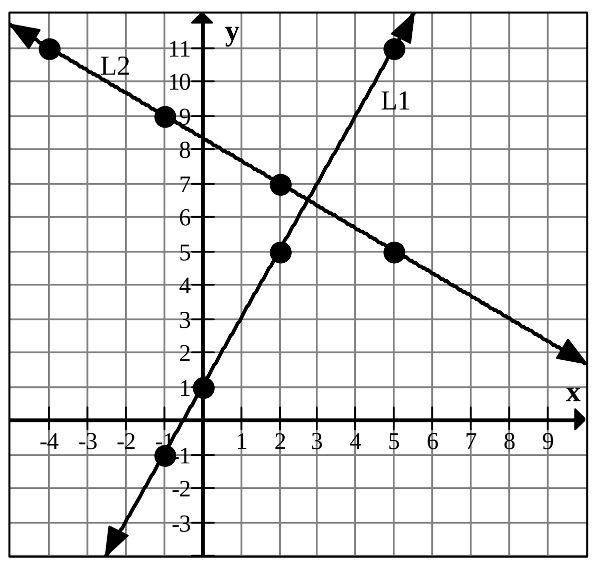
b.) Use the graph to estimate $F(25)$ and give the meaning for this situation. Write answer in a complete sentence and use appropriate units.

c.) Use the graph to solve $F(s) = 25$ and give the meaning for this situation.

d.) Find the maximum fuel economy and the corresponding speed using the graph. Write answer in a complete sentence and use appropriate units.

Supplement to §5.3

1.) The graph below shows a system of linear equations. However, the exact solution cannot be determined from the graph. Find the equations of the lines and solve the system algebraically and verify that your result makes sense for the graph.



Supplement to §5.4

1.) Hugo Reyes was mixing dried mango slices with dried pineapple to create a delightful island mix. The mango costs \$5.99 per pound and the pineapple costs \$3.99 per pound.

a.) Is it possible for Hugo to mix the fruit in such a way to create a mix that costs a total of \$1.99 per pound?

b.) If Hugo mixed the fruit and calculated that his mix would cost \$4.80 per pound, which ingredient did he add more of?

c.) If Hugo had a 5 pound bag of fruit that he said was worth \$5.99 per pound, how much of each fruit did he add to make it?

d.) If Hugo mixed the fruit and calculated that his mix would cost \$5.00 per pound, which ingredient did he add more of?

2.) Dimensional Analysis practice.

a.) Write 36 minutes in hours as a decimal.

b.) Write 54 minutes in hours as a fraction.

c.) Write 4:20 hours and minutes as minutes.

d.) Write 4.2 hours as hours and minutes.

e.) Find the number of feet (round to the nearest thousandth) in 248 centimeters [2.54 cm = 1 inch; 12 inches = 1 foot].

f.) Find the number of square inches in 4 square feet.

g.) Find the number of square feet in (round to the nearest thousandth) 343 square inches.

Supplement to §6.2

1.) Let $f(x) = x^2 + \frac{1}{3}x + \frac{4}{5}$ and $g(h) = \left(h - \frac{3}{4}\right)(h+8)$. Evaluate and simplify the expressions using correct formatting.

a.) $f(-3)$

b.) $g\left(-\frac{5}{4}\right)$

Supplement to §7.6

1.) Determine if the equation/function is linear, quadratic or something else.

a.) $5x^2 + 2y = 2$

b.) $5x + 2y = 2x$

c.) $y = \sqrt{2}x + 1$

d.) $f(x) = x$

e.) $x = -1$

f.) $\pi x + \sqrt{7}y = 3^2$

g.) $y = 4(x-1) + 2(x-3)$

h.) $y = \frac{3}{x} + 4x$

i.) $h(r) = r^3 + r^2$

j.) $g(x) = (x-1)(x+5)$

k.) $y = \frac{4}{5}$

Supplement to §9.1

If we want to estimate $\sqrt{10}$, we need to find the nearest integers below and above the 10 that are perfect squares (so the square root can be found). These numbers are 9 and 16. So, since 10 is between 9 and 16 (i.e., $9 < 10 < 16$) we have that $\sqrt{10}$ will be between $\sqrt{9}$ and $\sqrt{16}$ $\left(\text{i.e., } \sqrt{9} < \sqrt{10} < \sqrt{16}\right)$. We chose perfect squares so we could simplify the radicals. Thus, $\sqrt{10}$ is between 3 and 4 $\left(\text{i.e., } 3 < \sqrt{10} < 4\right)$, and $\sqrt{10}$ is closer to 3 than 4 since 10 is closer to 9 than 16.

1.) Use your calculator to check this estimate of $\sqrt{10}$.

2.) Fill-in the blanks with integers. Verify using your calculator.

a.) $\sqrt{19}$: Since _____ < 19 < ______, we know that ______< $\sqrt{19}$ < ______. Without a calculator, I estimate that $\sqrt{19} \approx$__________.

b.) $\sqrt{3.2}$: Since _____ < 3.2 < ______, we know that ______< $\sqrt{3.2}$ < ______. Without a calculator, I estimate that $\sqrt{3.2} \approx$__________.

Supplement to §9.4

1.) A student correctly solved an equation and ended up with the solution $\frac{30}{\sqrt{12}}$. However, the answer in the back of the book is $5\sqrt{3}$.

a.) Round both numbers to the nearest tenth.

b.) Show how these answers are the same algebraically.

2.) Solve the equation $\sqrt{3}x + 4 = 10$ algebraically. Rationalize the denominator of your solution.

Supplement to §10.1

1.) Solve the equations below using the square root property, if possible. If not possible, use factoring. Use correct formatting.

a.) $3x^2 = 48$ b.) $(x-3)^2 = 4x$ c.) $3x^2 - 5 = -14x$ d.) $3(2x-4)^2 - 4 = 20$

2.) The stopping distance of a car is proportional to the square of the its speed before slamming on the brakes. In math words, $D(v) = kv^2$, where D is the stopping distance in feet, v is the speed of the car before braking in miles per hour and k is a number that depends on how good the tires are and the road conditions. For a car with good tires on a good road, $k \approx 0.05$, so $D(v) = 0.05v^2$.

a.) Find $D(60)$ and interpret your answer.

b.) Find $D(70)$ and interpret your answer.

c.) Using your answers above, what is the ratio $\dfrac{D(70)}{D(60)}$ and what does it mean?

d.) A neighbor's basketball rolls out into the road 30ft in front of you. There is no room to swerve to avoid it! What is the maximum speed you could be going and still not hit the ball if you slam on the brakes?

Supplement to §10.3

1.) First, identify the following as being a linear equation, linear expression, quadratic equation or quadratic expression. Then, using correct formatting, for a

i.) linear equation, solve. Write your solution in a solution set and verify your solution.
ii.) linear expression, simplify.
iii.) quadratic equation, solve using the easiest method. Write your solution(s) in a solution set and verify your solution(s).
iv.) quadratic expression, simplify and if possible factor.

a.) $\dfrac{3}{2}x + \dfrac{4}{5} = \dfrac{3}{10}$

Circle: Equation / Expression
Circle: Linear / Quadratic
Solve/simplify/factor as appropriate:
Check solutions, if applicable:

b.) $3x^2 + 11x - 4$

Circle: Equation / Expression
Circle: Linear / Quadratic
Solve/simplify/factor as appropriate:
Check solutions, if applicable:

c.) $2(2x-2)^2 - 10 = 26$

Circle: Equation / Expression
Circle: Linear / Quadratic
Solve/simplify/factor as appropriate:
Check solutions, if applicable:

d.) $(x-4)^2 = x$

Circle: Equation / Expression
Circle: Linear / Quadratic
Solve/simplify/factor as appropriate:
Check solutions, if applicable:

2.) Let $f(x) = (x+6)^2$ and $g(x) = -(10x+1)(x-3)$. Find the missing coordinates in the tables. Note that there may be 2 inputs for some outputs. Approximate any irrational numbers to the tenths. If there is no real number that works, indicate this.

x	$y = f(x)$
-2	
0	
	0
	-2
	9
$\sqrt{5}$	

x	$y = g(x)$
-1	
-4/5	
	0
	24
$-\sqrt{3}$	
	33

3.) Let $f(x) = x^2 - 1$, $g(x) = 3x - 1$ and $h(x) = 2x - 6$. Using correct formatting, find the following:

a.) Find $f(-4)$.

b.) Is “-4” in $f(-4)$ an input or output?

c.) Is “ $f(-4)$ ” an input or output?

d.) If $h(3) = 0$, write a point that you know is on the graph of $y = h(x)$.

e.) If $f(-3) = 8$, write a point that you know is on the graph of $y = f(x)$.

f.) Determine which function would have the point $(2,3)$ on its graph.

g.) Determine which function would have the point $(-2,-7)$ on its graph.

h.) Solve $g(x) = 7$. Write the solution in a solution set.

i.) Evaluate and simplify the expression $g\left(\frac{4}{5}\right) + f\left(\frac{2}{3}\right)$ to simplest form.

j.) Solve $h(x) = 0$. Write solution in a solution set.

k.) Solve $f(x) = 8$. Hint: There are two solutions. Write solutions in a solution set.

l.) Fix and explain what is wrong with the underlined part of each of the following.

i.) $\underline{f(x)} = (3)^2 - 1$

ii.) $g(2) = \underline{3x - 1}$

iii.) $h(a) = \underline{2x - 6}$

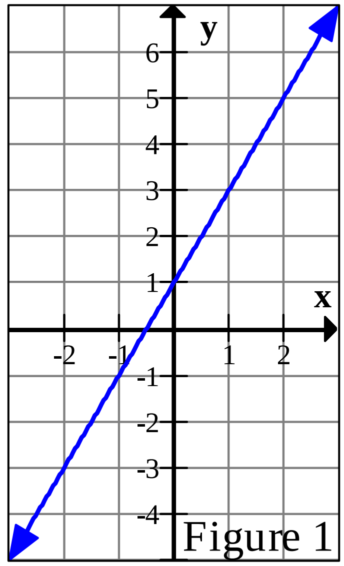
4.)a.) If $L(2) = 5$ and $L(-1) = 3$, write two points that you know will be on the graph of L.

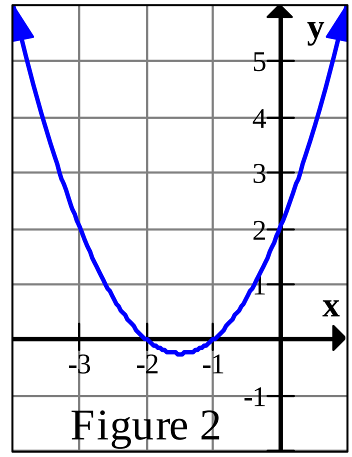
b.) Using the points found above, find the formula for the linear function, L, that passes through the two points.

Supplement to §10.5

1. a.) What exactly is the relationship between the equation $y = 2x + 1$ and the picture shown in Figure 1?

b.) What exactly is the relationship between the equation $y = x^2 + 3x + 2$ and the picture shown in Figure 2?





2.) For the function $j(t) = -3t^2 + 8t + 10$,

a.) Find the vertex.

b.) What is the axis of symmetry?

c.) Find the vertical intercept and show work using function notation.

d.) Find the horizontal intercept(s). Round your answers to the tenths with a calculator, if needed.

e.) Based on the information from the previous parts, draw a complete graph of $y = j(t)$.

f.) Find the domain of j and state it in interval notation.

g.) Find the range of j and state it in interval notation.

3.) If the graph of a function is symmetric about the line $x = 5$ and the point $(1, -9)$ is on the graph, what other point must be on the graph? Explain your reasoning.

4.) If the graph of a quadratic function has the points $(1, 6)$ and $(9, 6)$ on it, what is the x-value of the vertex? Explain your reasoning.

5.) For the function $R(x) = x^2 + 4x + 21$,

a.) Find the vertical intercept and show work using function notation.

b.) Find the horizontal intercept(s).

c.) Find the vertex.

d.) What is the axis of symmetry?

e.) Based on the information from the previous parts, draw a complete graph of $y = R(x)$.

f.) Find the domain of R and state it in interval notation.

g.) Find the range of R and state it in interval notation.

6.) If a parabola has vertex (-6, 17), use the information given and symmetry to fill-in the missing value in the table.

x	y
-2	18
	18

7.) An artist, Michael, sells 100 prints over one year for $10 each. Michael, who is an amateur mathematician and statistician, did some research and found out that for each price increase of $2 per print, the sales drop by 5 prints per year. The revenue, R, from selling the prints is given by $R(x) = (100 - 5x)(2x + 10)$ where $100 - 5x$ is the number of prints sold and $2x + 10$ is the cost of each print, and x is the number of $2 price increases he has done.

a.) At what price should Michael sell his prints to maximize the revenue? How many prints will he sell at this price?

b.) Find the horizontal intercepts of $y = R(x)$ and interpret their meaning in the context of the problem.

8.) The river running through L.A., like everything else in L.A., has been paved. This river exists as a meager trickle through the dry months of all-the-time; however, every 17years or so, L.A. receives some rain and everyone's yards turn green for 5 minutes before dying again. The L.A. River collects all this runoff rainwater and channels it out to sea. The depth of water in the L.A. River, D, in ft, is a function of time, t, in hours since a storm ended. The function is given by $D(t) = -t^2 + 2t + 8$.

a.) Evaluate and interpret $D(3)$.

b.) Find and interpret the vertical intercept.

c.) Find and interpret the horizontal intercepts.

d.) At what time will the water be deepest? What is that maximum depth?

e.) Make a graph of $y = D(t)$ on it's domain.

f.) Realistically, what is the range of D and what does it mean?

9.) A trebuchet is a French catapult originally used to launch large projectiles long distances. North of England a man named Hew Kennedy built a full size one to hurl random objects. Suppose that the height of a piano off the ground, h, in feet, is a function of the horizontal distance along the ground in the direction it is thrown, x, also in feet. Given that $h = f(x) = -.002x^2 + .6x + 60$,

a.) Find and interpret the vertical intercept.

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

c.) Find the vertex. Explain what the vertex means in context.

d.) Find and interpret $f(60)$.

e.) Solve $f(x) = 20$. Explain what this means in context.

f.) If I want to crush a Volkswagen bug with the piano, how far from the trebuchet should I park it?

Mth65 Supplement Key

§10.6

1.) a.) $f(-3)=1$ b.) $g(-3)=2$ c.) $h(0)=64$

d.) $j(-3)=-16$ e.) $f(1)$ does not exist. f.) $h(-3)$ does not exist.

g.) $\{6\}$ h.) $\{4\}$ i.) $\{0,1\}$

j.) $\{-1\}$ k.) $\{17\}$ l.) $\{1,-3\}$

m.) $\{3,-4\}$ n.) $\{\ \}$ o.) $\{-3.5\}$

p.) $\{-4,-3,0,2,3,4\}$ q.) $\{-3,0,1,2,6\}$ r.) $(-4,1]$

s.) $[-2,7)$ t.) $\{-7,-5,0,1,17,20\}$ u.) $\{-4,-3,0,3,64\}$

v.) $\mathbb{R}$ w.) $\mathbb{R}$

2.) a.) $F(0)=0$. This indicates that at a speed of 0 miles per hour, you have a fuel economy of 0 miles per gallon.

b.) $F(25)\approx 27$. This means that when traveling at 25 miles per hour, your fuel economy is about 27 miles per gallon.

c.) The solutions are approximately 20 and 70. This would mean that at the speeds of 20 miles per hour and 70 miles per hour, your fuel economy is about 25 miles per gallon.

d.) The maximum fuel economy of about 30 miles per gallon occurs at a speed of about 50 miles per hour

§5.3

1.) The simplified system is $\begin{cases} y=2x+1 \\ y=-\frac{2}{3}x+\frac{25}{3} \end{cases}$ The solution to the system is $\left(\frac{11}{4},\frac{13}{2}\right)$.

§5.4

1.)a.) No, it's not possible. The cheapest mix he could possibly make is made entirely of pineapple and would cost $3.99 per pound. Even if you add a tiny amount of mango, it would raise the price.

b.) The cost of $4.80 per pound is closer to $3.99 than $5.99. This means that more of the pineapple was added than mango.

c.) He added 5 pounds of mango and no pineapple at all.

d.) The cost of $5.00 per pound is closer to $5.99 than $3.99. This means he added more mango than pineapple.

2.) Dimensional Analysis practice.

a.) $36\min\cdot\frac{1hr}{60\min}=\frac{36}{60}hr=0.6hr$

b.) $54\min\cdot\frac{1hr}{60\min}=\frac{54}{60}hr=\frac{9}{10}hr$

c.) $4hr\cdot\frac{60\min}{1hr}=240\min$. So, 4hr20min is 260min.

d.) $0.2hr\cdot\frac{60\min}{1hr}=12\min$. So 4.20hr is 4hr12min.

e.) $248cm\cdot\frac{1in}{2.54cm}\cdot\frac{1ft}{12in}\approx 8.136\,ft$

f.) $4\,ft^2\cdot\frac{12in}{1ft}\cdot\frac{12in}{1ft}=576in^2$

g.) $343in^2\cdot\frac{1ft}{12in}\cdot\frac{1ft}{12in}\approx 2.382\,ft^2$

§6.2

1.) Let $f(x)=x^2+\frac{1}{3}x+\frac{4}{5}$ and $g(h)=\left(h-\frac{3}{4}\right)(h+8)$. Evaluate and simplify the expressions using correct formatting.

a.) $f(-3)=\frac{44}{5}$

b.) $g\left(-\frac{5}{4}\right)=-\frac{27}{2}$

§7.6

1.) a.) Quadratic

b.) Linear

c.) Linear

d.) Linear

e.) Linear

f.) Linear

g.) Linear

h.) Something else

i.) Something else

j.) Quadratic

k.) Linear

§9.1

1.) $\sqrt{10} \approx 3.16227766$

2.) a.) $\sqrt{19}$: Since $\underline{16} < 19 < \underline{25}$ (but closer to 16), we know that $\underline{4} < \sqrt{19} < \underline{5}$. Without a calculator, I estimate that $\sqrt{19} \approx$ 4.3 or 4.4. Note: $\sqrt{19} \approx 4.359$.

b.) $\sqrt{3.2}$: Since $\underline{1} < 3.2 < \underline{4}$ (but closer to 4), we know that $\underline{1} < \sqrt{3.2} < 2$. Without a calculator, I estimate that $\sqrt{3.2} \approx 1.7$ or 1.8 Note: $\sqrt{3.2} \approx 1.789$.

§9.4

1.)a.) $\dfrac{30}{\sqrt{12}} \approx 8.7$ and $5\sqrt{3} \approx 8.7$.

b.)

$$\begin{aligned}\frac{30}{\sqrt{12}} &= \frac{30}{\sqrt{4}\sqrt{3}}\\ &= \frac{30}{2\sqrt{3}}\\ &= \frac{15}{\sqrt{3}}\\ &= \frac{15}{\sqrt{3}}\cdot\frac{\sqrt{3}}{\sqrt{3}}\\ &= \frac{15\sqrt{3}}{3}\\ &= 5\sqrt{3}\end{aligned}$$

2.)

$$\begin{aligned}\sqrt{3}x + 4 &= 10\\ \sqrt{3}x &= 6\\ x &= \frac{6}{\sqrt{3}}\\ &= \frac{6}{\sqrt{3}}\cdot\frac{\sqrt{3}}{\sqrt{3}}\\ &= \frac{6\sqrt{3}}{3}\\ &= 2\sqrt{3}\end{aligned}$$

The solution set is $\left\{2\sqrt{3}\right\}$.

§10.1

1.) The square root property only applies in parts 'a' and 'd'. The square root property can't be used for parts 'b' and 'c' without completing the square (covered in Math 95).

* : The asterisk in the work below indicates the step where the square root property was applied and where the $\pm$ MUST first appear.

a.) Square root property applies

$$3x^2 = 48$$
$$x^2 = 16$$
$$x = \pm\sqrt{16} \quad *$$
$$x = \pm 4$$
$$\{-4, 4\}$$

b.) Square root property does not apply (the 4x on the right-hand side violates the square-root property form)

$$(x-3)^2 = 4x$$
$$(x-3)(x-3) = 4x$$
$$x^2 - 6x + 9 = 4x$$
$$x^2 - 10x + 9 = 0$$
$$(x-1)(x-9) = 0$$
$$x - 1 = 0 \quad or \quad x - 9 = 0$$
$$x = 1 \quad or \quad x = 9$$
$$\{1, 9\}$$

c.) Square root property does not apply (the variable with the -14 is the fatal error)

$$3x^2 - 5 = -14x$$
$$3x^2 + 14x - 5 = 0$$
$$(x+5)(3x-1) = 0$$
$$x + 5 = 0 \quad or \quad 3x - 1 = 0$$
$$x = -5 \quad or \quad x = \frac{1}{3}$$
$$\left\{-5, \frac{1}{3}\right\}$$

d.) Square root property applies

$$3(2x-4)^2 - 4 = 20$$
$$3(2x-4)^2 = 24$$
$$(2x-4)^2 = 8$$
$$2x - 4 = \pm\sqrt{8} \quad *$$
$$2x = 4 \pm \sqrt{8}$$
$$x = \frac{4 \pm \sqrt{8}}{2}$$
$$x = \frac{4 \pm 2\sqrt{2}}{2}$$
$$x = 2 \pm \sqrt{2}$$
$$\left\{2+\sqrt{2}, 2-\sqrt{2}\right\} \quad or \quad \left\{2 \pm \sqrt{2}\right\}$$

2.) a) $D(60) = 180$. This means that at a speed of 60mph, the car will need 180ft to stop.

b.) $D(70) = 245$. This means that at a speed of 70mph, the car will need 245ft to stop.

c.) $\frac{D(70)}{D(60)} = \frac{245}{180} \approx 1.36$. This means it takes about 1.36 times as much distance to stop at a speed of 70mph than at 60mph. The stopping distance increased 36% even though the speed only increased by 17%.

d.)
$$\begin{aligned} 30 &= 0.05v^2 \\ 600 &= v^2 \\ \sqrt{600} &= v \\ 24.5 &\approx v \end{aligned}$$
I hope you were driving less than 24.5mph or else you're going to crush a basketball.

§10.3

1.) a.) Equation, Linear, (Solve)

Solution set: $\left\{\frac{-1}{3}\right\}$

$$\begin{aligned} \frac{3}{2}\left(\frac{-1}{3}\right) + \frac{4}{5} &\stackrel{?}{=} \frac{3}{10} \\ -\frac{1}{2} + \frac{4}{5} &\stackrel{?}{=} \frac{3}{10} \\ -\frac{5}{10} + \frac{8}{10} &\stackrel{?}{=} \frac{3}{10} \\ \frac{3}{10} &= \frac{3}{10} \end{aligned}$$

b.) Expression, Quadratic, (Factor)

$(3x-1)(x+4)$

c.) Equation, Quadratic, (Solve)

"Easiest" method to solve:

Zero Factor/Product Property

Solution set: $\left\{\frac{2 \pm 3\sqrt{2}}{2}\right\}$ *or* $\left\{1 \pm \frac{3\sqrt{2}}{2}\right\}$

Check: $x = \frac{2 \pm 3\sqrt{2}}{2} \approx 3.121, -1.121$

c.)
$$\begin{aligned} (2\cdot(3.121)-2)^2 - 5 &\stackrel{?}{\approx} 13 \\ 12.995 &\approx 13 \end{aligned}$$

and

$$\begin{aligned} (2\cdot(-1.121)-2)^2 - 5 &\stackrel{?}{\approx} 13 \\ 12.995 &\approx 13 \end{aligned}$$

d.) Equation, Quadratic, (Solve)

"Easiest" method to solve:

Quadratic Formula

Solution set: $\left\{\frac{9 \pm \sqrt{17}}{2}\right\}$

Check: $x = \frac{9 \pm \sqrt{17}}{2} \approx 6.56, 2.44$

$$\begin{aligned} (6.56-4)^2 &\stackrel{?}{\approx} 6.56 \\ 6.554 &\approx 6.56 \end{aligned}$$

and

$$\begin{aligned} (2.44-4)^2 &\stackrel{?}{\approx} 2.44 \\ 2.434 &\approx 2.44 \end{aligned}$$

2.) Let $f(x)=(x+6)^2$ and $g(x)=-(10x+1)(x-3)$.

x	$y=f(x)$
-2	16
0	36
-6	0
Non-Real	-2
-3 and -9	9
$\sqrt{5}$	67.8

x	$y=g(x)$
-1	-36
-4/5	-133/5
-1/10 and 3	0
7/5 and 3/2	24
$-\sqrt{3}$	-77.2
Non-Real	33

3.) a.) $f(-4)=15$

b.) input c.) output d.) (3,0) e.) (-3,8)

f.) Function f g.) Function g h.) $\left\{\frac{8}{3}\right\}$ i.) $g\left(\frac{4}{5}\right)+f\left(\frac{2}{3}\right)=\frac{38}{45}$

j.) {3} k.) {-3, 3}

l.) *i.)* $\underline{f(x)}=(3)^2-1$: Here a number has been filled into the variable in function *f* 's definition. This means we are evaluating function *f* at the number 3. So, this input value should replace the *x* in *f*(*x*) as well: $f(3)=(3)^2-1$.

ii.) $g(2)=\underline{3x-1}$: We are evaluating function *g* at 2. This means the "2" should replace all the *x*'s in the definition of the function:

$$\begin{aligned} g(2)&=3\cdot 2-1 \\ &=5 \end{aligned}$$

iii.) $h(a)=\underline{2x-6}$: We are evaluating function *h* at "*a*." which means we need to replace the *x*'s in the function definition with "*a.* " This changes the independent variable in the function definition:
$h(a)=2a-6$

4.) a.) $(2,5)$ and $(-1,3)$
b.)

$$\begin{aligned} m&=\frac{5-3}{2-(-1)} \\ &=\frac{2}{3} \end{aligned}$$

So,

$$\begin{aligned} y&=\frac{2}{3}x+b \\ 5&=\frac{2}{3}(2)+b \\ 5&=\frac{4}{3}+b \\ 5-\frac{4}{3}&=b \\ \frac{11}{3}&=b \end{aligned}$$

So,

$$\begin{aligned} y&=\frac{2}{3}x+\frac{11}{3} \\ L(x)&=\frac{2}{3}x+\frac{11}{3} \end{aligned}$$

§10.5

1\. a.) The graph shown is the solution set to the equation $y = 2x + 1$. Every point on the line is a solution.

b.) The graph shown is the solution set to the equation $y = x^2 + 3x + 2$. Every point on the parabola is a solution.

2.) a.) $\left(\frac{4}{3}, \frac{46}{3}\right)$

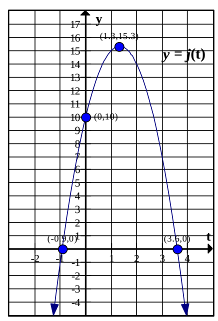
b.) $t = \frac{4}{3}$

c.) Vertical Intercept: (0, 10)

Work: $j(0) = -3(0)^2 + 8(0) + 10$
$= 10$

d.) $\left(\frac{4-\sqrt{46}}{3}, 0\right), \left(\frac{4+\sqrt{46}}{3}, 0\right)$

e.) Graph shown.



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

g.) $\left(-\infty, \frac{46}{3}\right]$

3.) (9, -9) must be on the graph. Explanation: The point $(1, -9)$ is 4 units to the left of the axis of symmetry. Since the parabola is symmetric about its axis of symmetry x = 5, the point that corresponds to $(1, -9)$ will be 4 units to the right of the axis of symmetry and have the same y-coordinate.

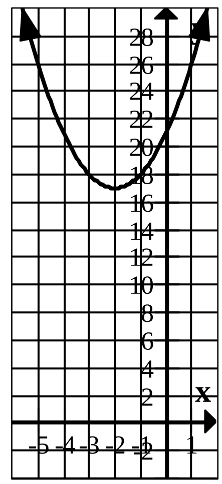
4.) The *x*-value of the vertex is 5. Explanation: The given points $(1, 6)$ and $(9, 6)$ both have the same *y*-coordinate. This means that the axis of symmetry lies between the two given points and the vertex will lie on the axis of symmetry. Since 5 is halfway between 1 and 9, the equation of the axis of symmetry is $x = 5$ and the *x*-coordinate of the vertex is 5. Note that we can not determine the *y*-coordinate of the vertex (the parabola could be "tall" or "short" or have the same shape as $y = x^2$). We can only say that the *y*-coordinate of the vertex is not 6 because if it was, we would have a line and not a parabola with the original points $(1, 6)$ and $(9, 6)$ a "vertex" of (5,6)!

5.) For the function $R(x) = x^2 + 4x + 21$,

a.) $R(0) = 0^2 + 4(0) + 21$
$= 21$ The vertical intercept is $(0, 21)$

b.) The solutions to $x^2 + 4x + 21 = 0$ are non-Real. This means that there are no (Real) horizontal intercepts.

c.) $x = \frac{-b}{2a}$
$= -2$ and $R(-2) = 17$ So, the vertex is $(-2, 17)$.



d.) As above, the axis of symmetry is $x = -2$

e.) Graph shown.

f.) The domain is $(-\infty, \infty)$.

g.) The range is $[17, \infty)$.

6.) Missing value: -10

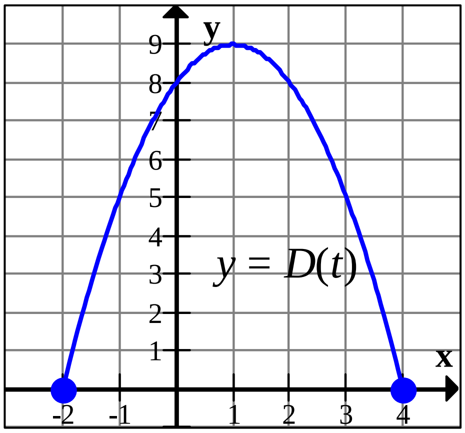
7.) a.) Vertex of the parabola: (7.5, 1562.5); So to maximize revenue and bring in \$1562.50 per year, Michael needs have 7.5 \$2 price increases. This means that the cost of each print will be \$25 (evaluate $2x + 10$ at x = 7.5) and he will need to sell 62.5 prints per year (evaluate 100 - 5x at x = 7.5). Since it is not possible to sell a half of a print, Michael won't be able to earn the maximum possible revenue in one year, but he can aim to sell an average of 62.5 prints per year over several years. Let's take a look at what happens if he sells 62 prints or 63 prints per year: If Michael sells 62 prints per year, the revenue is given by R(7.6) where 7.6 is found by solving 100 – 5x = 62. So, the revenue for selling 62 prints per year is \$1562.40 and the price per print is \$25.20. If Michael sells 63 prints per year, the revenue is given by R(7.4) where 7.4 is found by solving 100 – 5x = 63. So, the revenue for selling 63 prints per year is \$1562.40 and the price per print is \$24.80. Can you explain why the revenue is the same for selling 62 and 63 prints?

b.) Horizontal intercepts of $y = R(x)$: (20,0) and (-5,0).

The horizontal intercept (20,0) means that Michael has increased the price of his print by \$2, 20 times and he has a revenue of \$0. This means that no one feels Michael's prints are worth buying at \$50 per print (evaluate 2x+10 at x = 20) – poor Michael! The horizontal intercept (-5,0) means that Michael has increased the price of his print by \$2, "-5 times" (i.e., he has decreased the price by \$2, 5 times) and he has a revenue of \$0 because he would be giving his prints away for free (evaluate 2x+10 at x = -5).

8.) a.) $D(3)=5$. Three hours after the storm ended, the river was 5 ft deep.

b.) The VI is $(0,8)$. When the storm ended, the river was 8ft deep.



c.) The HI's are $(-2,0)$ and $(4,0)$. Two hours before the storm ended and four hours after the storm ended, the river was dry but in between those times the river was flowing.

d.) The vertex is $(1,9)$. This means that the river had a maximum depth of 9ft 1 hour after the storm ended.

e.) Shown is the graph of $y=D(t)$ on it's domain.

f.) The range of the real world function D is $[0,9]$. This means that the river has a depth somewhere between 0ft and 9ft at all times.

9.) The height of a piano off the ground, h, in feet, is a function of the horizontal distance along the ground in the direction it is thrown, x, also in feet. Given that $h=f(x)=-.002x^2+.6x+60$,

a.) The vertical intercept is $(0,60)$. This means that when the piano is thrown, it is launched from an initial height of 60ft above the ground (indicating a very large Trebuchet).

b.) The horizontal intercepts are $(-79.1,0)$ and $(379.1,0)$. The intercept $(379.1,0)$ indicates that the height is 0ft off the ground when the piano has been thrown 379.1ft from the trebuchet, which means that it hit the ground 379.1ft away. The other intercept is a nonsensical answer because the piano did not go backwards from the trebuchet.

c.) The vertex is $(150,105)$ which means that the maximum height the piano reached was 105ft off the ground when it was 150ft horizontally from the trebuchet.

d.) $f(60)=88.8$. This means that when the piano is 60ft horizontally from the trebuchet, it is 88.8ft above the ground.

e.) The solutions are approximately -56.2 and 356.2. This means that when the piano is 356.2ft horizontally from the trebuchet, the piano is 20ft above the ground. The other solution is a nonsense answer because the piano did not go backwards from the trebuchet.

f.) You should probably park the Volkswagen about 379ft from the trebuchet based on the horizontal intercept. However, if you want to be very accurate, you could estimate that a Bug is about 4ft tall and subsequently solve the equation $f(x)=4$. The reasonable solution to this is 374.7ft. So if you park the Bug with the middle of the car at about 375ft from the Trebuchet it will accurately land directly on the roof, smashing it to pieces for some reason.