

Warm Up

Determine the slope and y -intercept of each linear function.

1. $h(x) = 3x$

2. $g(x) = \frac{1}{2}(x - 5)$

3. $k(x) = x - 2$

4. $m(x) = \frac{8x}{4} + 1$

Remember!

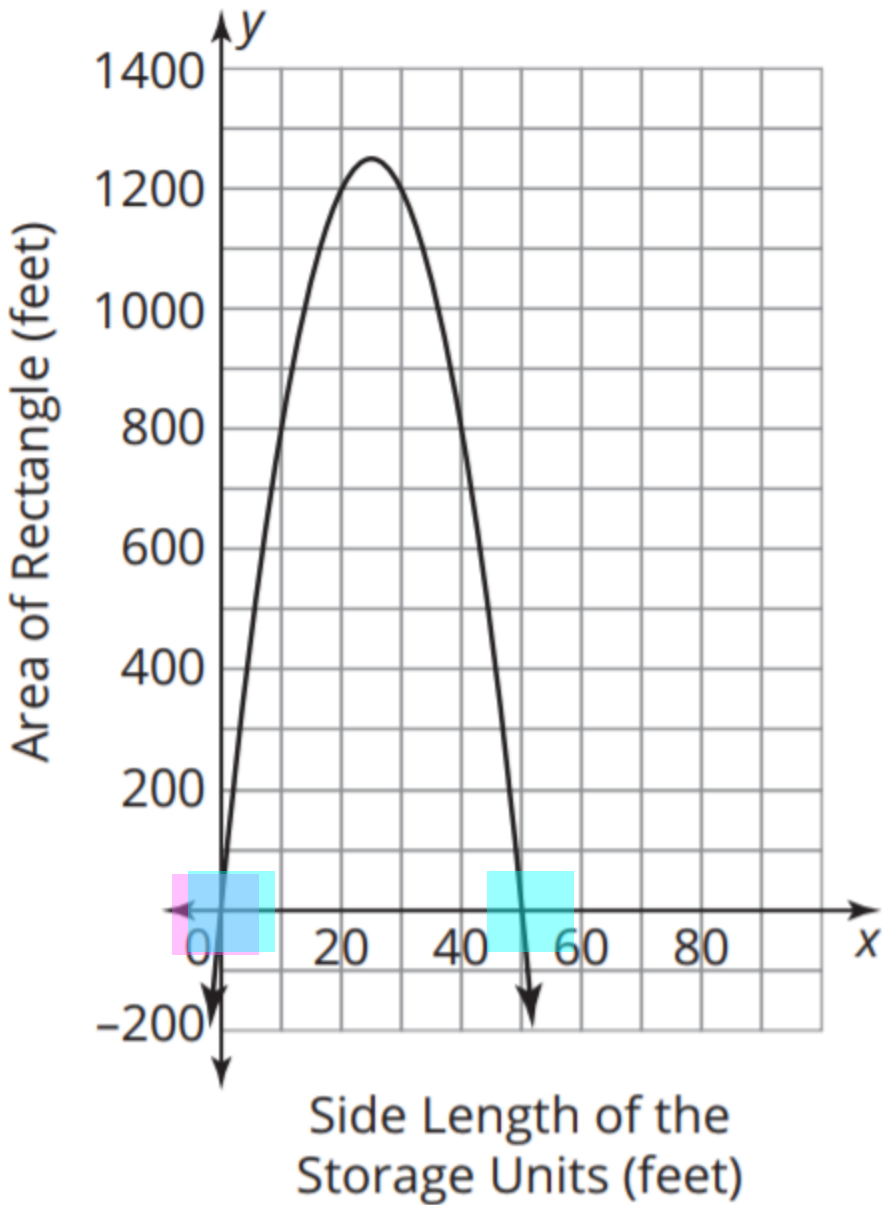
$$f(x) = mx + b$$

m = slope

b = y -intercept

Area of Dog Enclosure

$$A(s) = -2s^2 + 100s$$
$$= -2(s)(s - 50)$$



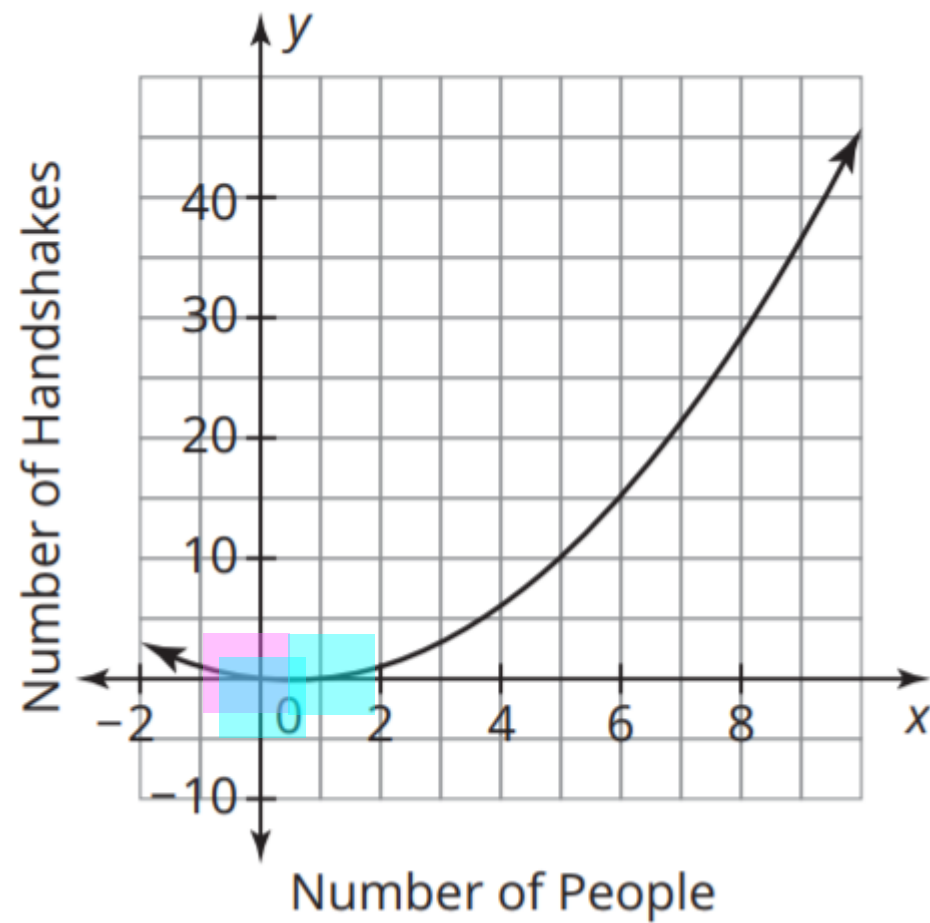
M3-168

s	$A(s)$
0	0
1	98
2	192
3	282
4	368

Handshake Problem

$$f(n) = \frac{1}{2}n^2 - \frac{1}{2}n$$

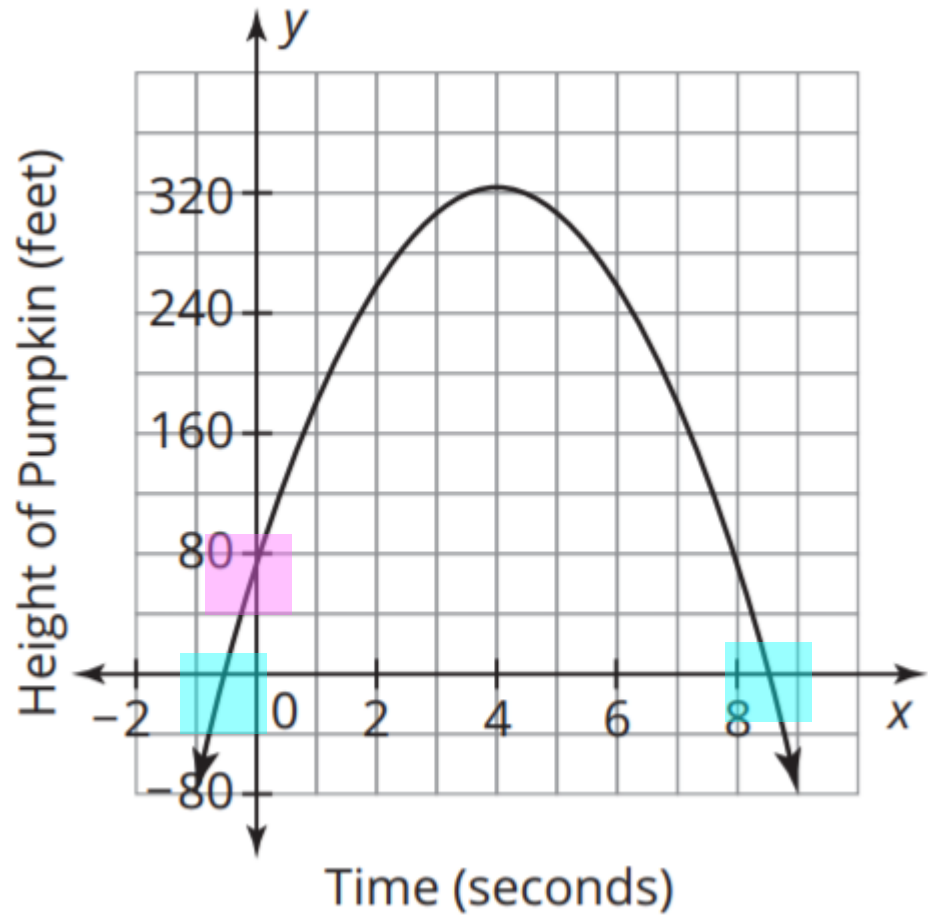
$$= \frac{1}{2}(n)(n - 1)$$



n	$f(n)$
0	0
1	0
2	1
3	3
4	6

Punkin' Chunkin'

$$h(t) = -16t^2 + 128t + 68$$
$$= -16\left(t - \frac{17}{2}\right)\left(t + \frac{1}{2}\right)$$

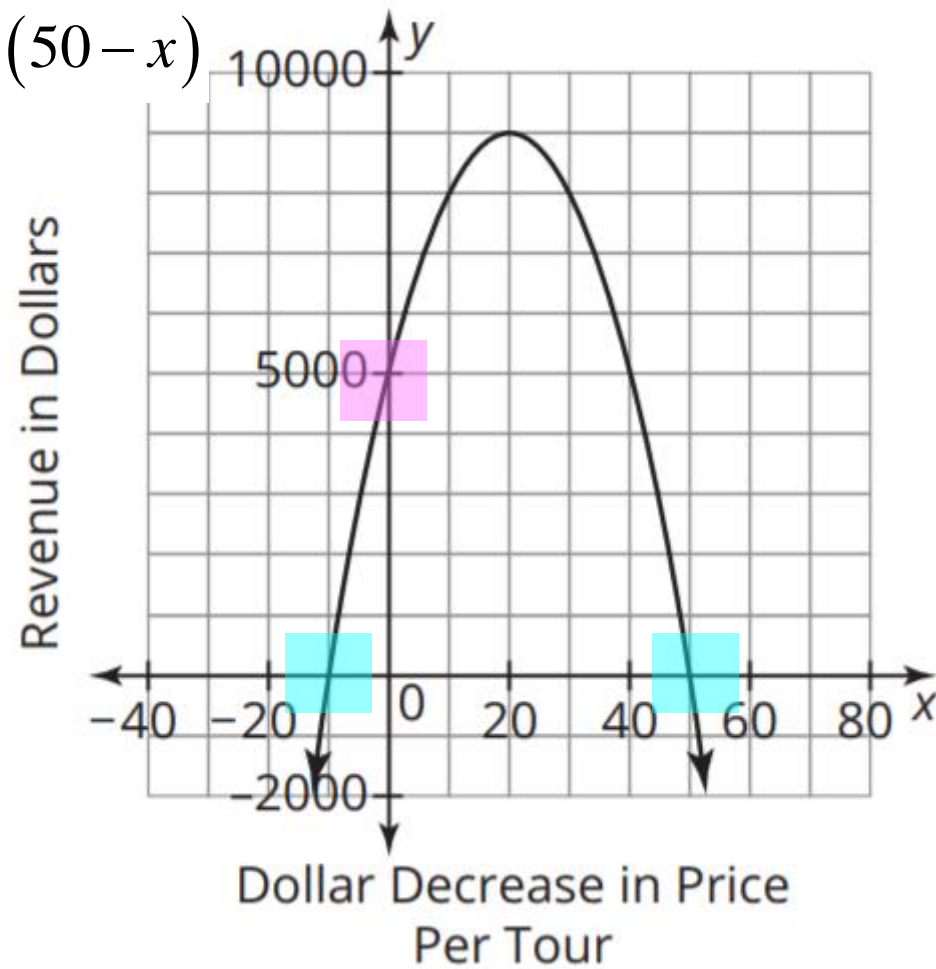


t	$h(t)$
0	68
1	180
2	260
3	308
4	324

Ghost Tour $r(x) = (10x + 100)(50 - x)$

M3-169

$$\begin{aligned} r(x) &= -10(x + 10)(x - 50) \\ &= -10x^2 + 400x + 5000 \end{aligned}$$



x	$r(x)$
0	5000
1	5390
2	5760
3	6110
4	6440

1. Consider each representation.

M3-169

a. How can you tell from the structure of the equation that it is quadratic?

It is a 2nd degree equation

b. What does the structure of the equation tell you about the shape and characteristics of the graph?

If the leading coefficient is negative, the graph opens down, if positive it opens up

c. How can you tell from the shape of the graph that it is quadratic?

It is U-shaped

d. How can you tell from the table that the relationship is quadratic?

It is not linear or exponential, we will explore this aspect...

x	y
-2	-4
-1	-1
0	2
1	5
2	8

difference of
 y -values

$$\left. \begin{array}{c} -2 \\ -1 \end{array} \right\} -1 + 4 = 3$$

$$\left. \begin{array}{c} -1 \\ 0 \end{array} \right\} 2 + 1 = 3$$

$$\left. \begin{array}{c} 0 \\ 1 \end{array} \right\} 5 - 2 = 3$$

$$\left. \begin{array}{c} 1 \\ 2 \end{array} \right\} 8 - 5 = 3$$

Last year, you
learned about 1st
differences and
linear functions!

$$f(x) = 3x + 2$$

Let's explore how a table of values can show that a function is quadratic.

M3-170

Consider the table of values represented by the basic quadratic function. This table represents the first differences between seven consecutive points.

You can tell whether a table represents a linear function by analyzing first differences. First differences imply the calculation of $y_2 - y_1$.

x	$f(x)$	First Differences
-3	9	
-2	4	
-1	1	
0	0	
1	1	
2	4	
3	9	

$4 - 9 = -5$

$1 - 4 = -3$

$0 - 1 = -1$

$1 - 0 = 1$

$4 - 1 = 3$

$9 - 4 = 5$

Let's consider the *second differences*. The **second differences** are the differences between consecutive values of the first differences.

1. What do the first differences tell you about the relationship of the table of values?

		First Differences		Second Differences
x	$f(x)$			
-3	9		$4 - 9 = -5$	2
-2	4		$1 - 4 = -3$	
-1	1		$0 - 1 = -1$	2
0	0		$1 - 0 = 1$	2
1	1		$4 - 1 = 3$	2
2	4		$9 - 4 = 5$	2
3	9			

2. Calculate the second differences for $f(x)$. What do you notice?

The second differences are each equal to 2. The second differences are constant.

5. Identify each equation as linear or quadratic. Complete the table to calculate the first and second differences. Then sketch the graph.

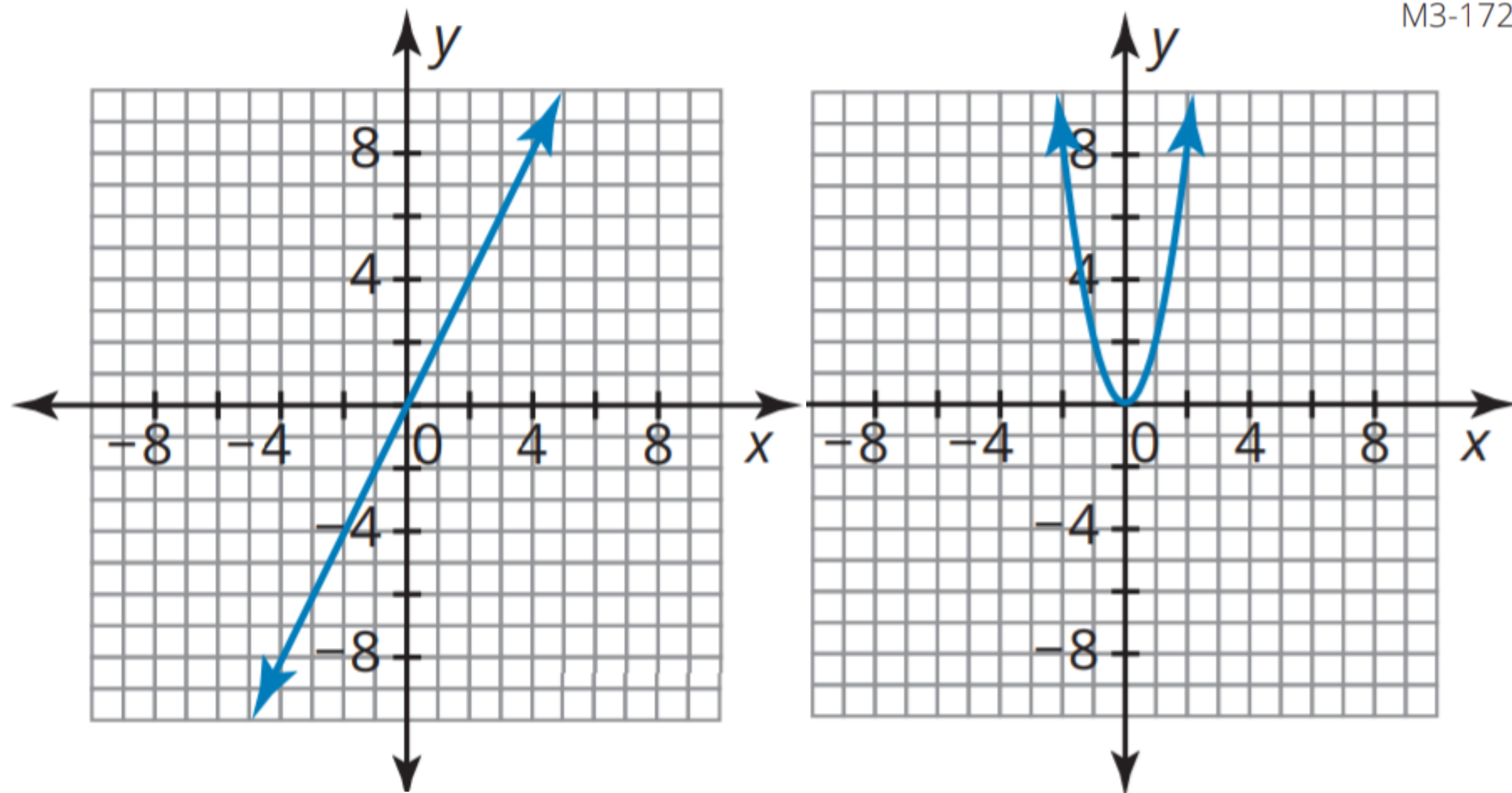
M3-172

a. $y = 2x$ Linear

x	y	First Differences	Second Differences
-3	-6	2	0
-2	-4	2	
-1	-2	2	
0	0	2	
1	2	2	
2	4	2	
3	6	2	

b. $y = 2x^2$ Quadratic

x	y	First Differences	Second Differences
-3	18	-10	4
-2	8	-6	
-1	2	-2	
0	0	2	
1	2	6	
2	8	10	
3	18		



c. $y = -x + 4$

x	y	First Differences	Second Differences
-3	7		
-2	6		
-1	5		
0	4		
1	3		
2	2		
3	1		

d. $y = -x^2 + 4$

x	y	First Differences	Second Differences
-3	-5		
-2	0		
-1	3		
0	4		
1	3		
2	0		
3	-5		

