Name: ______________________________ Per: _____

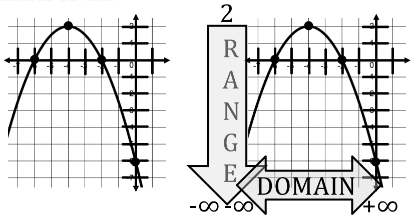
Features of a Parabola (Quadratic Function)

	Definition	Written as…
Domain	All **values of x** that are possible on the graph.	(or [lowest x, highest x] or) (&) mean "not equal" [&] mean "equal"
Range	All **values of y** that are possible on the graph.	(or [lowest value, highest value] or) (&) mean "not equal" [&] mean "equal"
Interval of Increase	All **values of x** where the graph is rising from left to right.	(or [lowest x, highest x] or) (&) mean "not equal" [&] mean "equal"
Interval of Decrease	All **values of x** where the graph is falling from left to right.	(or [lowest x, highest x] or) (&) mean "not equal" [&] mean "equal"
Zeros	Zeros <u>are</u> x-intercepts The point(s) where the graph crosses the **x-axis ($y = 0$).**	(x-value, 0) & (x-value, 0) *There could be zero, one, or two of these points.*
x-intercept		
y-intercept	The point(s) where the graph crosses the **y-axis ($x = 0$).**	(0, y-value)

<u>Domain & Range</u>

Domain is what x can be, and Range is what y can be. They are only limited if the graph stops or turns around.

EXAMPLE

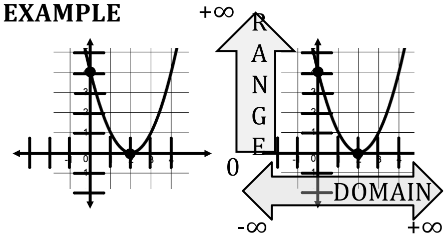


Domain: <u>$(-\infty, \infty)$</u>

Range: <u>$(-\infty, 2]$</u>

The 2 is part of the range, so]

EXAMPLE

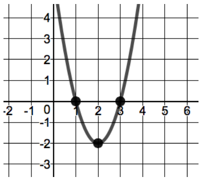


Domain: <u>$(-\infty, \infty)$</u>

Range: <u>$[0, \infty)$</u>

The 0 is part of the range, so [

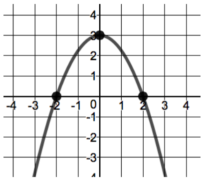
1.



Domain: ___________

Range: ___________

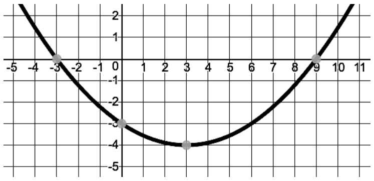
2.



Domain: ___________

Range: ___________

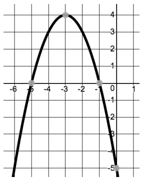
3.



Domain: ___________

Range: ___________

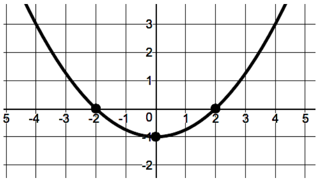
4.



Domain: ___________

Range: ___________

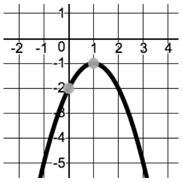
5.



Domain: ___________

Range: ___________

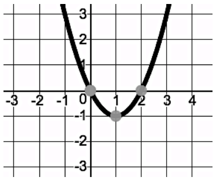
6.



Domain: ___________

Range: ___________

7.



Domain: ___________

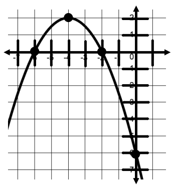
Range: ___________

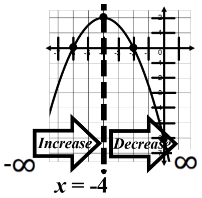
Name: ______________________________ Per: _____

Intervals of Increase & Decrease

The intervals are the values of x where the parabola either rises (increase) or falls (decreases). The axis of symmetry (x-value of the vertex) is the turning point and is not part of the increase or the decrease, so we'll use ( ) not [ ].

EXAMPLE



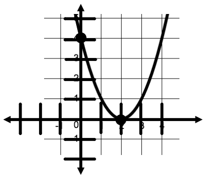


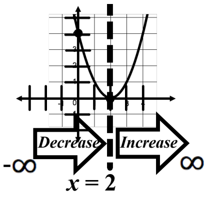
Interval of Increase: $(-\infty, -4)$

Interval of Decrease: $(-4, \infty)$

-4 is the turning point—it's not increase or decrease—, so use ( )

EXAMPLE



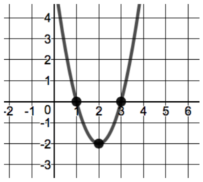


Interval of Increase: $(2, \infty)$

Interval of Decrease: $(-\infty, 2)$

2 is the turning point—it's not increase or decrease, so use ( )

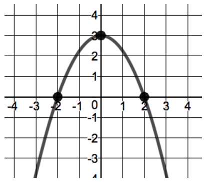
8.



Interval of Increase: ___________

Interval of Decrease: ___________

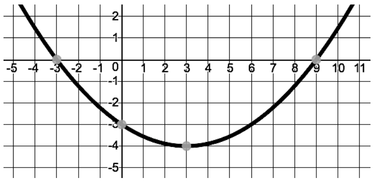
9.



Interval of Increase: ___________

Interval of Decrease: ___________

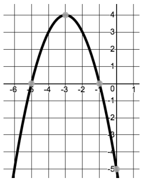
10.



Interval of Increase: ___________

Interval of Decrease: ___________

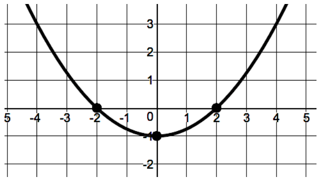
11.



Interval of Increase: ___________

Interval of Decrease: ___________

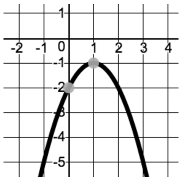
12.



Interval of Increase: ___________

Interval of Decrease: ___________

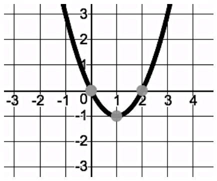
13.



Interval of Increase: ___________

Interval of Decrease: ___________

14.



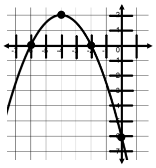
Interval of Increase: ___________

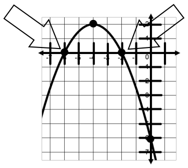
Interval of Decrease: ___________

Zeros & X-Intercepts

The zeros/x-intercepts are the points where the parabola crosses the x-axis. The points will look like: (__, 0).

EXAMPLE

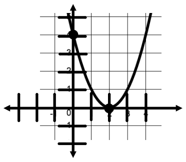


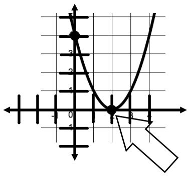


Zeros: $(-6, 0)$ & $(-2, 0)$

x-intercept: $(-6, 0)$ & $(-2, 0)$

EXAMPLE

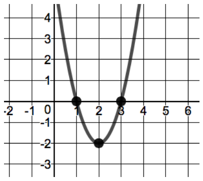




Zeros: $(2, 0)$

x-intercept: $(2, 0)$

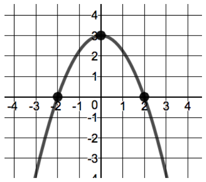
15.



Zeros: ___________

x-intercept: ___________

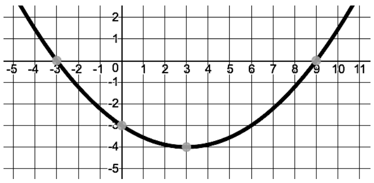
16.



Zeros: ___________

x-intercept: ___________

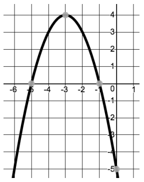
17.



Zeros: ___________

x-intercept: ___________

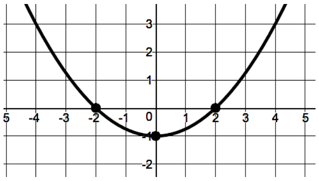
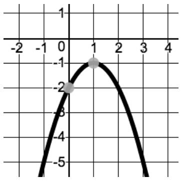
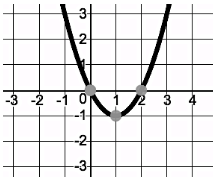
18.



Zeros: ___________

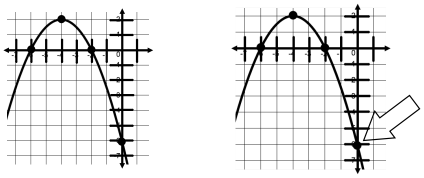
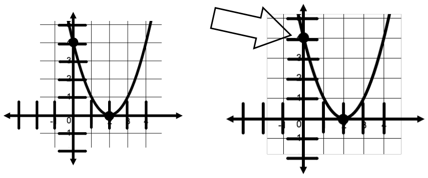
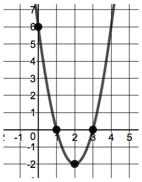
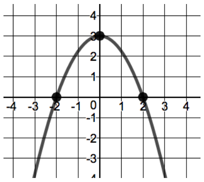
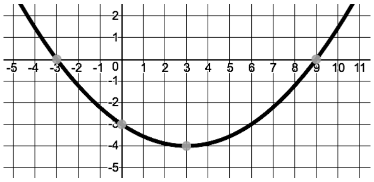
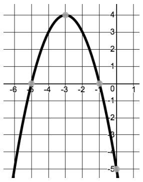
x-intercept: ___________

Name: ______________________________ Per: _____

19.  Zeros: __________ x-intercept: __________	20.  Zeros: __________ x-intercept: __________	21.  Zeros: __________ x-intercept: __________

Y-intercept

The *Y*-intercept is the point where the parabola crosses the y-axis. The point will look like: (0, __).

EXAMPLE  y-intercept: <u>$(0, -6)$</u>	**EXAMPLE**  y-intercept: <u>$(0, 4)$</u>	22.  y-intercept: __________
23.  y-intercept: __________	24.  y-intercept: __________	25.  y-intercept: __________

When you're done solving the problems on this handout, make sure you check your answers against the **correct answers below**.

1. $Domain$: $(-\infty, \infty)$ $Range$: $[-2, \infty)$	2. $Domain$: $(-\infty, \infty)$ $Range$: $(-\infty, 3]$	3. $Domain$: $(-\infty, \infty)$ $Range$: $[-4, \infty)$
4. $Domain$: $(-\infty, \infty)$ $Range$: $(-\infty, 4]$	5. $Domain$: $(-\infty, \infty)$ $Range$: $[-1, \infty)$	6. $Domain$: $(-\infty, \infty)$ $Range$: $(-\infty, -1]$
7. $Domain$: $(-\infty, \infty)$ $Range$: $[-1, \infty)$	8. $Interval$: $(2, \infty)$ $Decrease$: $(-\infty, 2)$	9. $Interval$: $(-\infty, 0)$ $Decrease$: $(0, \infty)$
10. $Interval$: $(3, \infty)$ $Decrease$: $(-\infty, 3)$	11. $Interval$: $(-\infty, -3)$ $Decrease$: $(-3, \infty)$	12. $Interval$: $(0, \infty)$ $Decrease$: $(-\infty, 0)$
13. $Interval$: $(-\infty, 1)$ $Decrease$: $(1, \infty)$	14. $Interval$: $(1, \infty)$ $Decrease$: $(-\infty, 1)$	15. $Zeros$: $(1, 0)$ & $(3, 0)$ $x - intercept$: $(1, 0)$ & $(3, 0)$
16. $Zeros$: $(-2, 0)$ & $(2, 0)$ $x - intercept$: $(-2, 0)$ & $(2, 0)$	17. $Zeros$: $(-3, 0)$ & $(9, 0)$ $x - intercept$: $(-3, 0)$ & $(9, 0)$	18. $Zeros$: $(-5, 0)$ & $(-1,0)$ $x - intercept$: $(-5, 0)$ & $(-1,0)$
19. $Zeros$: $(-2, 0)$ & $(2, 0)$ $x - intercept$: $(-2, 0)$ & $(2, 0)$	20. *Zeros:* There are none. *x-intercept:* There are none.	21. $Zeros$: $(0, 0)$ & $(2, 0)$ $x - intercept$: $(0, 0)$ & $(2, 0)$
22. $y - intercept$: $(0, 6)$	23. $y - intercept$: $(0, 3)$	24. $y - intercept$: $(0, -3)$
25. $y - intercept$: $(0, -5)$		

Name: ______________________________ Per: _____

Linear vs. Quadratic
& Writing Equations from Tables

Determining if a function is linear or quadratic from a table:

If the first differences are the same, then it is linear. If the second differences are the same, then it's quadratic.

For each table, use the word bank to fill in the blanks.

The function is __________ because it has a ______________ that is __________.

Possible responses are:	Linear or Quadratic	1st difference or 2nd difference	constant

Linear

Determine if the function is linear or quadratic.

x	y	1st
1	7	
		-3
2	4	
		-3
3	1	
		-3
4	-2	
		-3
5	-5	

Fill in the blanks:

The function is **linear** because it has a **1st difference** that is **constant**.

Quadratic

Determine if the function is linear or quadratic.

x	y	1st	2nd
1	9		
		-6	
2	3		+4
		-2	
3	1		+4
		+2	
4	3		+4
		+6	
5	9		

Fill in the blanks:

The function is **quadratic** because it has a **2nd difference** that is **constant**.

Determine if the function is Linear or Quadratic.

EXAMPLE

x	y	1st	2nd
1	9		
		-6	
2	3		+4
		-2	
3	1		+4
		+2	
4	3		+4
		+6	
5	9		

EXAMPLE

x	y	1st	2nd
1	9		
		-6	
2	3		+4
		-2	
3	1		+4
		+2	
4	3		+4
		+6	
5	9		

1.

2.

3.

4.

5.

6.

7.

Name: ______________________________ Per: _____

Writing the Equation from a Table

A linear equation uses the formula $f(x) = mx + b$, so you need to find m & b.
A quadratic equation uses the formula $f(x) = ax^2 + bx + c$, so you need to find a, b, & c.

<table>
<tr><th>Steps for writing the Linear equation…</th><th>Linear Example</th></tr>
<tr><td>Step 1: Find the 1st differences.</td><td><table><tr><th>x</th><th>y</th></tr><tr><td>1</td><td>7</td></tr><tr><td>2</td><td>4</td></tr><tr><td>3</td><td>1</td></tr><tr><td>4</td><td>-2</td></tr><tr><td>5</td><td>-5</td></tr></table>← That gives us this →<table><tr><th>x</th><th>y</th><th>1st</th></tr><tr><td>1</td><td>7</td><td></td></tr><tr><td></td><td></td><td>-3</td></tr><tr><td>2</td><td>4</td><td></td></tr><tr><td></td><td></td><td>-3</td></tr><tr><td>3</td><td>1</td><td></td></tr><tr><td></td><td></td><td>-3</td></tr><tr><td>4</td><td>-2</td><td></td></tr><tr><td></td><td></td><td>-3</td></tr><tr><td>5</td><td>-5</td><td></td></tr></table></td></tr>
<tr><td>Step 2:
Find the leading coefficient (the first number in the equation), m.

<u>Here's how</u>
When it's $\boxed{linear}$, $\boxed{f(x) = mx + b}$, the leading coefficient is:
$\boxed{m = \frac{1st\ difference}{1}}$</td><td>When it's linear, use:
$f(x) = mx + b$

$m = \frac{first\ difference}{1}$

$m = \frac{-3}{1}$
$m = -3$

My equation so far:
$f(x) = mx + b$
$f(x) = -3x + b$</td></tr>
<tr><td>Step 3:
Find the constant (the last number in the equation-the one that doesn't have an x), b.

<u>Here's how</u>
The constant (b) is where x is 0.

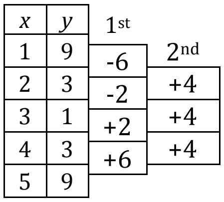
So, use the differences to find what y would be if x were 0.</td><td>$b = \ y$ when $x = 0$
(use the 1st difference to get 0)

<i>I know that the y-value at $x = 0$ is b, and that it will go down 3 units to become 7 (the y-value at $x = 1$). So…</i><table><tr><th>x</th><th>y</th><th>1st</th></tr><tr><td>0</td><td>b</td><td></td></tr><tr><td></td><td></td><td>-3</td></tr><tr><td>1</td><td>7</td><td></td></tr></table>$b - 3 = 7$
$b = 10$

My equation so far:
$f(x) = -3x + b$
$f(x) = -3x + 10$
I'm done! The equation of this line is: $\boxed{f(x) = -3x + 10}$.</td></tr>
</table>

1.	

Name: ______________________________ Per: _____

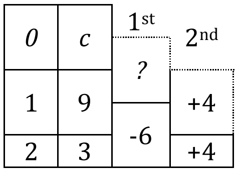
<table>
<tr><th>Steps for writing the Quadratic equation…</th><th>Quadratic Example</th></tr>
<tr><td>Step 1: Find the 1st differences and the 2nd differences.</td><td>
<table>
<tr><th>x</th><th>y</th></tr>
<tr><td>1</td><td>9</td></tr>
<tr><td>2</td><td>3</td></tr>
<tr><td>3</td><td>1</td></tr>
<tr><td>4</td><td>3</td></tr>
<tr><td>5</td><td>9</td></tr>
</table>
← *That gives us this* →


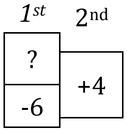
</td></tr>
<tr><td>Step 2:
Find the leading coefficient (the first number in the equation), a.

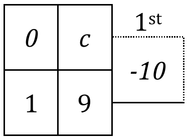
<u>Here's how</u>
When it's $\boxed{quadratic}$, $\boxed{f(x) = ax^2 + bx + c}$, the leading coefficient is:
$\boxed{a = \frac{2nd\ difference}{2}}$</td><td>When it's quadratic, use:
$f(x) = ax^2 + bx + c$
$a = \frac{second\ difference}{2}$
$a = \frac{+4}{2}$
$a = 2$

My equation so far:
$f(x) = ax^2 + bx + c$
$f(x) = 2x^2 + bx + c$</td></tr>
<tr><td>Step 3:
Find the constant (the last number in the equation-the one that doesn't have an x), c.

<u>Here's how</u>
The constant (b) is where x is 0.

First, use the second differences to figure out what the first difference is</td><td>$c =\ y$ when $x = 0$
(Start by using the 2nd difference to find the 1st)


So, focusing on the 1st difference that I need…


$1st\ + 4 = -6$
$1st\ = -10$</td></tr>
<tr><td>Now, use the 1st differences to find what y would be if x were 0.</td><td>


$c - 10 = 9$
$c = 19$

My equation so far:
$f(x) = 2x^2 + bx + c$
$f(x) = 2x^2 + bx + 19$</td></tr>
</table>