CCGPS Analytic Geometry Notes: Graphing Quadratics in <u>Intercept Form</u> February 3, 2015 (Tues)
Essential Question: How do you identify characteristics of a function on a table or graph?

There are three different forms in which quadratics can be presented: yesterday, we explored the **<u>standard form</u>** of the quadratic function: ______________________________ Using this form, it was not too hard to graph the parabola after identifying the vertex and using a table to find points. But, the ______________________ were not always easy to name. Today we are going to look at another form of the quadratic function. Identifying the x-intercepts is easier with the form called the .....

***Intercept Form: ___________________________________**

- If "a" is __________, the parabola opens _______. If "a" is __________, the parabola opens _______.
- The x-intercepts are the points __________ and ___________. Set factors equal to 0 and solve to get p and q.
- The x-coordinate of the vertex is _______________; it is half way between the x-intercepts, so find the AVERAGE of the x-intercepts. To find the y-coordinate of the vertex, substitute this value in for x in the function and solve for y.
- The axis of symmetry is the vertical line x = ____________; the AOS passes through the vertex.
- To graph, plot the x-intercepts, vertex, and axis of symmetry. Then connect with a smooth curve. You may want to use substitute in another value for x to get 4th and 5th point (using symmetry) for the graph.

Example 1: Find the x-intercepts of the quadratic and the x-value of vertex. Hint: you may need to factor!

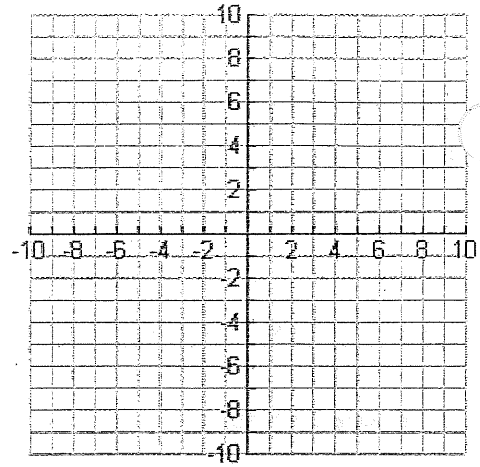
a) $y = 2(x - 3)(x + 5)$ b) $y = x^2 + 5x + 6$ c) $y = 3x^2 - 12x - 15$

x-intercepts: ______________ **x-intercepts:** ______________ **x-intercepts:** ______________

Vertex: ______________ **Vertex:** ______________ **Vertex:** ______________

Intercept form: $a(x - p)(x - q)$ vertex x-value: $\frac{p+q}{2}$

Example 2: Graph $y = -(x + 2)(x - 4)$ Opens: ______ p: ____ q: ____



Vertex: ________ a = ______ Max / Min (Circle one)

AOS: ________ x – intercept(s): ______________ y – intercept: _________

Domain: _____________ Range: _______________

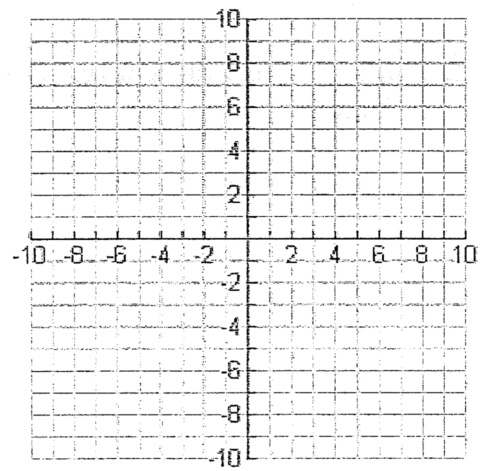
Avg. Rate of Change [-2, 1]: ______________

End Behavior:

As $x \to \infty, f(x) \to$ ________ Increasing: __________ Positive: ____________

As $x \to -\infty, f(x) \to$ _______ Decreasing: _________ Negative: ___________

Example 3: Graph $y = (x - 5)(x + 1)$ Opens: ______ p: ____ q: ____



Vertex: ________ a = ______ Max / Min (Circle one)

AOS: _________ x – intercept(s): ______________ y – intercept: _________

Domain: _____________ Range: _______________

Avg. Rate of Change [3, 5]: ______________

End Behavior:

As $x \to \infty, f(x) \to$ ________ Increasing: __________ Positive: ____________

As $x \to -\infty, f(x) \to$ _______ Decreasing: _________ Negative: ___________

<u>Homework</u>: Graphing Quadratics in INTERCEPT Form **(Tues) Feb 3, 2015**

Intercept form: a(x – p)(x – q) vertex x-value: $\frac{p+q}{2}$

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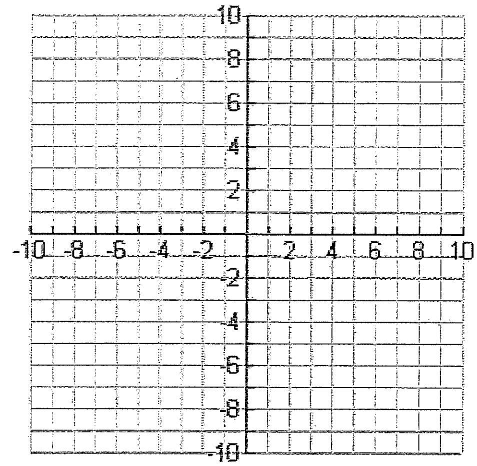
1. Graph y = -2x(x – 4) Opens: __________ p: ______ q: ______



Vertex: ________ a = ______ Max / Min (Circle one)

AOS: __________ x – intercept(s): ______________ y – intercept: _________

Domain: ______________ Range: _______________

Avg. Rate of Change [0, 2]: ______________

End Behavior:

As x $\to \infty$, $f(x) \to$ ________ Increasing: __________Positive:_____________

As x $\to -\infty$, $f(x) \to$ _______Decreasing: __________Negative: ___________

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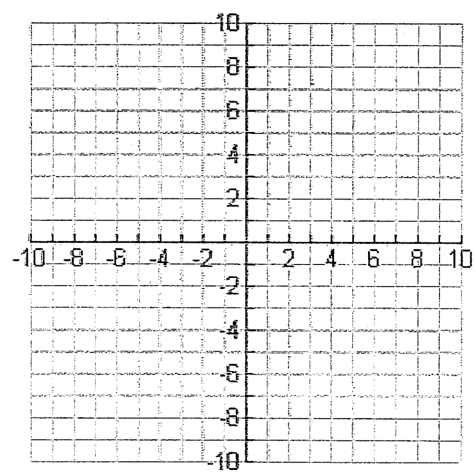
2. y = 4(x + 1) (x – 1) Opens: __________ p: ______ q: ______



Vertex: ________ a = ______ Max / Min (Circle one)

AOS: __________ x – intercept(s): ______________ y – intercept: _________

Domain: ______________ Range: _______________

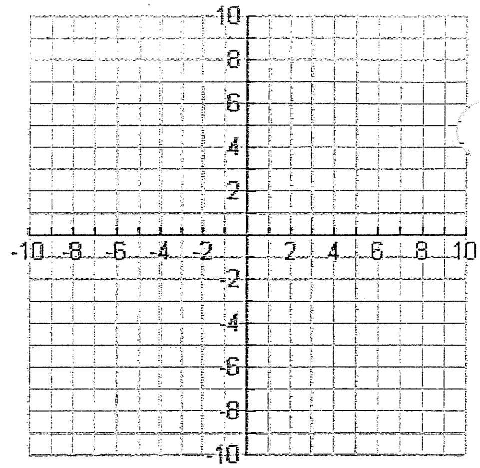
Avg. Rate of Change [-1, 0]: ______________

End Behavior:

As x $\to \infty$, $f(x) \to$ ________ Increasing: __________Positive:_____________

As x $\to -\infty$, $f(x) \to$ _______Decreasing: __________Negative: ___________

3. 2(x + 3) (x + 5) Opens: __________ p: ______ q: ______



Vertex: ________ a = ______ Max / Min (Circle one)

AOS: __________ x – intercept(s): _______________ y – intercept: _________

Domain: ______________ Range: ________________

Avg. Rate of Change [-3, -2]: _______________

End Behavior:
As x $\to \infty, f(x) \to$ ________ Increasing: __________ Positive: ____________

As x $\to -\infty, f(x) \to$ _______ Decreasing: __________ Negative: ____________

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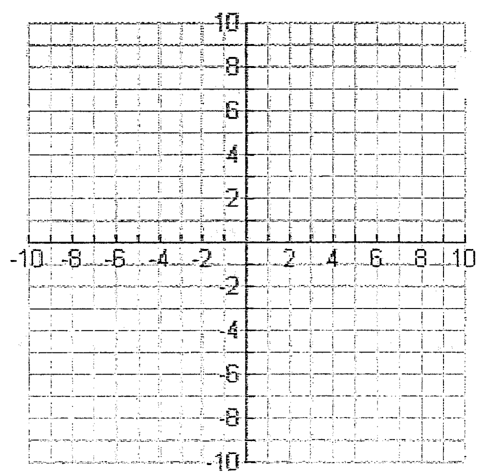
4. y = x(x – 6) Opens: __________ p: ______ q: ______



Vertex: ________ a = ______ Max / Min (Circle one)

AOS: __________ x – intercept(s): _______________ y – intercept: _________

Domain: ______________ Range: ________________

Avg. Rate of Change [3, 6]: _______________

End Behavior:
As x $\to \infty, f(x) \to$ ________ Increasing: __________ Positive: ____________

As x $\to -\infty, f(x) \to$ _______ Decreasing: __________ Negative: ____________

CCGPS Analytic Geometry Notes: Graphing Quadratics in Intercept Form February 3, 2015 (Tues) Key
Essential Question: How do you identify characteristics of a function on a table or graph?

There are three different forms in which quadratics can be presented: yesterday, we explored the **standard form** of the quadratic function: $y = ax^2 + bx + c$ Using this form, it was not too hard to graph the parabola after identifying the vertex and using a table to find points. But, the X-intercepts were not always easy to name. Today we are going to look at another form of the quadratic function. Identifying the x-intercepts is easier with the form called the .....

***Intercept Form:** $y = a(x-p)(x-q)$

- If "a" is positive, the parabola opens up. If "a" is negative, the parabola opens down.
- The x-intercepts are the points $x=p$ and $x=q$. Set factors equal to 0 and solve to get *p* and *q*.
- The x-coordinate of the vertex is $\frac{p+q}{2}$; it is half way between the x-intercepts, so find the AVERAGE of the x-intercepts. To find the y-coordinate of the vertex, substitute this value in for x in the function and solve for y.
- The axis of symmetry is the vertical line x = $\frac{p+q}{2}$; the AOS passes through the vertex.
- To graph, plot the x-intercepts, vertex, and axis of symmetry. Then connect with a smooth curve. You may want to use substitute in another value for x to get 4th and 5th point (using symmetry) for the graph.

Example 1: Find the x-intercepts of the quadratic and the x-value of vertex. Hint: you may need to factor!

a) $y = 2(x - 3)(x + 5)$

$x=3, x=-5$

x-intercepts: $x=3, x=-5$

$(3,0)\ (-5,0)$

$x = \frac{3-5}{2} = \frac{-2}{2} = -1$

Vertex: $(-1, \_)$

b) $y = x^2 + 5x + 6$

$(x+2)(x+3)$

$x=-2, x=-3$

x-intercepts: $x=-2$

$(-2,0)\ (-3,0)$

$\frac{-2+-3}{2} = \frac{-5}{2}$

Vertex: $(-5/2, \_)$

c) $y = 3x^2 - 12x - 15$

$3(x^2-4x-5)$

$3(x-5)(x+1)$

$x=5, x=-1$

x-intercepts: $(5,0)\ (-1,0)$

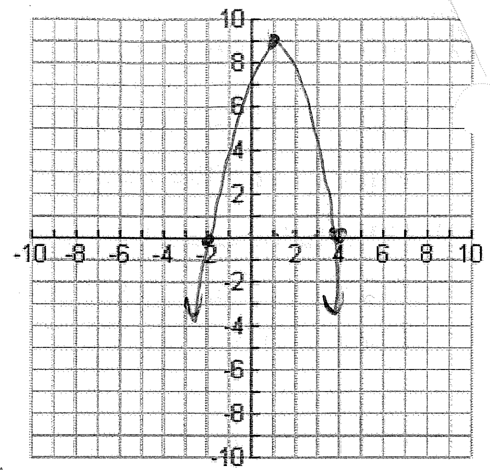
$x = \frac{5-1}{2} = \frac{4}{2} = 2$

Vertex: $(2, \_)$

Intercept form: $a(x - p)(x - q)$ vertex x-value: $\frac{p+q}{2}$

Example 2: Graph y = -(x + 2) (x – 4) Opens: down p: -2 q: 4

$x = \frac{4-2}{2} = \frac{2}{2} = 1$



Vertex: 1,

a = -1 Max / Min (Circle one)

AOS: $x=1$ x – intercept(s): (-2,0) (4,0) y – intercept: (0,8)

Domain: $(-\infty, \infty)$ Range: $(-\infty, 9]$

x	y
-1	0
0	
1	9
2	
3	

Avg. Rate of Change [-2, 1]: 3

(-2, 0) (1, 9) $\frac{9-0}{1+2} = \frac{9}{3} = 3$

End Behavior:

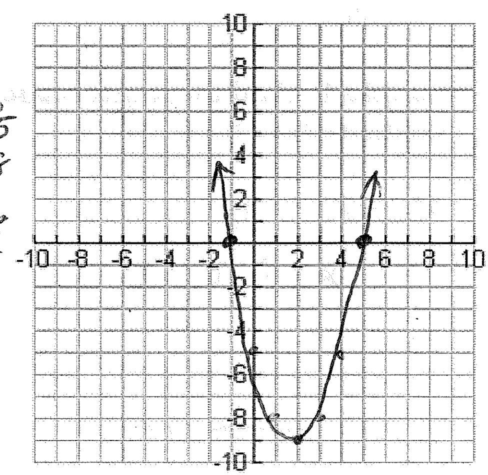
As $x \to \infty, f(x) \to$ $-\infty$ Increasing: $(-\infty, 1)$ Positive: $(-2, 4)$

As $x \to -\infty, f(x) \to$ $-\infty$ Decreasing: $(1, \infty)$ Negative: $(-\infty, -2) \cup (4, \infty)$

Example 3: Graph y = (x – 5) (x + 1) Opens: up p: 5 q: -1

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

x	y
-1	0
0	-5
1	-8
2	-9
3	-8
4	-5
5	0



Vertex: (2, -9) a = -1 Max / Min (Circle one)

AOS: $x = 2$ x – intercept(s): (5,0) (-1,0) y – intercept: (0,-5)

Domain: $(-\infty, \infty)$ Range: $[-9, \infty)$

Avg. Rate of Change [3, 5]: 4

(3, -8)
(5, 0)

$m = \frac{-8-0}{3-5} = \frac{-8}{-2}$

End Behavior:

As $x \to \infty, f(x) \to$ $+\infty$ Increasing: $(2, \infty)$ Positive: $(-\infty, -1) \cup (5, \infty)$

As $x \to -\infty, f(x) \to$ $+\infty$ Decreasing: $(-\infty, 2)$ Negative: $(-1, 5)$

Homework: Graphing Quadratics in INTERCEPT Form (Tues) Feb 3, 2015

Intercept form: a(x – p)(x – q) vertex x-value: $\frac{p+q}{2}$

---

1. Graph y = -2x(x – 4) Opens: down p: 0 q: 4

$-2(x-0)(x-4)$

Vertex: (2, 8) a = -2 Max / Min (Circle one)

AOS: x = 2 x – intercept(s): (0, 0) (4, 0) y – intercept: (0, 0)

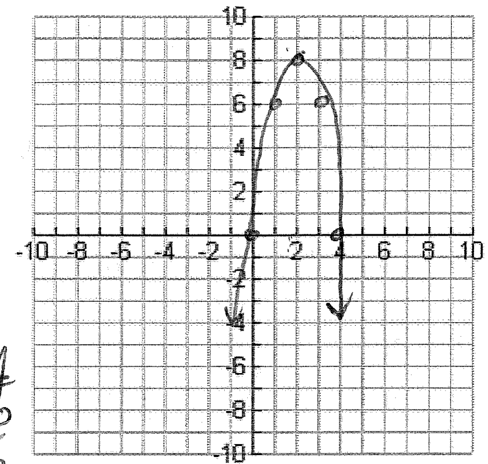
Domain: $(-\infty, \infty)$ Range: $(-\infty, 8]$

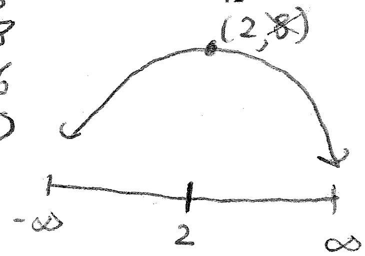
Avg. Rate of Change [0, 2]: 4

(0, 0)
(2, 8)

$m = \frac{8-0}{2-0} = \frac{8}{2} = 4$

x	y
0	0
1	6
2	8
3	6
4	0

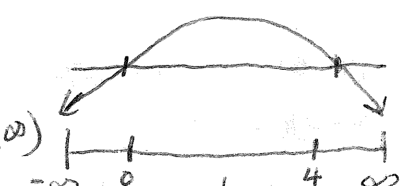




End Behavior:

As $x \to \infty, f(x) \to$ $-\infty$ Increasing: x-value $(-\infty, 2)$ Positive: (0, 4)

As $x \to -\infty, f(x) \to$ $-\infty$ Decreasing: $(2, \infty)$ Negative: $(-\infty, 0) \cup (4, \infty)$



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2. y = 4(x + 1) (x – 1) Opens: up p: -1 q: 1

Vertex: (0, -4) a = 4 Max / Min (Circle one)

AOS: x = 0 x – intercept(s): (-1, 0) (1, 0) y – intercept: (0, -4)

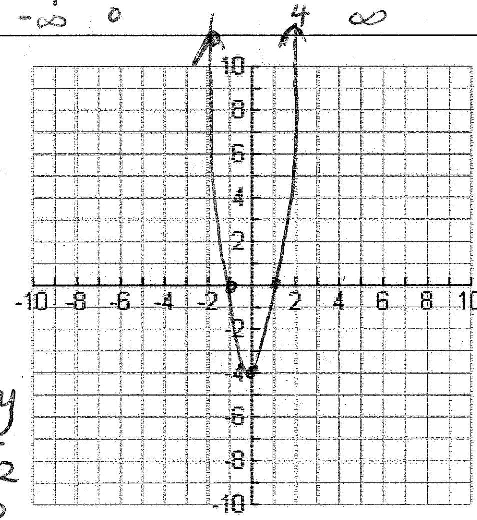
Domain: $(-\infty, \infty)$ Range: $[-4, \infty)$

Avg. Rate of Change [-1, 0]: -4

(-1, 0)
(0, -4)

$\frac{-4-0}{0--1} = \frac{-4}{1}$

x	y
-2	12
-1	0
0	-4
1	0
2	12

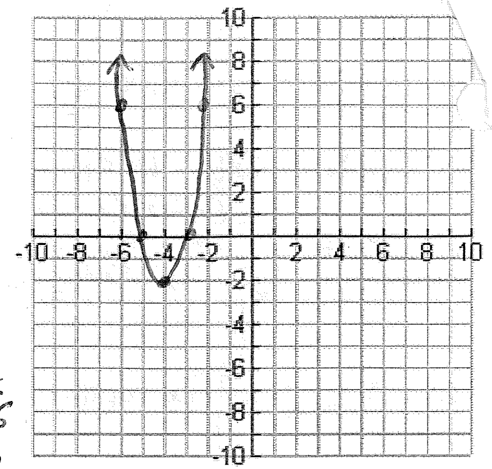


End Behavior:

As $x \to \infty, f(x) \to$ $+\infty$ Increasing: $(0, \infty)$ Positive: $(-\infty, -1) \cup (1, \infty)$

As $x \to -\infty, f(x) \to$ $+\infty$ Decreasing: $(-\infty, 0)$ Negative: (-1, 1)

3. 2(x + 3) (x + 5) Opens: up p: -3 q: -5



Vertex: (-4, _) a = 2 Max / Min (Circle one)

AOS: X=-4 x – intercept(s): (-5,0)(-3,0) y – intercept: (0,30)

Domain: (-∞,∞) Range: [-2,∞)

x	y
-6	6
-5	0
-4	-2
-3	0
-2	6
0	30

Avg. Rate of Change [-3, -2]: 6

(-3, 0) $\frac{6-0}{-2+3}$

(-2, 6)

End Behavior:

As $x \to \infty$, $f(x) \to$ +∞ Increasing: (-4,∞) Positive: (-∞,-5)U(-3,∞)

As $x \to -\infty$, $f(x) \to$ +∞ Decreasing: (-∞,-4) Negative: (-5,-3)

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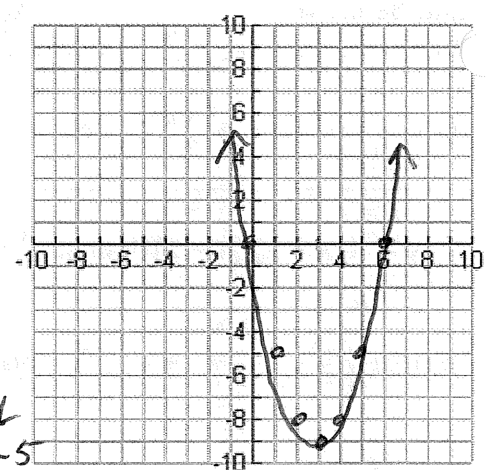
4. y = x(x – 6) Opens: up p: 0 q: 6

y=(x-0)(x-6)



Vertex: (3,-9) a = 1 Max / Min (Circle one)

AOS: X=3 x – intercept(s): (0,0)(6,0) y – intercept: (0,0)

Domain: (-∞,∞) Range: [-9, ∞)

x	y
1	-5
2	-8
3	-9
4	-8
5	-5

Avg. Rate of Change [3, 6]: -3

(3, -9) $\frac{-9-0}{3-6} = \frac{-9}{3}$

(6, 0)

End Behavior:

As $x \to \infty$, $f(x) \to$ +∞ Increasing: (3,∞) Positive: (-∞,0)U(6,∞)

As $x \to -\infty$, $f(x) \to$ +∞ Decreasing: (-∞,3) Negative: (0,6)