Graphing Quadratic Functions

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PRE-CALCULUS 11
QUADRATIC FUNCTIONS
GRAPHING QUADRATIC FUNCTIONS

A. Definitions

1. **quadratic function:** any function that can be written in the form: $y = ax^2 + bx + c$ or $f(x) = ax^2 + bx + c$. Where a,b and c are constants and $a \neq 0$.

2. **x-intercept:** the place where the curve crosses the x-axis. These are also referred to as the roots or zeros of the function.

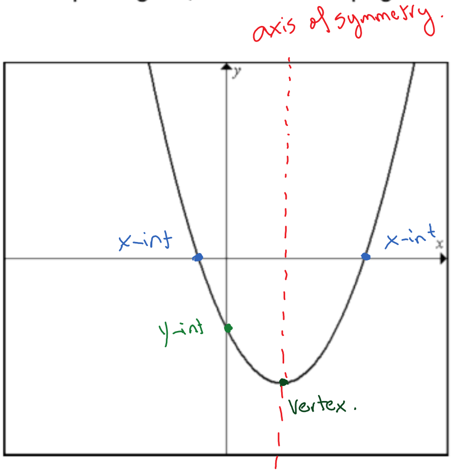
3. **y-intercept:** the place where the curve crosses the y-axis. In the form of the quadratic function the c value represents the y-intercept.

4. **vertex:** the highest or lowest point of a quadratic function

5. **axis of symmetry:** the imaginary line, through the vertex, that divides the quadratic function into two perfect halves

B. Properties of a Quadratic Function

Remember from last year that all Linear Functions will form graphs of a line. In comparison, all Quadratic Functions will form graphs of a **parabola**. A parabola is a U-shaped figure, either in an upright or inverted position on the graph.



- the vertex is always half way between the x-intercepts

- the axis of symmetry is always half way between the x-intercepts.

- the axis of symmetry will mirror points on each side.

C. <u>Determining the Coordinates of the Vertex of a Quadratic Function</u>

Consider the quadratic function

$$y = x^2 - 6x + 8$$

Since the vertex of the parabola must lay halfway between the two zeros of the function, finding the zeros is critical. We can easily factor the equation to find the zeros.

8
-2   -4
-6

$y = x^2 - 6x + 8$
$0 = x^2 - 6x + 8$
$0 = (x - 2)(x - 4)$

$\boxed{\text{x-int } (2,0) \ \& \ (4,0)}$

Finding the halfway point between the zeros gives you the x-coordinate of the vertex. To determine the y-coordinate we can substitute the x-coordinate into the equation and solve.

X-coordinate $= \dfrac{2+4}{2} = \underline{\underline{3}}$

$y = x^2 - 6x + 8$
$y = (3)^2 - 6(3) + 8$
$y = 9 - 18 + 8$
y-coordinate $= \underline{\underline{-1}}$

$\boxed{\text{Vertex } (3,-1)}$

D. <u>Graphing the Quadratic Function</u>

The vertex is the most important point on the parabola because it is where the parabola will begin. In order to see the rest of the parabola we will need a few more points (minimum of 5 - 6 points for a parabola). For this, we can use the x & y intercepts plus at least one more point to help us graph the quadratic function.

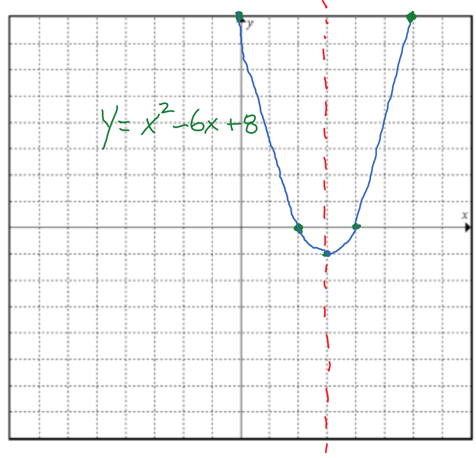
X-int (2,0) & (4,0).
Vertex (3,-1)
y-int (0,8)

✱ If you need extra points you can make a table of values. Remember that each point will be mirrored over the axis of symmetry.

Graph the quadratic function $y = x^2 - 6x + 8$ using the vertex, x & y intercepts and at least one other point.

axis of symmetry.

x-int $(2,0)$ & $(4,0)$
vertex $(3,-1)$
y-int $(0,8)$
extra point. $(6,8)$



Graph the quadratic function $y = -2x^2 + 4x + 6$ using the vertex, x & y intercepts and at least one other point.

axis of symmetry

-3
-3 1
-2

$y = -2x^2 + 4x + 6$
$0 = -2(x^2 - 2x - 3)$
$0 = -2(x - 3)(x + 1)$

$\boxed{\text{x-int } (3,0) \text{ \& } (-1,0)}$

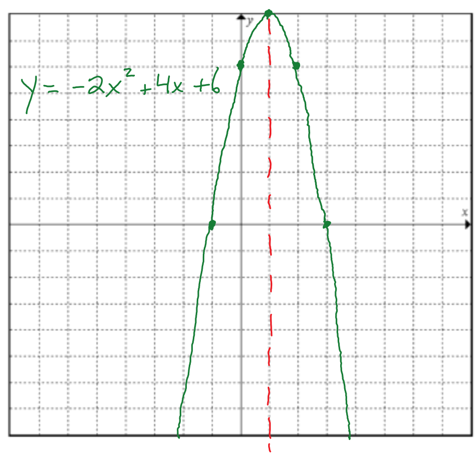
x-coordinate $= \dfrac{3 + -1}{2} = \underline{\underline{1}}$

$y = -2x^2 + 4x + 6$
$y = -2(1)^2 + 4(1) + 6$
y-coordinate $= \underline{\underline{8}}$

$\boxed{\text{vertex } (1,8)}$

$\boxed{\text{y-int } (0,6)}$

$\boxed{\text{extra point } (2,6)}$



Assignment : Graphing Quadratic Functions Assignment #1 - 12

PRE-CALCULUS 11
QUADRATIC FUNCTIONS
GRAPHING QUADRATIC FUNCTIONS ASSIGNMENT

For each of the following quadratic functions, determine the coordinates of the x-intercepts, y-intercept and vertex, then graph the function.

1) $y=(x+1)(x+5)$

2) $y=(x-2)(x+2)$

3) $y=x^2-2x$

4) $y=x^2-4x+3$

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

6) $y=x^2-4$

7) $y=-x^2-2x+3$

8) $y=-x^2-4x$

9) $y=2x^2+8x+6$

10) $y=3x^2-3$

11) $y=-2x^2+4x$

12) $y=-2x^2-8x-6$

Answers

1) x-int $(-1,0)$, $(-5,0)$
y-int $(0,5)$
vertex $(-3,-4)$

2) x-int $(2,0)$, $(-2,0)$
y-int $(0,-4)$
vertex $(0,-4)$

3) x-int $(0,0)$, $(2,0)$
y-int $(0,0)$
vertex $(1,-1)$

4) x-int $(1,0)$, $(3,0)$
y-int $(0,3)$
vertex $(2,-1)$

5) x-int $(1,0)$, $(5,0)$
y-int $(0,-5)$
vertex $(3,4)$

6) x-int $(2,0)$, $(-2,0)$
y-int $(0,-4)$
vertex $(0,-4)$

7) x-int $(-3,0)$, $(1,0)$
y-int $(0,3)$
vertex $(-1,4)$

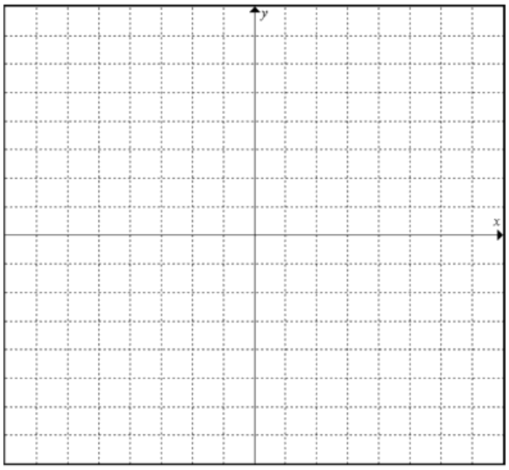
8) x-int $(0,0)$, $(-4,0)$
y-int $(0,0)$
vertex $(-2,4)$

9) x-int $(-3,0)$, $(-1,0)$
y-int $(0,6)$
vertex $(-2,-2)$

10) x-int $(1,0)$, $(-1,0)$
y-int $(0,-3)$
vertex $(0,-3)$

11) x-int $(0,0)$, $(2,0)$
y-int $(0,0)$
vertex $(1,2)$

12) x-int $(-1,0)$, $(-3,0)$
y-int $(0,-6)$
vertex $(-2,2)$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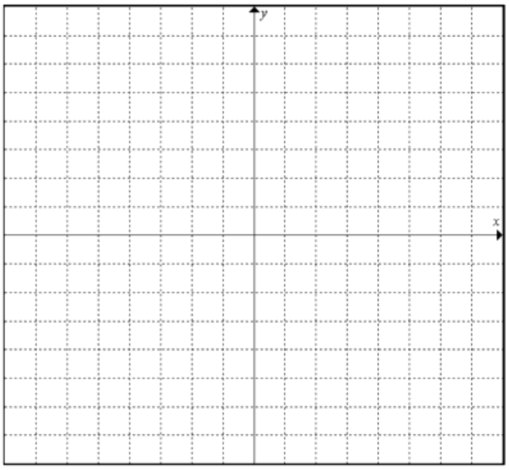
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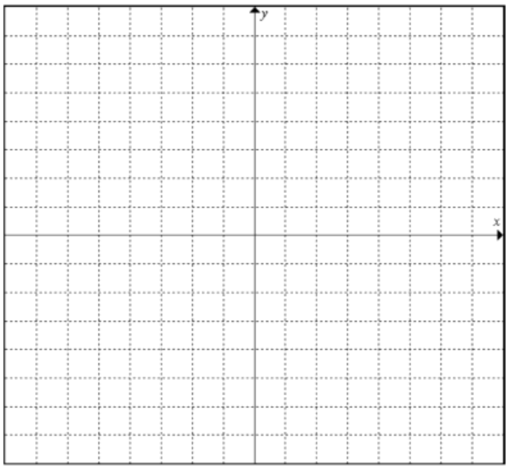
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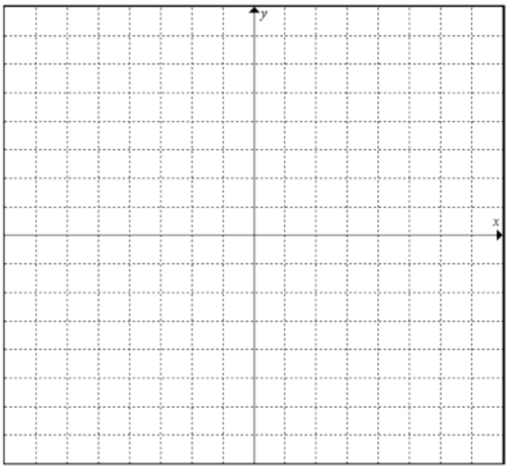
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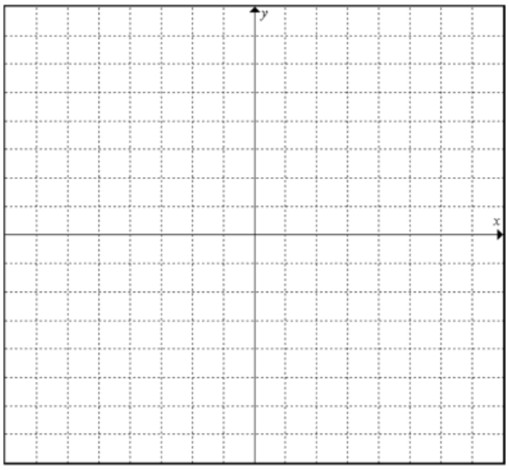
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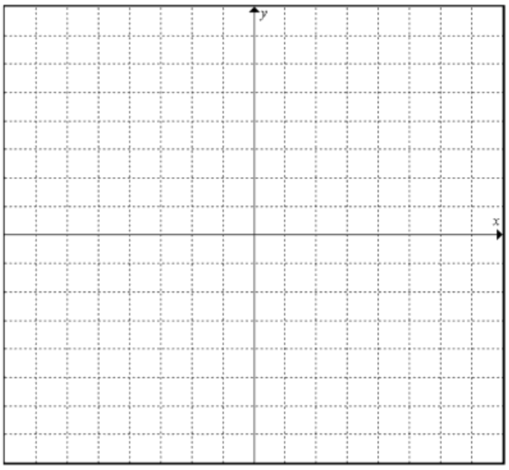
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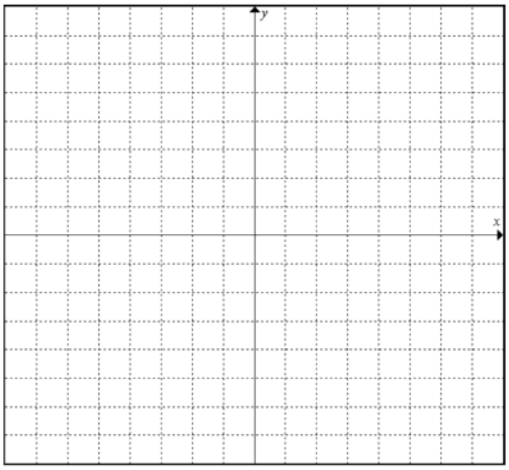
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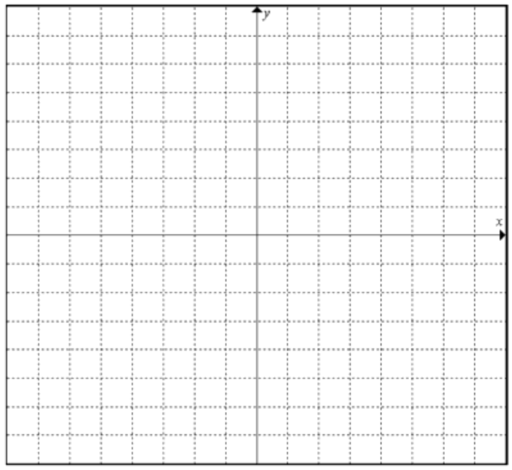
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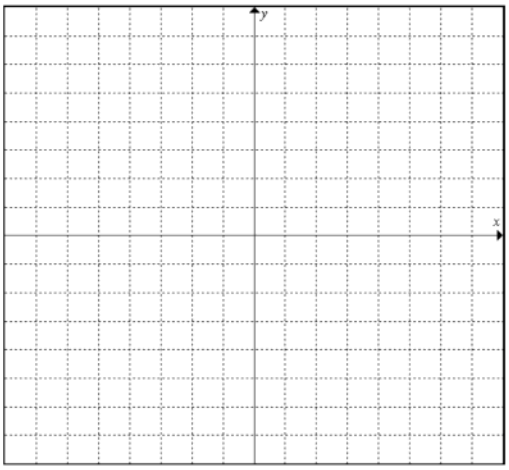
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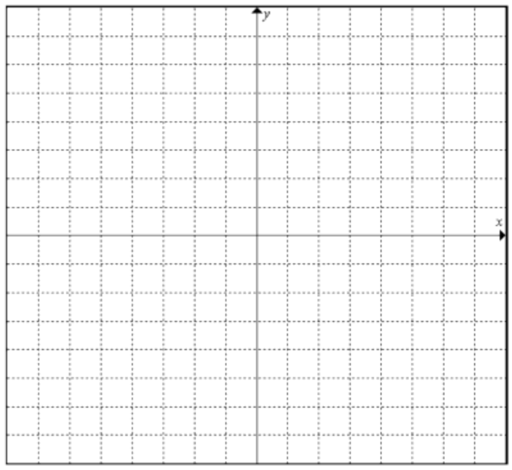
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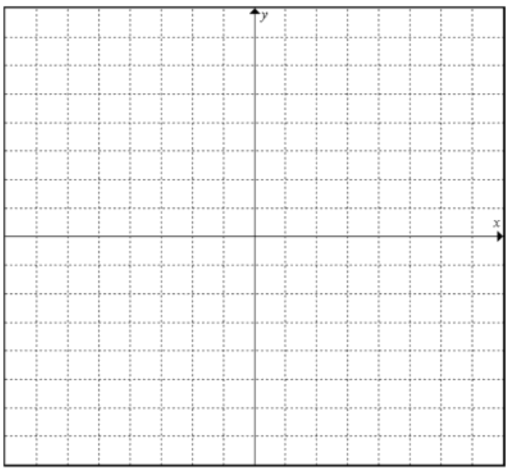
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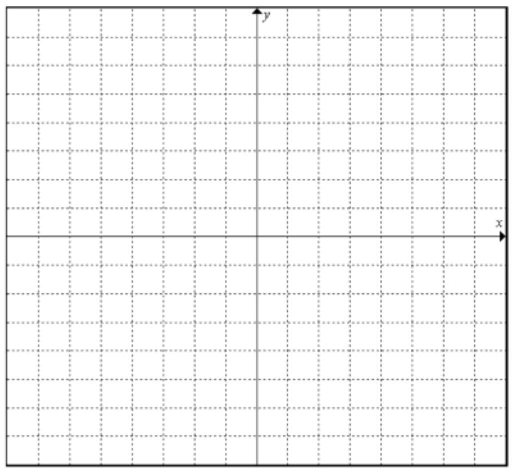
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