

Key

Section 4.7 Notes Day 1

Objective: Writing Quadratic Functions in Vertex Form.

Warm-Up: Identify the vertex & the transformations of $g(x)$ from the parent function $f(x) = x^2$.

$f(x) = a(x-h)^2 + k$ $(h, k) = \text{vertex}$

$g(x) = -2(x+5)^2 - 7$

$g(x) = \frac{1}{3}(x-4)^2 + 2$

vertex: $(-5, -7)$

vertex: $(4, 2)$

transformations:

5 left & 7 down
vertical stretch by 2
vertical reflection

transformations: 4 right & 2 up
vertical compression by $\frac{1}{3}$

When a quadratic function is in the standard form $f(x) = ax^2 + bx + c$, you can complete the square to write the function in vertex form.

Ex. Write the function in vertex form.

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

$(\frac{6}{2})^2 = 9$

Step 1: set equation = 0

$x^2 + 6x - 5 = 0$

Step 2: complete the square

$x^2 + 6x + \underline{9} = 5 + \underline{9}$

Step 3: move constant back across =

$(x+3)^2 = 14$

Step 4: rewrite in 'y=' form

$y = (x+3)^2 - 14$

vertex $(-3, -14)$

Ex. 1) $y = x^2 - 6x + 3$

$x^2 - 6x + \underline{9} = -3 + \underline{9}$

$(x-3)^2 = 6$

$y = (x-3)^2 - 6$

Ex. 2) $y = x^2 + 4x + 9$

$(\frac{4}{2})^2 = 4$

$x^2 + 4x + 9 = 0$

$x^2 + 4x + \underline{4} = -9 + \underline{4}$

$(x+2)^2 = -5$

$y = (x+2)^2 + 5$

Write the function in vertex form and graph:

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

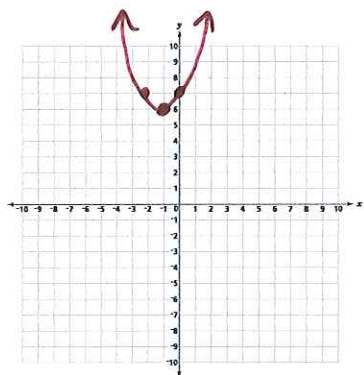
$x^2 + 2x + 7 = 0$

$x^2 + 2x + \underline{1} = -7 + \underline{1}$

$(x+1)^2 = -6$

$y = (x+1)^2 + 6$

vertex
 $(-1, 6)$



4) $y = x^2 - 12x + 36$

$x^2 - 12x + 36 = 0$

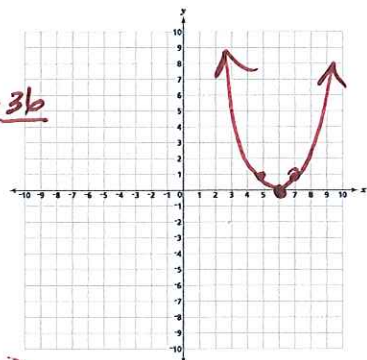
$x^2 - 12x + \underline{36} = -36 + \underline{36}$

$(x-6)^2 = 0$

$(\frac{12}{2})^2 = 36$

$y = (x-6)^2$

vertex = $(6, 0)$



If the coefficient of the quadratic term is not 1, then factor the coefficient from the quadratic and linear terms before completing the square.

Ex. $y = 2x^2 - 12x + 17$

$$2x^2 - 12x + 17 = 0$$

$$2x^2 - 12x = -17$$

$$2(x^2 - 6x + \underline{9}) = -17 + \underline{18}$$

$$2(x-3)^2 = 1$$

vertex
(3, 1)

$$\left(\frac{6}{2}\right)^2 = 9$$

$$y = 2(x-3)^2 - 1$$

5) $y = 4x^2 - 16x - 40$

$$4x^2 - 16x - 40 = 0$$

$$4x^2 - 16x = 40$$

$$4(x^2 - 4x + \underline{4}) = 40 + \underline{16}$$

$$4(x-2)^2 = 56$$

$$y = 4(x-2)^2 - 56$$

vertex
(2, -56)

Write the function in vertex form and graph:

7) $y = -2x^2 + 8x - 5$

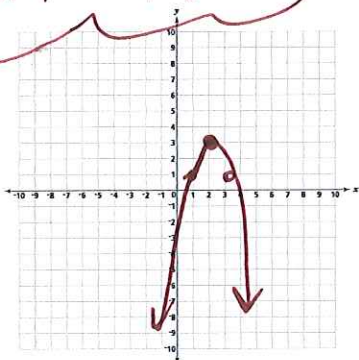
$$-2x^2 + 8x = 5$$

$$-2(x^2 - 4x + \underline{4}) = 5 + \underline{-8}$$

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

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

vertex (2, 3)



Ex. $y = 4x^2 + 24x + 24$

$$4x^2 + 24x + 24 = 0$$

$$4x^2 + 24x = -24$$

$$4(x^2 + 6x + \underline{9}) = -24 + \underline{36}$$

$$4(x+3)^2 = 12$$

vertex
(-3, -12)

$$y = 4(x+3)^2 - 12$$

6) $y = -2x^2 + 8x - 3$

$$-2x^2 + 8x - 3 = 0$$

$$-2x^2 + 8x = 3$$

$$-2(x^2 - 4x + \underline{4}) = 3 + \underline{-8}$$

$$-2(x-2)^2 = -5$$

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

8) $y = -x^2 - 4x + 1$

$$-x^2 - 4x + 1 = 0$$

$$-x^2 - 4x = -1$$

$$-1(x^2 + 4x + \underline{4}) = -1 + \underline{4}$$

$$-1(x+2)^2 = -5$$

$$y = -1(x+2)^2 + 5$$

vertex
(-2, 5)

