

Converting between the Forms (3)

Convert from standard to Vertex Form.

Step 1: Find the vertex.

Step 2: Identify a .

Step 3: Plug a , h , and k in to the vertex form equation, $y = a(x-h)^2 + k$.

Ex. 1) $y = x^2 - 2x + 9$

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

$$y = (1)^2 - 2(1) + 9 = 1 - 2 + 9 = -1 + 9 = 8$$

Vertex: $(1, 8) \Rightarrow h = 1, k = 8$

$a = 1$

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

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

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

$$y = -(2)^2 + 4(2) - 3 = -4 + 8 - 3 = 4 - 3 = 1$$

Vertex: $(2, 1) \Rightarrow h = 2, k = 1$

$a = -1$

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

Ex. 3) $y = 2x^2 - 4x + 1$

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

$$y = 2(1)^2 - 4(1) + 1 = 2 - 4 + 1 = -2 + 1 = -1$$

Vertex: $(1, -1) \Rightarrow h = 1, k = -1$

$a = 2$

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

$$\text{EX.4) } y = 3x^2 + 6x$$

$$x = \frac{-b}{2a} = \frac{-6}{2(3)} = \frac{-6}{6} = -1$$

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

$$\text{Vertex: } (-1, -3) \Rightarrow h = -1, k = -3$$

$$a = 3$$

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

Practice Problems

Convert each to vertex form.

1. $y = x^2 - 16x + 8$

2. $y = 2x^2 - 10x - 8$

3. $y = x^2 + 2x - 3$

4. $y = 2x^2 + 6x + 25$

5. $y = -3x^2 + 18x + 30$

6. $y = 4x^2 + 12x - 4$

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

$$\textcircled{1} y = x^2 - 16x + 8$$

$$x = \frac{-(-16)}{2(1)} = \frac{16}{2} = 8$$

$$y = (8)^2 - 16(8) + 8$$

$$= 64 - 128 + 8$$

$$= -56$$

$$V: (8, -56)$$

$$h = 8$$

$$k = -56$$

$$a = 1$$

$$y = (x-8)^2 - 56$$

$$\textcircled{2} y = 2x^2 - 10x - 8$$

$$V: (2.5, -20.5)$$

$$x = \frac{-(-10)}{2(2)} = \frac{10}{4} = 2.5$$

$$y = 2(2.5)^2 - 10(2.5) - 8$$

$$= 12.5 - 25 - 8$$

$$= -20.5$$

$$a = 2$$

$$y = 2(x-2.5)^2 - 20.5$$

$$\textcircled{3} y = x^2 + 2x - 3$$

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

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

$$= 1 - 2 - 3$$

$$= -4$$

$$V: (-1, -4)$$

$$h = -1$$

$$k = -4$$

$$a = 1$$

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

$$\textcircled{4} y = 2x^2 + 6x + 25$$

$$\textcircled{5} y = -3x^2 + 18x + 30$$

$$\begin{aligned} V: (-1.5, 20.5) \quad x &= \frac{-b}{2a} = \frac{-6}{2 \cdot 2} = -1.5 \\ h &= -1.5 \\ k &= 20.5 \\ a &= 2 \\ y &= 2(-1.5)^2 + 6(-1.5) + 25 \\ &= 4.5 - 9 + 25 \\ &= 20.5 \end{aligned}$$

$$\begin{aligned} x &= \frac{-b}{2a} = \frac{-18}{2 \cdot (-3)} = 3 \quad V: (3, 57) \\ h &= 3 \\ k &= 57 \\ a &= -3 \\ y &= -3(3)^2 + 18(3) + 30 \\ &= -27 + 54 + 30 \\ &= 57 \end{aligned}$$

$$y = 2(x + 1.5)^2 + 20.5$$

$$y = -3(x - 3)^2 + 57$$

$$\textcircled{6} y = 4x^2 + 12x - 4$$

$$\textcircled{7} y = x^2 + 6x - 5$$

$$\begin{aligned} V: (-1.5, -13) \\ h &= -1.5 \\ k &= -13 \\ a &= 4 \\ x &= \frac{-b}{2a} = \frac{-12}{2 \cdot 4} = -1.5 \\ y &= 4(-1.5)^2 + 12(-1.5) - 4 \\ &= 9 - 18 - 4 \\ &= -13 \end{aligned}$$

$$\begin{aligned} V: (-3, -14) \\ h &= -3 \\ k &= -14 \\ a &= 1 \\ x &= \frac{-b}{2a} = \frac{-6}{2 \cdot 1} = -3 \\ y &= (-3)^2 + 6(-3) - 5 \\ &= 9 - 18 - 5 \\ &= -14 \end{aligned}$$

$$y = 4(x + 1.5)^2 - 13$$

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