

- Standard Form

$$y = ax^2 + bx + c$$

What you will learn about:  
Vertex Form

- Intercept Form

$$y = a(x-p)(x-q)$$

- Vertex Form

$$y = a(x-h)^2 + k$$

Vertex  $(h, k)$

$a > 0$  opens up  
(min)

$a < 0$  opens down  
(max)

y-intercept

Let  $x=0$

$$y = ax^2 + bx + c$$

Completing the Square

1) a-value is 1

2) b-value Divide  
by 2

3) Square answer  
from step 2

$$\left(\frac{15}{2}\right)^2$$

$$\frac{25}{13} \cdot \frac{1}{2} = \frac{25}{26}$$

Locate the vertex of each quadratic function. Tell whether it is a maximum value or a minimum value. Find the y-intercept for each equation.

$$g(x) = (x-3)^2 + 5$$

$$V(3, 5)$$

minimum

$$g(0) = (0-3)^2 + 5$$

$$(0, 14)$$

$$m(x) = (x-1)^2 + 25$$

$$V(1, 25)$$

min

$$y(0, 26)$$

$$f(x) = 3(x-7)^2 - 12$$

$$V(7, -12)$$

minimum

$$f(0) = 3(0-7)^2 - 12$$

$$(0, 135)$$

$$n(x) = -2(x+6)^2 + 20$$

$$V(-6, 20)$$

max

$$(0, -52)$$

Find the value of  $c$  that completes the square. Write your expression as a square of a binomial.

$$x^2 + 12x + \boxed{\phantom{00}} \quad c=36$$

$$x^2 + 12x + 36$$

$$(x+6)^2$$

$$x^2 - 15x + c$$

$$x^2 - 15x + \frac{225}{4}$$

$$\left(x - \frac{15}{2}\right)^2$$

$$x^2 - \frac{25}{13}x + c$$

$$x^2 - \frac{25}{13}x + \frac{625}{169}$$

$$\left(x - \frac{25}{26}\right)^2$$

$$x^2 - 6x + c$$

$$x^2 - 6x + 9$$

$$(x-3)^2$$

$$x^2 + 11x + c$$

$$x^2 + 11x + \frac{121}{4}$$

$$\left(x + \frac{11}{2}\right)^2$$

a=1

Use completing the square to write each function in vertex form. Label the vertex and find the y-intercept.

$$f(x) = x^2 - 6x + 11$$

$$f(x) - 11 = x^2 - 6x + 9$$

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

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

$$v(3, 2)$$

$$(0, 11)$$

$$f(x) = x^2 - 2x - 9$$

$$f(x) + 9 = x^2 - 2x + 1$$

$$f(x) + 10 = (x - 1)^2$$

$$f(x) = (x - 1)^2 - 10$$

$$v(1, -10)$$

$$(0, -9)$$

$$f(x) = x^2 + 16x + 14$$

$$f(x) - 14 = x^2 + 16x + 64$$

$$f(x) + 50 = (x + 8)^2$$

$$f(x) = (x + 8)^2 - 50$$

$$v(-8, -50)$$

$$(0, 14)$$

$$f(x) = x^2 + 7x - 1$$

$$f(x) + 1 = x^2 + 7x + \frac{49}{4}$$

$$f(x) + \frac{53}{4} = \left(x + \frac{7}{2}\right)^2$$

$$f(x) = \left(x + \frac{7}{2}\right)^2 - \frac{53}{4}$$

$$\left(-\frac{7}{2}, -\frac{53}{4}\right)$$

$$(0, -1)$$

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

$$f(x) + 2 = x^2 - 3x + \frac{9}{4}$$

$$f(x) + \frac{17}{4} = \left(x - \frac{3}{2}\right)^2$$

$$f(x) = \left(x - \frac{3}{2}\right)^2 - \frac{17}{4}$$

$$\left(\frac{3}{2}, -\frac{17}{4}\right)$$

$$(0, -2)$$

$$\frac{2}{1} + \frac{9}{4} = \frac{8}{4} + \frac{9}{4} = \frac{17}{4}$$

$$y = a(x-h)^2 + k$$

$$\frac{f(x)}{-1} = \frac{-x^2 + 20x - 80}{-1}$$

$$-f(x) = x^2 - 20x + 80$$

$$-f(x) - 80 = x^2 - 20x + 100$$

$$-f(x) + 20 = (x-10)^2$$

$$-1 \cdot (-f(x)) = [(x-10)^2 - 20]^{-1}$$

$$f(x) = -(x-10)^2 + 20$$

$$V(10, 20)$$

$$(0, -80)$$

$$\frac{f(x)}{3} = \frac{3x^2 - 12x + 1}{3}$$

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

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

$$+ 4$$

$$\frac{f(x)}{3} + \frac{11}{3} = (x-2)^2$$

$$3 \left( \frac{f(x)}{3} \right) = \left( (x-2)^2 \right) \cdot \left( \frac{11}{3} \right)^3$$

$$f(x) = 3(x-2)^2 - 11$$

$$V(2, -11)$$

$$(0, 1)$$

$$\frac{f(x)}{3} = \frac{3x^2 - 5x + 2}{3}$$

$$\frac{f(x)}{3} = x^2 - \frac{5}{3}x + \frac{2}{3}$$

$$\frac{f(x)}{3} - \frac{2}{3} = x^2 - \frac{5}{3}x + \frac{25}{36}$$

$$+ \frac{25}{36}$$

$$\frac{f(x)}{3} + \frac{1}{36} = \left( x - \frac{5}{6} \right)^2$$

$$3 \left( \frac{f(x)}{3} \right) = \left( \left( x - \frac{5}{6} \right)^2 \right) \cdot \left( \frac{1}{36} \right)^3$$

$$\frac{f(x)}{-2} = \frac{-2x^2 - 2x - 7}{-2}$$

$$\frac{f(x)}{-2} = x^2 + x + \frac{7}{2}$$

$$\frac{f(x)}{-2} - \frac{7}{2} = x^2 + x + \frac{1}{4}$$

$$+ \frac{1}{4}$$

$$\frac{f(x)}{-2} - \frac{13}{4} = \left( x + \frac{1}{2} \right)^2$$

$$-2 \left( \frac{f(x)}{-2} \right) = \left( \left( x + \frac{1}{2} \right)^2 \right) \cdot \left( \frac{13}{4} \right)^{-2}$$

$$f(x) = -2 \left( x + \frac{1}{2} \right)^2 - \frac{13}{2}$$

$$V \left( -\frac{1}{2}, -\frac{13}{2} \right)$$

$$(0, -7)$$

$$f(x) = 3 \left( x - \frac{5}{6} \right)^2 - \frac{1}{12}$$

$$V \left( \frac{5}{6}, -\frac{1}{12} \right)$$

$$(0, 2)$$

$$-\frac{7}{2} + \frac{1}{4}$$

$$-\frac{14}{4} + \frac{1}{4} = -\frac{13}{4}$$

$$-\frac{24}{36} + \frac{25}{36}$$

$$\frac{1}{36}$$