$$y = ax^2 + bx + c \qquad\qquad x = -\frac{b}{2a}$$
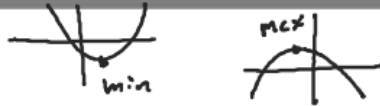
What you will learn about:
Vertex Form

Vertex Form

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

Vertex (h, k)

y-intercept
$x = 0$

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.

min   max

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

Vertex $(3, 5)$
$a = 1$ min value
$(0-3)^2 + 5$
$(0, 14)$

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

Vertex $(7, -12)$
$a = 3$ min value
$3(0-7)^2 - 12$
$(0, 135)$

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

Vertex $(1, 25)$
$a = 1$ min value
$(0, 26)$

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

Vertex $(-6, 20)$
$a = -2$ max value
$(0, -52)$

Put in Vertex form

Completing the Square

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

1st: $a = 1$

2nd: take "b" term
Divide by 2

3rd: Square answer
from step 2

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

$$c = \left(\frac{12}{2}\right)^2$$

$$x^2 + 12x + c \qquad = 36$$

$x^2 + 12x + 36$
$(x + 6)^2$

$$x^2 - \frac{15}{2}x + c$$

$x^2 - 15x + \frac{225}{4}$
$\left(x - \frac{15}{2}\right)^2$

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

$x^2 - \frac{25}{13}x + \frac{625}{676}$

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

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

$x^2 - 6x + 9$
$(x - 3)^2$

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

$x^2 + 11x + \frac{121}{4}$
$\left(x + \frac{11}{2}\right)^2$

$$\frac{6}{2} = (3)^2 = 9$$

$$\left(\frac{11}{2}\right)^2 = \frac{121}{4}$$

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

a = 1

Make sure a = 1
All values with x
on one side of equation
Complete Square
Solve for f(x)

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

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

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

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

Vertex $(3, 2)$

y-intercept $(0, 11)$

$f(x) = x^2 - 2x - 9$
$+9 \qquad +9$

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

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

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

$v(1, -10)$

y-intercept $(0, -9)$

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

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

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

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

$v(-8, -50)$

y-intercept $(0, 14)$

$\frac{2}{1} + \frac{9}{4}$

$\frac{8}{4} + \frac{9}{4}$

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

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

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

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

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

y-intercept $(0, -2)$

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

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

$\frac{53}{4} = x^2 + 7x + \frac{49}{4}$

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

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

$y = (0, -1)$