

Complete the square

1) $a = 1$

2) Everything with x on one side, every thing else on other side

3) Divide "b" term by 2, then square answer.

4) Add answer to #3 to both sides

$$\frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

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Use Completing the square to describe the graph each function. Then use the quadratic formula to find the x-intercepts

$a=1$ $b=6$ $c=-11$

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

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

$$f(x) + 20 = (x + 3)^2$$

$$f(x) = (x + 3)^2 - 20$$

$$\frac{-6 \pm \sqrt{6^2 - 4(1)(-11)}}{2(1)}$$

$$-3 \pm \frac{\sqrt{36 - (-44)}}{2}$$

$$= -3 \pm \frac{\sqrt{80}}{2}$$

~~$$-3 \pm \frac{\sqrt{40}}{2}$$~~

opens up
 $V(-3, -20)$

A.O.S $x = -3$

$$\sqrt{80} = \frac{4\sqrt{5}}{2} = 2\sqrt{5}$$

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

$$f(x) + 2 = x^2 - 5x + \frac{25}{4}$$

$$f(x) + \frac{33}{4} = \left(x - \frac{5}{2}\right)^2$$

$$f(x) = \left(x - \frac{5}{2}\right)^2 - \frac{33}{4}$$

$$\frac{5}{2(1)} \pm \frac{\sqrt{(-5)^2 - 4(1)(-2)}}{2(1)}$$

$$\frac{5}{2} \pm \frac{\sqrt{25 - (-8)}}{2}$$

$$\frac{5}{2} \pm \frac{\sqrt{33}}{2}$$

$$\left(\frac{5}{2}\right)^2 = \frac{25}{4}$$

$$\frac{2}{1} = \frac{8}{4}$$

opens up
 $V\left(\frac{5}{2}, -\frac{33}{4}\right)$

A.O.S = $x = \frac{5}{2}$

Use Completing the square to describe the graph each function. Then use the quadratic formula to find the x-intercepts

c) $\frac{f(x)}{3} = \frac{3x^2}{3} + \frac{12x}{3} + \frac{11}{3}$

$$\frac{f(x)}{3} = x^2 + 4x + \frac{11}{3}$$

$$\frac{f(x)}{3} - \frac{11}{3} = x^2 + 4x + 4$$

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

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

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

opens up

$$V(-2, -1)$$

$$A.O.S \ x = -2$$

$$\frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

$$\frac{-12 \pm \sqrt{(-12)^2 - 4(3)(11)}}{2(3)}$$

$$-2 \pm \frac{\sqrt{144 - 132}}{6}$$

$$-2 \pm \frac{\sqrt{12}}{6}$$

$$-2 \pm \frac{\sqrt{3}}{3}$$

$$-2 \pm \sqrt{\frac{1}{3}}$$

opens down

$$V(1, 9) \ A.O.S \ x = 1$$

$$\frac{-2 \pm \sqrt{2^2 - 4(-1)(8)}}{2(-1)}$$

$$1 \pm \frac{\sqrt{4 - (-32)}}{-2}$$

$$1 \pm \frac{\sqrt{36}}{-2} = 1 \pm \frac{6}{-2}$$

$$1 \pm -3$$

$$1 - 3 = -2$$

$$1 - (-3) = 4$$

$$-\frac{11}{3} + 4$$

$$-\frac{11}{3} + \frac{12}{3}$$

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

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

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

$$\frac{f(x)}{-1} + 8 = x^2 - 2x + 1$$

$$\frac{f(x)}{-1} + 9 = (x-1)^2$$

$$-1 \left(\frac{f(x)}{-1} \right) = \left[(x-1)^2 - 9 \right]^{-1}$$

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

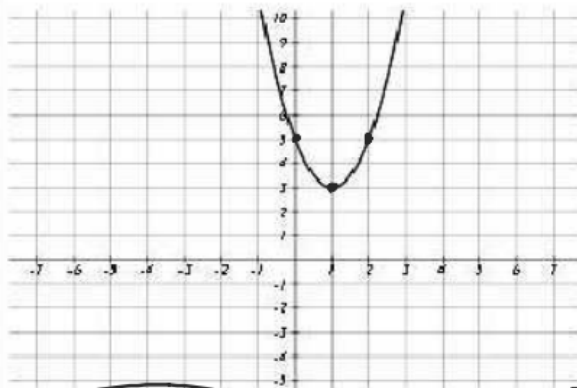
Use Vertex

Find an easy pt on Curve.

plug values in for h and k; x and y solve for a.

Rewrite equation with a, h, + k.

Write an equation for the parabola shown.



$V(1, 3) \rightarrow (h, k)$
 $pt (0, 5) \rightarrow (x, y)$

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

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

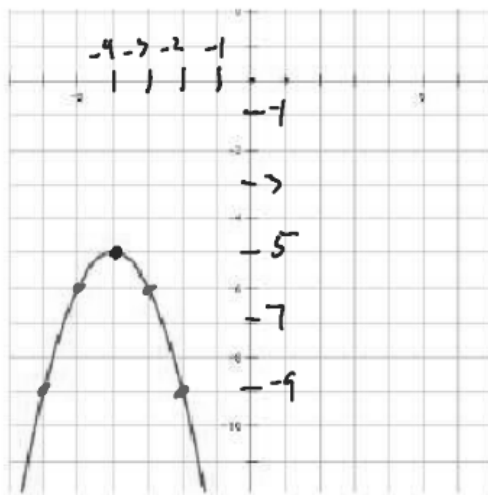
$$5 = a(0-1)^2 + 3$$

$$5 = a(-1)^2 + 3$$

$$5 = a + 3$$

$$a = 2$$

Write an equation for the parabola shown.



$$V(-4, -5)$$

$$pt (-3, -6)$$

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

$$-6 = a(-3 + 4)^2 - 5$$

$$-6 = a - 5$$

$$+5 \quad +5$$

$$a = -1$$

$$y = -(x+4)^2 - 5$$

Write an equation for the quadratic function whose graph contains the given vertex and point

Vertex $(-3, 4)$ and point $(2, 21)$

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

$$21 = a(2+3)^2 + 4$$

$$21 = 25a + 4$$

$$17 = 25a$$

$$a = \frac{17}{25}$$

$$y = \frac{17}{25}(x+3)^2 + 4$$