

## Steps to completing the square

$$\begin{aligned} a &= -1 \\ b &= -9 \\ c &= -16 \end{aligned}$$

example function:  $y = -x^2 - 9x - 16$

1) set the function to  $y = \emptyset$ ;  $-x^2 - 9x - 16 = \emptyset$

2) Move your "C" coefficient to the right side.

$$-x^2 - 9x = +16$$

3) Add your  $\square$  to both sides.

$$-x^2 - 9x + \square = +16 + \square$$

4) If the "a" coefficient = 1, then use  $(\frac{b}{2})^2 = \square$   
Otherwise, factor the left side to make "a" = 1.

i.e.  $-x^2 - 9x + \square = +16 + \square$

$$-1(x^2 + 9x + \square) = +16 + \square$$

5) Once "a" = 1, then complete the  $\square$  using  $(\frac{b}{2})^2 = \square$

since  $b = 9$ , so  $(\frac{9}{2})^2 = \frac{81}{4} \rightarrow$  place this in the  $\square$ .

on the right  $\square$  multiply by "a" if  $a \neq 1$ .

$$-1(x^2 + 9x + \frac{81}{4}) = +16 + \frac{-81}{4}$$

6) Factor the trinomial.  $\sqrt{\frac{81}{4}} = \frac{9}{2}$

$$-1(x + \frac{9}{2})(x + \frac{9}{2}) = +16 - \frac{81}{4}$$

7) Simplify both sides and put in vertex form.

$$-1(x + \frac{9}{2})(x + \frac{9}{2}) = 16 - 20.25 \quad \leftarrow \frac{81}{4} = \underline{\underline{20.25}}$$

$$-1(x + \frac{9}{2})^2 = -4.25$$

$$-1(x + \frac{9}{2})^2 + 4.25 = \emptyset$$

Vertex Form

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

$$V(-\frac{9}{2}, 4.25)$$

$$\text{or } V(-4.5, 4.25)$$

8) Now you can use vertex form to find the X-intercepts by solving for x.

$$\begin{array}{r|l} -1(x+4.5)^2 + 4.25 & \neq 0 \\ \hline -4.25 & -4.25 \\ \hline -1(x+4.5)^2 & \neq -4.25 \\ \hline -1 & -1 \\ \hline \sqrt{(x+4.5)^2} & \neq \sqrt{4.25} \end{array}$$

$$x + 4.5 = \pm \sqrt{4.25}$$

$$\begin{array}{r|l} -4.5 & -4.5 \\ \hline x & = -4.5 + \sqrt{4.25} = -2.49 \text{ , } x\text{-intercepts} \\ & \text{and } -4.5 - \sqrt{4.25} = -6.56 \end{array}$$