

# STUDY GUIDE = SOLVING QUADRATICS

## THE THREE FORMS

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

STANDARD FORM

- y-intercept  $\rightarrow (0, c)$
- axis of symmetry  $\rightarrow -\frac{b}{2a}$
- $a = \text{pos} \rightarrow \text{open up}$   
 $a = \text{neg} \rightarrow \text{open down}$

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

VERTEX FORM

- vertex  $\rightarrow (h, k)$
- axis of symmetry  $\rightarrow x = h$   
(notice  $h$  has changed signs)
- maximum/minimum  $\rightarrow y = k$
- $a = \text{pos} \rightarrow \text{open up}$   
 $a = \text{neg} \rightarrow \text{open down}$

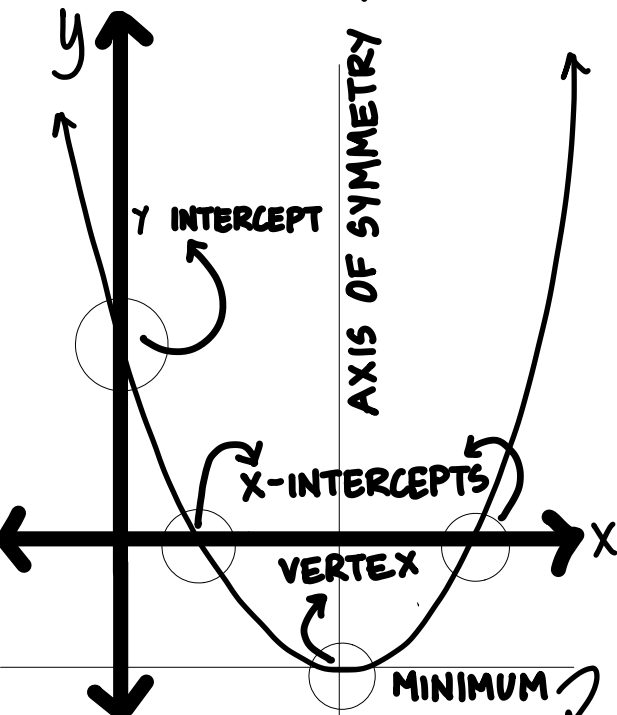
$$y = a(x-p)(x-q)$$

FACTORED FORM

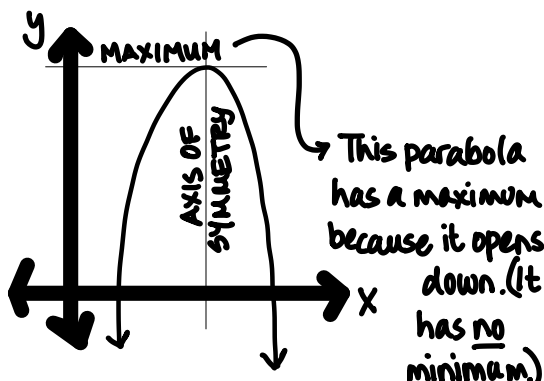
- x-intercepts/solutions/roots/zeros  $\rightarrow (p, 0)(q, 0)$
- $a = \text{pos} \rightarrow \text{open up}$   
 $a = \text{neg} \rightarrow \text{open down}$

www.suzannesardinha.com

## PARTS OF THE PARABOLA (the graph of a quadratic)



This parabola has a minimum because it opens up. (It has no maximum.)



This parabola has a maximum because it opens down. (It has no minimum.)

## SOLVING A QUADRATIC $\rightarrow$ there are 3 ways gives the x-intercepts

### 1. FACTORING

*easy and fast*

- $a = 1 \rightarrow \text{sum/product} \ \& \ \text{format} = (x + \square)(x + \square)$
- $a \neq 1 \rightarrow a \cdot c, \text{sum/product, rewrite } b \text{ term} \ \& \ \text{factor by grouping}$   
format =  $(\square x + \square)(\square x + \square)$
- TO SOLVE  $\rightarrow$  set each binomial equal to zero & solve for  $x$  algebraically

### 2. COMPLETING THE SQUARE

*most useful*  
*works every time*  
*gives the most info*

- Remember you are looking for the perfect square trinomial
- factor out  $a$ , find  $\frac{1}{2}b$  and  $(\frac{1}{2}b)^2 \rightarrow$  always positive
- format  $\rightarrow a \left[ \left( x + \left[ \frac{1}{2}b \right] \right)^2 + c - \left[ \frac{1}{2}b \right]^2 \right]$

TO SOLVE  $\rightarrow$  set equal to zero & solve for  $x$  algebraically.

### 3. QUADRATIC FORMULA

*works every time*

- Plug values into the equation & combine. 
$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

NB: Most quadratics have TWO solutions.  
When they have ONE, the vertex is on the x-axis.