

# Research Notes Topic 1:

## Features of Graphs

parent function:  $f(x) = x^2 \rightarrow$



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

$a$ : direction of opening  
Changes width ( $|a| > 1$  = narrower)  
( $|a| < 1$  = wider)

$(h, k)$  is vertex

$\rightarrow$   $h$  moves horizontally,  $k$  moves vertically

example:

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

$\nwarrow$  narrower than  $y = x^2$        $\nwarrow$  2 left       $\nwarrow$  3 down

$(-2, -3)$  is new vertex

Try it:

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

$\nwarrow$  opens down wider than  $y = x^2$        $\nwarrow$  3 right       $\nwarrow$  2 up

$(3, 2)$  is new vertex

## Completing the square

$$x^2 + 10x + \underline{\hspace{2cm}} \quad \left(\frac{b}{2}\right)^2 \rightarrow x^2 + 10x + 25$$

what # allows me to write this as a perfect square?

factors to  $(x+5)(x+5)$   
or  $(x+5)^2$

# Topic 1 Cont

so to go backwards...

$$x^2 + \underline{16x} + 64 \quad \text{means} \quad 64 = \left(\frac{b}{2}\right)^2$$

so to solve for b,

Try it:

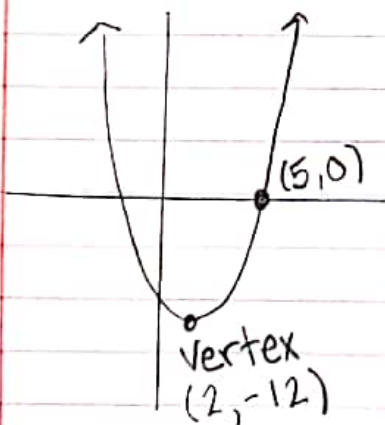
$$x^2 + 18x + \underline{\quad} \quad \leftarrow 81$$

$$\sqrt{64} = \frac{b}{2}, \quad 8 = \frac{b}{2},$$

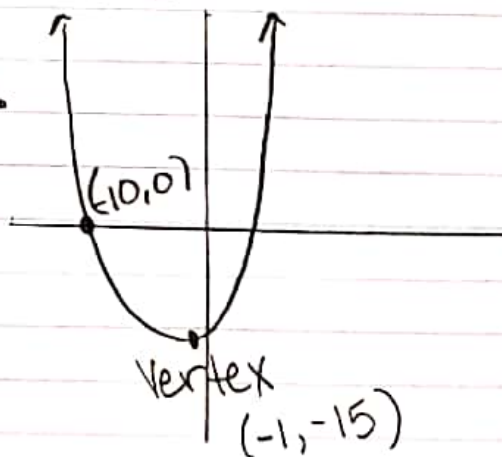
$$b = 16$$

$$x^2 + \underline{\quad} + 100 \quad \leftarrow 20$$

Finding a missing x-intercept:



Try it:



\* The vertex (and axis of symmetry) are halfway between the 2 x-intercepts, \*

Topic 1 Cont

Is the vertex a max or a min?



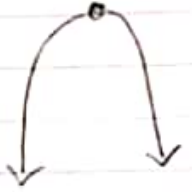
min



graph opens up



a is positive



max



graph opens down



a is negative