

# SEC 3.5 QUADRATIC FUNCTIONS ; MAXIMA & MINIMA

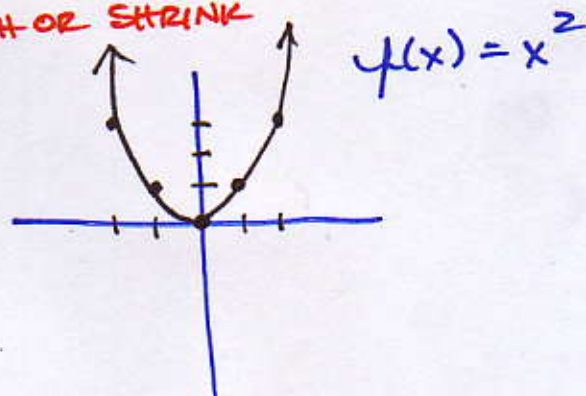
1. QUADRATIC FUNCTION :  $f(x) = ax^2 + bx + c$

WHERE  $a, b \in \mathbb{R}$  ARE REAL NUMBER  
 $a \neq 0$

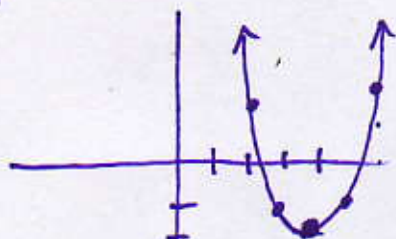
2. VERTEX FORM :  $f(x) = a(x-h)^2 + k$

VERTICAL  
STRETCH OR SHRINK

$(h, k)$  VERTEX

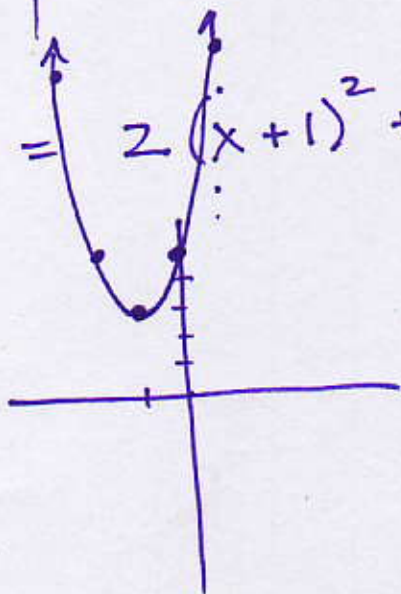


EX.  $f(x) = 1(x-4)^2 - 2$



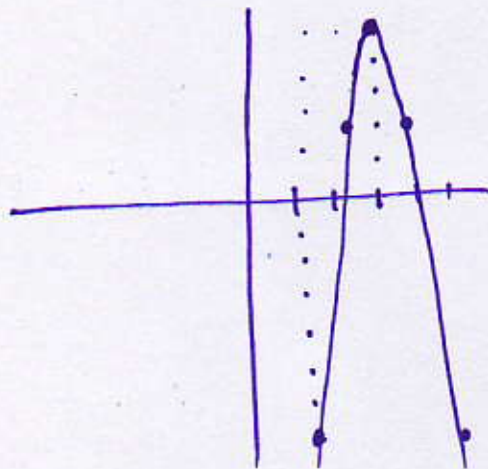
VERTEX  
 $(4, -2)$

EX.  $f(x) = 2(x+1)^2 + 3$



VERTEX  
 $(-1, 3)$

EX.  $f(x) = -3(x-3)^2 + 5$  (3,5) VERTEX



SUPPOSE THE QUADRATIC IS IN THIS FORM:

$$f(x) = 2x^2 - 12x + 23$$

$$y = 2x^2 - 12x + 23$$

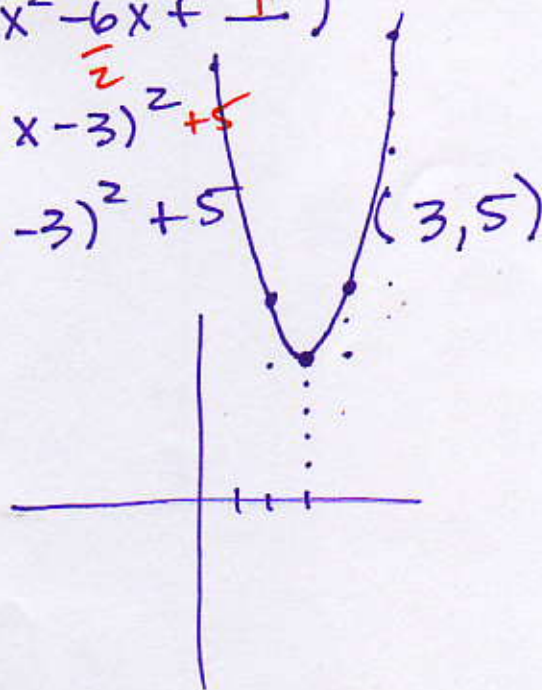
$$y - 23 = 2x^2 - 12x + 18$$

$$y - 23 = 2(x^2 - 6x) +$$

$$18 + y - 23 = 2(x^2 - 6x + 9)$$

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

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





## STEPS FOR COMPLETING THE SQUARE

- 1) CHANGE  $f(x)$  TO  $y$
- 2) MOVE THE "C" TO THE OTHER SIDE
- 3) FACTOR OUT THE "a" NUMBER
- 4) COMPLETE THE SQUARE
- 5) MOVE THE "C" BACK OVER
- 6) GRAPH

ONE MORE EXAMPLE:

#25  $g(x) = 3x^2 - 12x + 13$

$$y = 3x^2 - 12x + 13$$

-13                      -13

$$y - 13 = 3x^2 - 12x$$

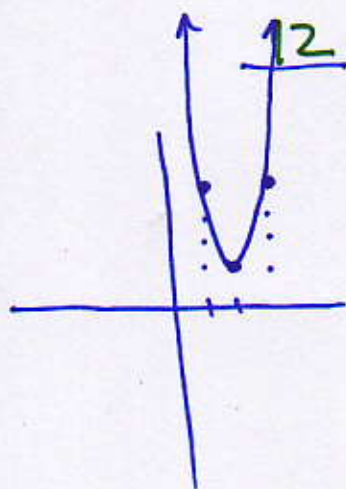
$$y - 13 = 3(x^2 - 4x + \underline{4})$$

12                      2                      4

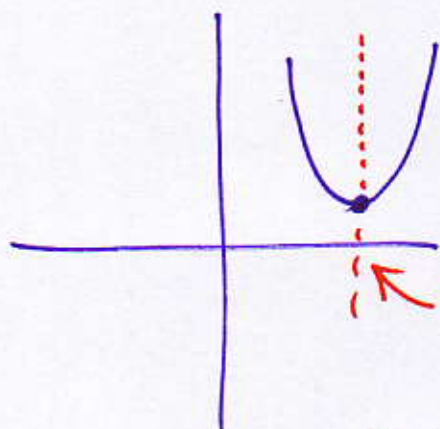
$$y - 1 = 3(x - 2)^2 + 1$$

+1

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



3. AXIS OF SYMMETRY:  $x = \frac{-b}{2a}$



AXIS OF SYMMETRY

$(h, k)$

$(3, 5)$

ex.  $f(x) = 2x^2 - 12x + 23$

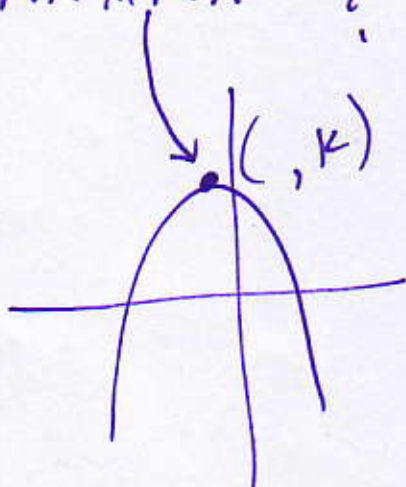
$$x = \frac{-b}{2a} = \frac{-(-12)}{2 \cdot 2} = \frac{12}{4} = 3$$

SUB AND 3 INTO FUNCTION AND SOLVE FOR Y

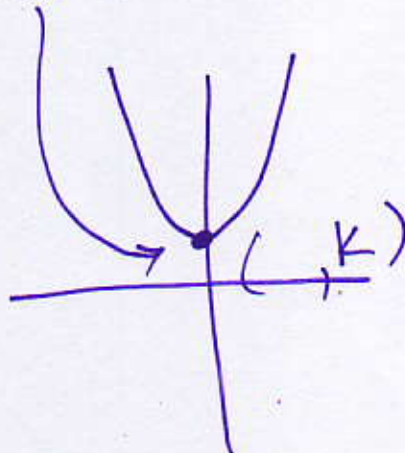
$$f(x) = 2(x-3)^2 + 5$$

$$\begin{aligned} &2(3)^2 - 12(3) + 23 \\ &2 \cdot 9 \\ &18 - 36 + 23 \\ &-18 + 23 \\ &5 \end{aligned}$$

4. MAXIMA :



MINIMA



5. LOCAL MAX OR LOCAL MIN

