

Unit 2: Quadratic Functions

2.1 Quadratic Functions in Vertex Form I

Quadratic Function: a function given by a polynomial of degree 2

ex. simplest case

$$y = x^2 \text{ or } f(x) = x^2$$

$$* f(x) = x^2$$

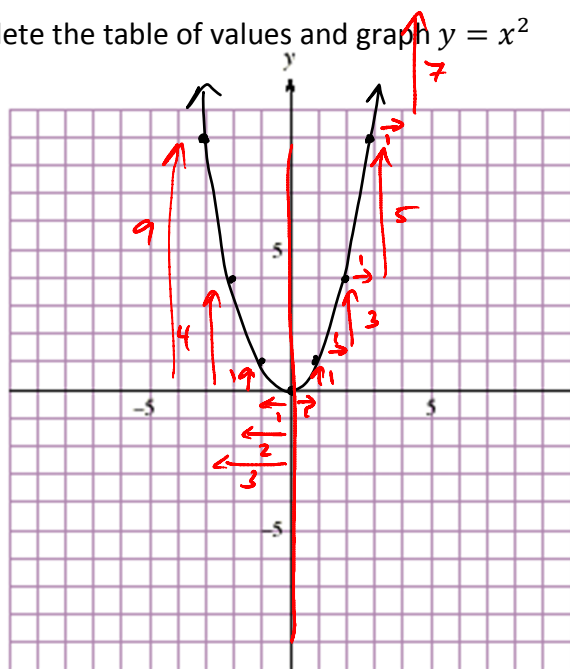
Parabola: the symmetrical curve of the graph of a quadratic function

$$f(3) = 3^2$$

$$f(3) = 9$$

ex. Complete the table of values and graph $y = x^2$

x	y
-3	9
-2	4
-1	1
0	0
1	1
2	4
3	9



1 4 9 16 25 36 49 64 ...

progression of odd numbers

vertex (0,0)
axis of symmetry a/s $x = 0$

Domain: $\mathbb{R}$

Range: $y \geq 0$

min value = 0

Vertex: - lowest point (opening upward) or highest point (opening downward) of the parabola
- where the axis of symmetry crosses the parabola

Minimum/Maximum Value:

- the least value (opens up) or greatest value (opens down) of the function

Axis of Symmetry: (a/s)

- the line that divides the graph into two congruent halves

Vertex Form of a Quadratic Function:

$$y = a(x-p)^2 + q \text{ or } f(x) = a(x-p)^2 + q$$

where a, p, q are constants and $a \neq 0$

Translation:

moving a graph horizontally or vertically

Vertical Translations: $y = x^2 + q$ or $f(x) = x^2 + q$

q units vertically $q > 0 \uparrow$
 $q < 0 \downarrow$

ex. Sketch:

a) $y = x^2 + 3$

translation of $y = x^2$
3 units up

vertex $(0,0) \Rightarrow \underline{(0,3)}$

D: $\mathbb{R}$

R: $y \geq 3$

a/s $x=0$ min: $y=3$

b) $f(x) = x^2 - 4$

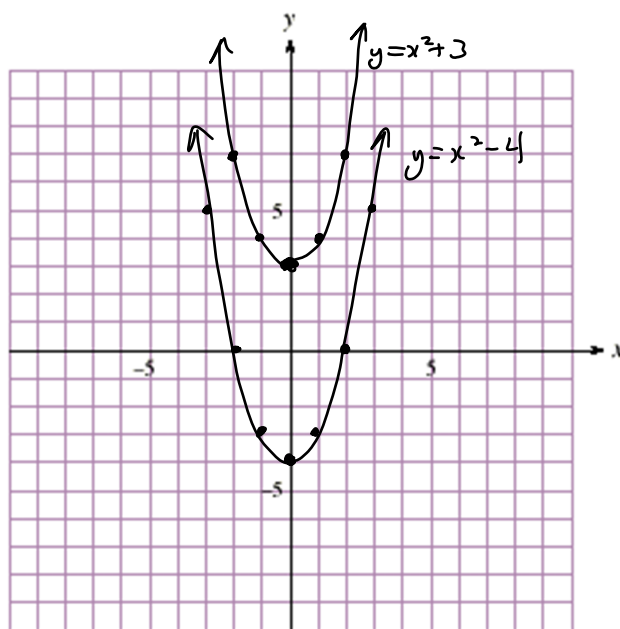
translation of $y = x^2$
4 units down

vertex $(0,0) \Rightarrow (0,-4)$

D: $\mathbb{R}$

R: $y \geq -4$

a/s $x=0$ min: $y=-4$



Horizontal Translations: $y = (x - p)^2$ or $f(x) = (x - p)^2$

p units horizontally $p > 0 \rightarrow$
 $p < 0 \leftarrow$

ex. Sketch:

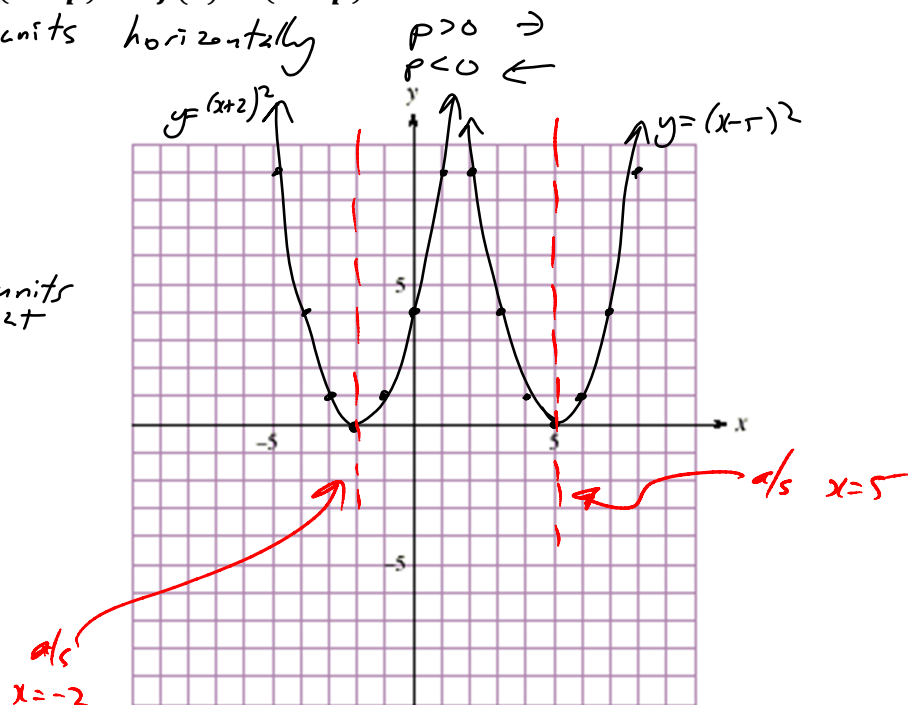
a) $f(x) = (x - 5)^2$

translation of $y = x^2$ 5 units right
vertex $(5,0)$

b) $y = (x + 2)^2$

2 units left

vertex $(-2,0)$



Combinations: $y = (x - p)^2 + q$ or $f(x) = (x - p)^2 + q$

Vertex (p, q)

a/s $x = p$

Domain: $\mathbb{R}$

Range: $y \geq q$

ex. Complete without graphing, then sketch:

a) $f(x) = (x - 1)^2 - 5$

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

Vertex: $(1, -5)$

Vertex: $(-3, 1)$

Axis of Symmetry: $x = 1$

Axis of Symmetry: $x = -3$

Domain: $\mathbb{R}$

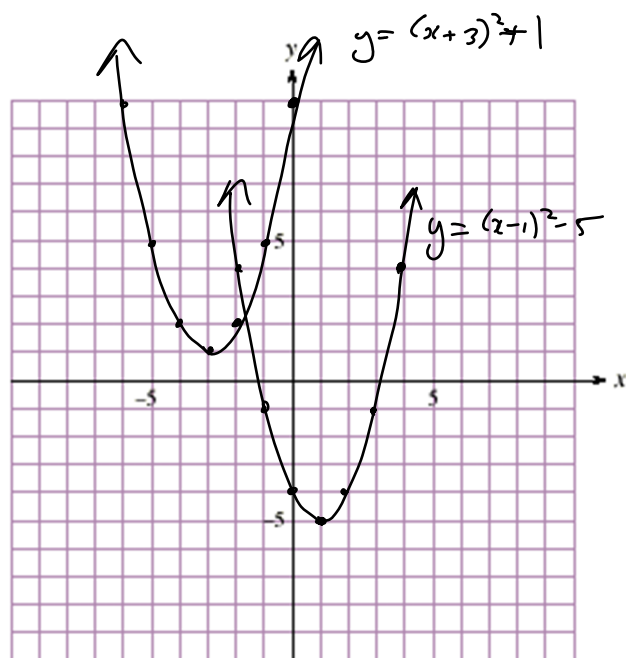
Domain: $\mathbb{R}$

Range: $y \geq -5$

Range: $y \geq 1$

~~Max/Min:~~ $y = -5$

~~Max/Min:~~ $y = 1$



Practice: pg. 157 / #2

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