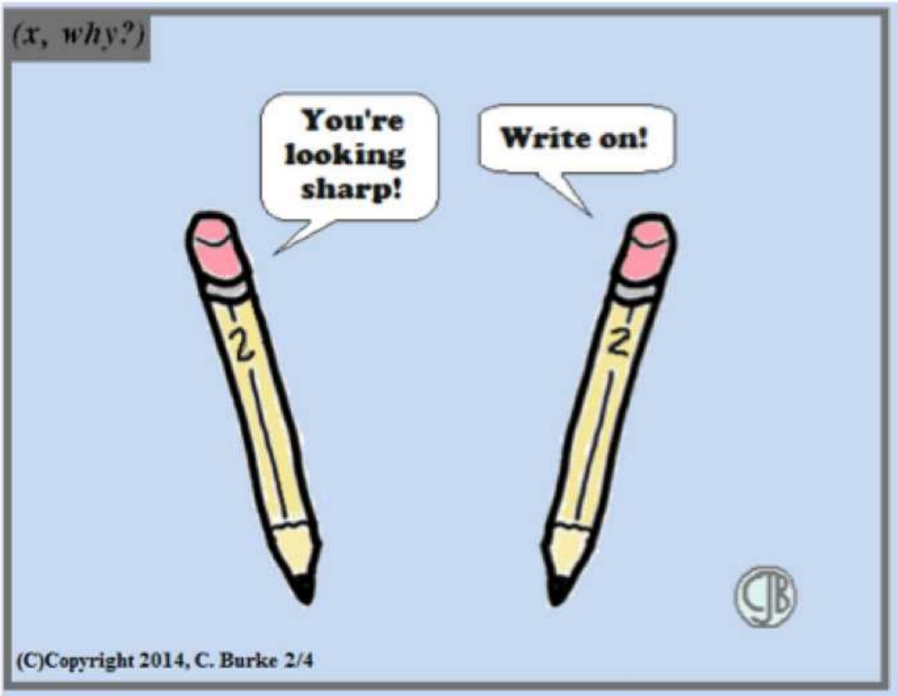
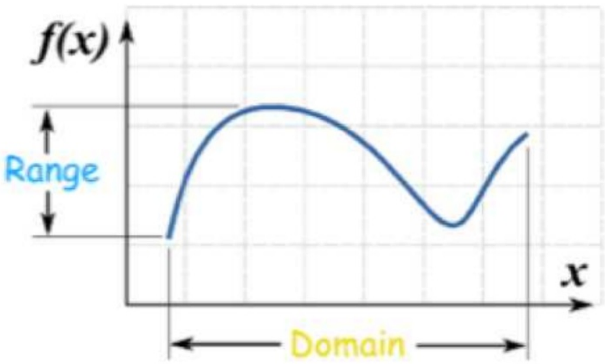
Domain and Range



*See printout.

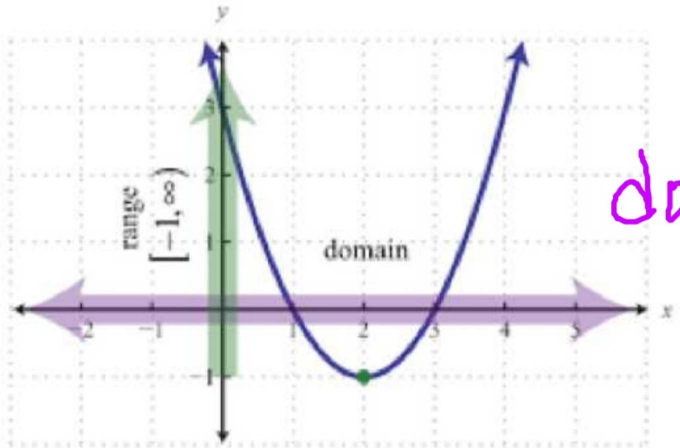


domain - the values of x

range - the values of y

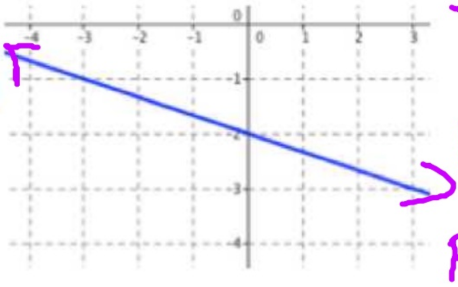
Questions to consider before finding domain and range...

- Does the graph open "left/right" forever?
- Does the open "up/down" forever?
- Can you trace the graph without lifting your pencil?

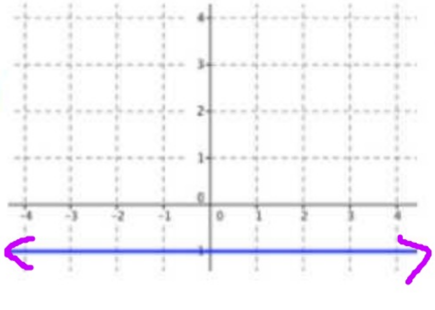


domain $(-\infty, \infty)$

ex: State the domain and range in set and interval notation.

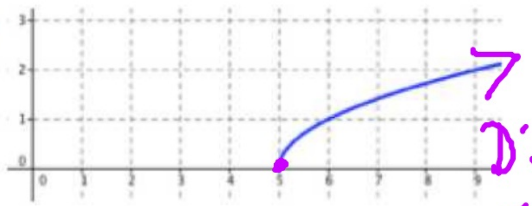
a) 

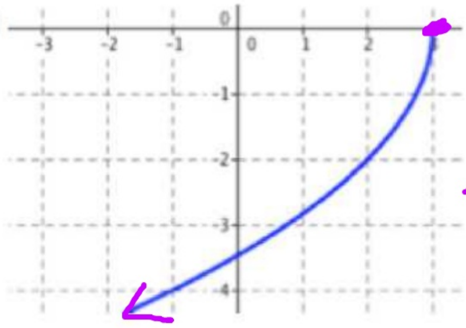
Set	Interval
D: $\{x \mid x \in \mathbb{R}\}$	D: $(-\infty, \infty)$
R: $\{y \mid y \in \mathbb{R}\}$	R: $(-\infty, \infty)$

b) 

Set	Interval
D: $\{x \mid x \in \mathbb{R}\}$	D: $(-\infty, \infty)$
R: $\{y \mid y = -1\}$	R: $[-1]$ or $[-1, -1]$

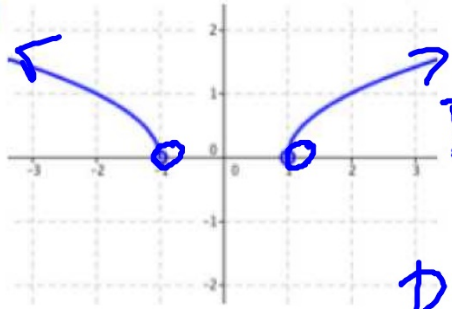
	Set	Interval
c)		
	D: $\{x \mid x \in \mathbb{R}\}$	$(-\infty, \infty)$
	R: $\{y \mid y \geq 2\}$	$[2, \infty)$
d)		
	D: $\{x \mid x \in \mathbb{R}\}$	$(-\infty, \infty)$
	R: $\{y \mid y \leq 1\}$	$(-\infty, 1]$

e) 

f) 

	Set	Interval
e)	D: $\{x \mid x \geq 5\}$	$[5, \infty)$
	D: $\{y \mid y \geq 0\}$	$[0, \infty)$
f)	D: $\{x \mid x \leq 3\}$	$(-\infty, 3]$
	R: $\{y \mid y \leq 0\}$	$(-\infty, 0]$

g)

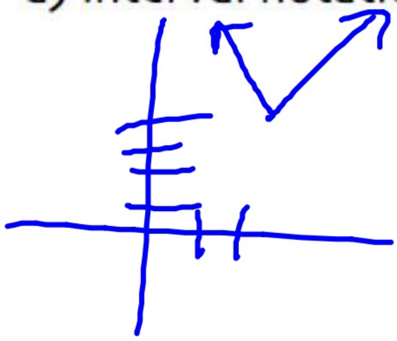


h)

	Set	Interval
g)	D: $\{x \mid x<-1 \text{ or } x>1\}$	$(-\infty,-1) \cup (1,\infty)$
	R: $\{y \mid y>0\}$	$(0,\infty)$
h)	D: $\{x \mid -2 \leq x<1 \text{ or } 1<x<4\}$	$[-2,1) \cup (1,4)$
	R: $\{y \mid 0<y<2\}$	$(0,2)$

ex: Sketch the graph then state the domain and range in the indicated notation.

a) interval notation, $y = |x-2| + 4$



b) set notation, $y = 3x + 1$

1.1 Graph Quadratic Functions in Standard Form

Standard Form:

$$f(x) = \underset{\substack{\uparrow \\ \text{quadratic coefficient}}}{a}x^2 + \underset{\substack{\uparrow \\ \text{linear coefficient}}}{b}x + \underset{\substack{\uparrow \\ \text{constant}}}{c}$$

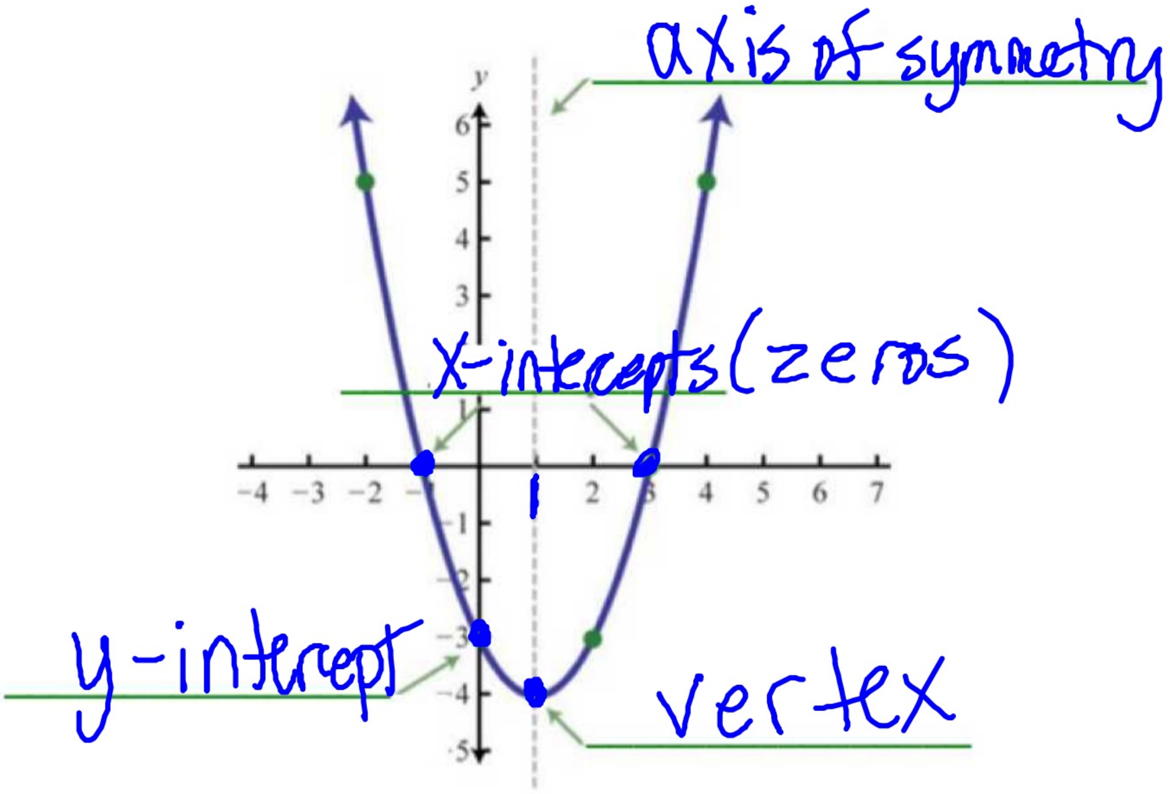
where:

a $\neq 0$, $a \in R$

b $\in R$

c $\in R$

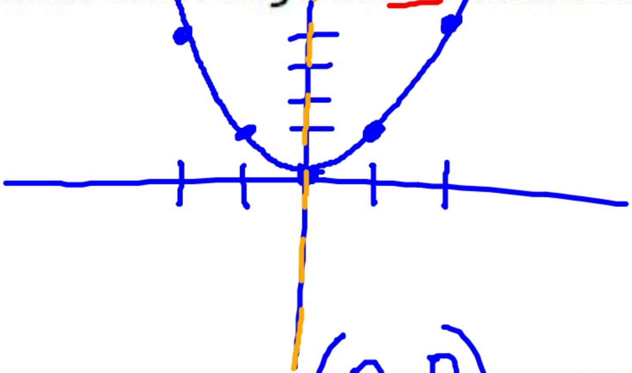
* The graph of a quadratic is called a Parabola.



Parent Function - the simplest form of a function

Parent Quadratic Function: $\boxed{y = x^2}$

ex: Sketch $y = x^2$. Then state the vertex, axis of symmetry and domain and range in set notation.



Vertex: $(0,0)$ AOS: $x=0$

Domain: $\{x \mid x \in \mathbb{R}\}$ Range: $\{y \mid y \geq 0\}$

To graph a quadratic function in standard form:

- Find the vertex.

$$\boxed{\text{Vertex: } x = \frac{-b}{2a}}$$

- Plot at least two other points, one on each side of the vertex.

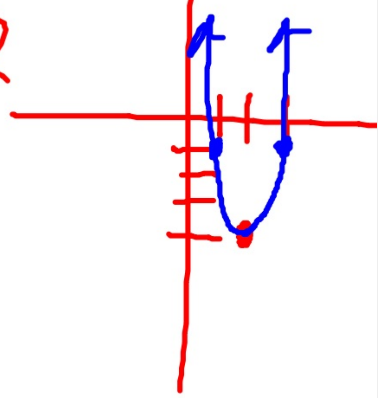
ex: Sketch, then state the vertex, axis of symmetry and domain and range in the indicated notation.

x	y
1	-1
2	-4
3	-1

a) $y = 3x^2 - 12x + 8$

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

$$y = 3(2)^2 - 12(2) + 8 = -4$$



Vertex: $(2, -4)$ AOS: $x = 2$

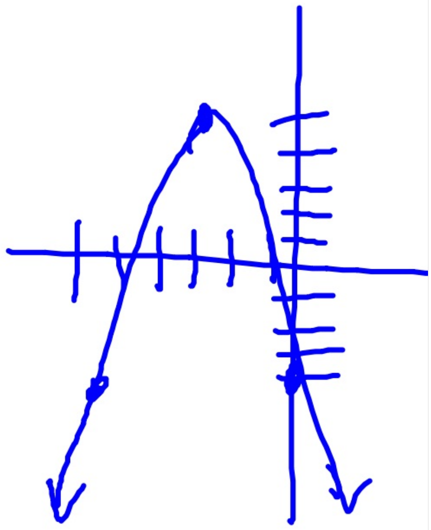
(INT) Domain: $(-\infty, \infty)$ Range: $[-4, \infty)$

b) $y = -x^2 - 6x - 4$

$$x = \frac{-(-6)}{2(-1)} = -3$$

$$y = -(-3)^2 - 6(-3) - 4$$
$$= -9 + 18 - 4$$
$$= 5$$

x	y
-6	-4
-3	5
0	-4



Vertex: (-3, 5) AOS: x = -3

(SET) Domain: $\{x \mid x \in \mathbb{R}\}$ Range: $\{y \mid y \leq 5\}$

ex: Consider the graph of: $y = ax^2 + bx + c$

a) When does the graph open up?

$a > 0$

b)When does the graph open down?

$a < 0$

c) What is the axis of symmetry?

$x = \frac{-b}{2a}$

Maximum and Mimimum Values

* The maximum or mimimum of a parabola always occurs at the vertex.

*The maximum or mimimum value is the y-coordinate of vertex.

ex: Without graphing, consider the function: $y = -\frac{1}{2}x^2 + 3$

a) What is the direction of opening? down

b)What is the axis of symmetry? $x = 0$

c) What is the maximum/minimum value? 3

d) State the domain and range in interval notation.

$(-\infty, \infty)$ $(-\infty, 3]$

ex: The table below represents some points on the graph of a quadratic function.

x	a	-2	-1	0	1	6
y	45	-3	-4	-3	0	45

a) What is the direction of opening?

UP

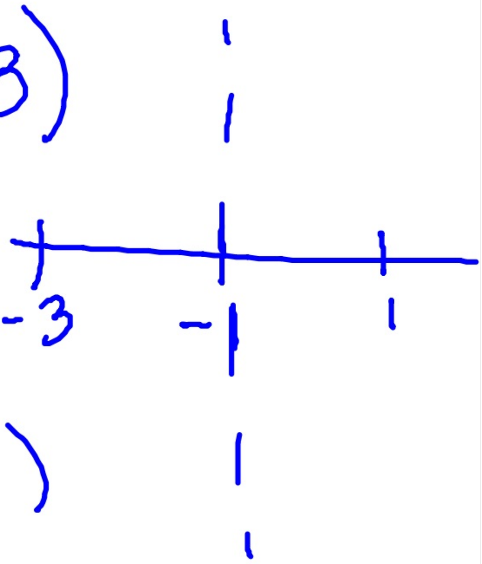
b)What is the maximum/minimum value of the quadratic function?

-4

x	a	-2	-1	o	1	6
y	45	-3	-4	-3	o	45

c) What is the y-intercept?

$(0, -3)$



d) What are the x-intercepts?

$(1, 0)$

$(-3, 0)$

e) What is the value of a?

-8

Find the vertex for $f(x) = \frac{1}{3}x^2 - x + 3$

y

$$x = \frac{-(-1)}{2\left(\frac{1}{3}\right)} = \frac{1}{\frac{2}{3}} = 1 \cdot \frac{3}{2} = \frac{3}{2}$$

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

$$= \frac{9}{12} - \frac{3}{2} + 3 = \frac{3}{4} - \frac{3}{2} + 3$$

$$\frac{3}{4} - \frac{6}{4} + \frac{12}{4} = \frac{9}{4}$$