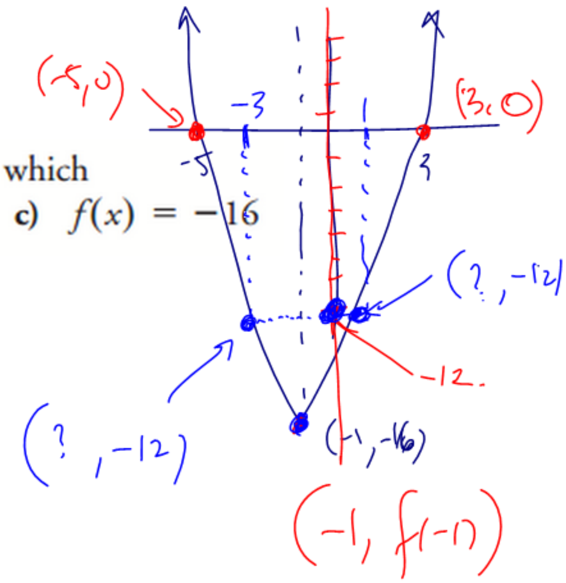
Hwk Check

$(x, f(x))$



16. Let $f(x) = x^2 + 2x - 15$. Determine the values of x for which
a) $f(x) = 0$ **b)** $f(x) = -12$ **c)** $f(x) = -16$

$x = -3, 1$

a) $0 = x^2 + 2x - 15$

$0 = (x+5)(x-3)$

$\therefore \quad x+5 = 0 \quad \text{or} \quad x - 3 = 0$

$\Rightarrow \quad x = -5 \quad | \quad x = 3$

$\Rightarrow (-5, 0)$; $(3, 0)$ are points

b) $f(x) = -12$

$a = b$

$b = a$

$\Rightarrow \quad -12 = x^2 + 2x - 15$

$\Rightarrow \quad x^2 + 2x - 3 = 0$

$\Rightarrow \quad (x+3)(x-1) = 0$

$x + 3 = 0$
$\Rightarrow x = -3$

$\therefore \quad x = -3 \quad \text{or} \quad x = 1$

c)
$\Rightarrow \quad -16 = x^2 + 2x - 15$

$x^2 + 2x + 1 = 0$

$\Rightarrow \quad (x+1)^2 = 0$

$\Rightarrow \quad x + 1 = 0$

$\Rightarrow \quad x = -1$

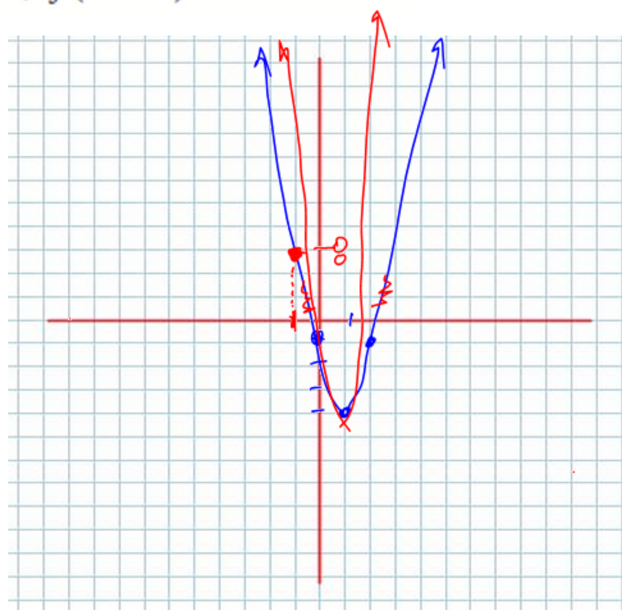
15. a) Graph the function $f(x) = 3(x-1)^2 - 4$. $\{(x, 3(x-1)^2 - 4) \mid x \in \mathbb{R}\}$

b) What does $f(-1)$ represent on the graph? Indicate on the graph how you would find $f(-1)$.

c) Use the equation to determine

i) $f(2) - f(1)$ ii) $2f(3) - 7$ iii) $f(1-x)$

the final value assigned to the domain value $x = -1$



$f(2) = -1$, $f(1) = -4$

$\therefore f(2) - f(1) = -1 - (-4)$

$= 3$

$f(x) = 3(x-1)^2 - 4$

$f(1-x) = 3((1-x)-1)^2 - 4$

$= 3(-x)^2 - 4$

$= 3x^2 - 4$

$3(-1)^2(x)^2 - 4$

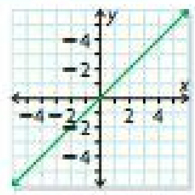
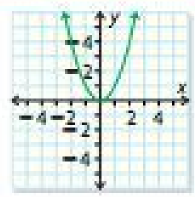
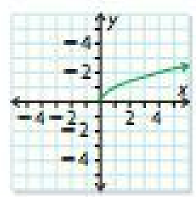
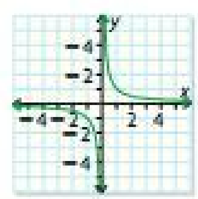
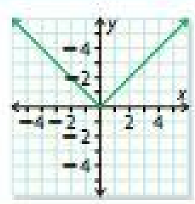
$f(\triangle) = 3(\triangle - 1)^2 - 4$

$f(\square + \circ) = 3((\square + \circ) - 1)^2 - 4$

Chapter 1 – Introduction to Functions

1.3 and 1.4 Parent Functions and Domain and Range

We will be closely studying **5 types of functions** (***Actually we'll study more than the following five, but for now….the big five are***:)

Equation of Function	Name of Function	Sketch of Graph
$f(x) = x$	linear function	
$f(x) = x^2$	quadratic function	
$f(x) = \sqrt{x}$	square root function	
$f(x) = \frac{1}{x}$	reciprocal function	
$f(x) = \|x\|$	absolute value function	

Domain and Range

Two **incredibly important** aspects of functions are their

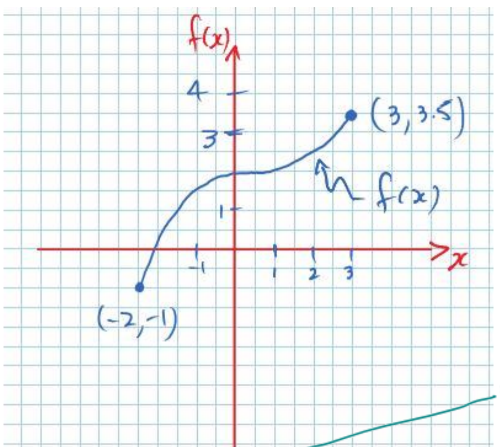
Again, the Domain is the set of "x" values allowed to be plugged in.

And, the Range is The set of functional values calculated using the functional rule.

Example 1.4.1

Given the sketch of the graph of the **relation** determine: the domain, the range of the relation, and whether the relation is, or is not, a function.

a)

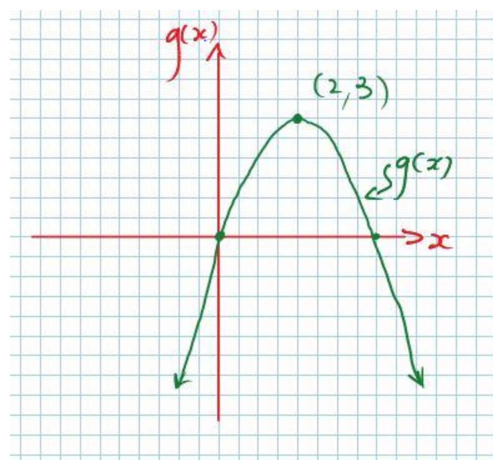


f(x) is a fn ⇒ it passes the V.L.T.

$D_f = \{x \in \mathbb{R} \mid -2 \le x \le 3\}$

$R_f = \{f(x) \in \mathbb{R} \mid -1 \le f(x) \le 3.5\}$

b)

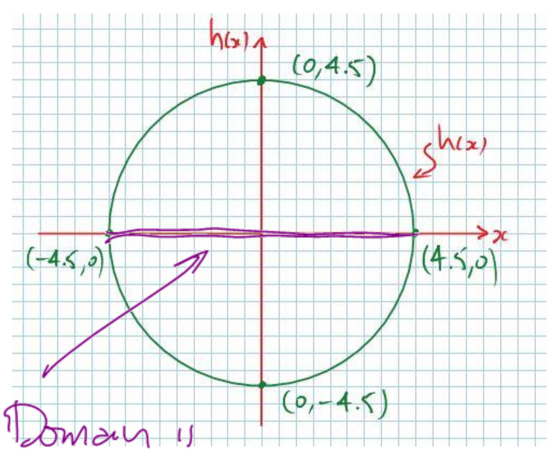


g(x) is a fn (passes the V.L.T)

$D_g = \{x \in \mathbb{R}\}$

$R_g = \{g(x) \in \mathbb{R} \mid g(x) \le 3\}$

c)



Domain is restricted

h(x) does not pass the V.L.T ⇒ h(x) is NOT a fn

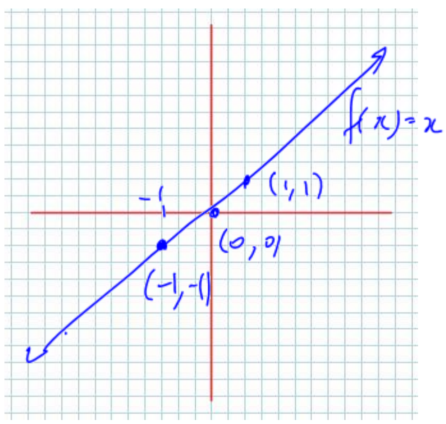
$D_h = \{x \in \mathbb{R} \mid -4.5 \le x \le 4.5\}$

$R_h = \{h(x) \in \mathbb{R} \mid -4.5 \le h(x) \le 4.5\}$

The Parent Functions (*for Grade 11*)

Together we will explore (graphically) basic properties of the five *parent* functions:

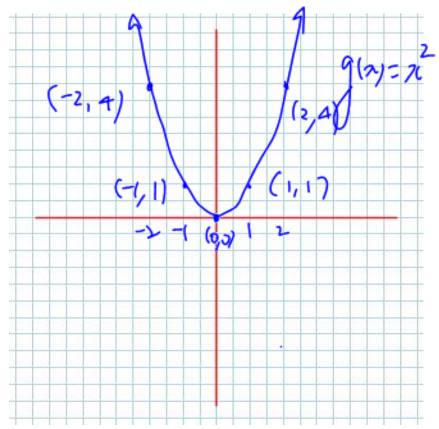
a) Linear



$D_f = \{x \in \mathbb{R}\}$ NO RESTRICTIONS

$R_f = \{f(x) \in \mathbb{R}\}$ NO RESTRICTIONS

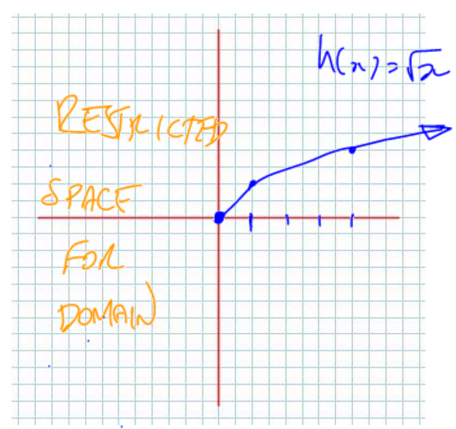
b) Quadratic



$D_g = \{x \in \mathbb{R}\}$ NO RESTRICTIONS

$R_g = \{g(x) \in \mathbb{R} \mid g(x) \geq 0\}$

c) Square Root



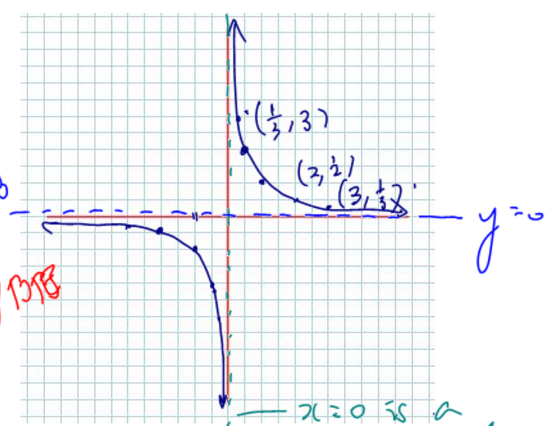
$D_h = \{x \in \mathbb{R} \mid x \geq 0\}$

$R_h = \{h(x) \in \mathbb{R} \mid h(x) \geq 0\}$

d) Reciprocal $f(x) = \frac{1}{x}$

horizontal Asymptote

LABEL ASYMPTOTE



x = 0 is a vertical Asymptote

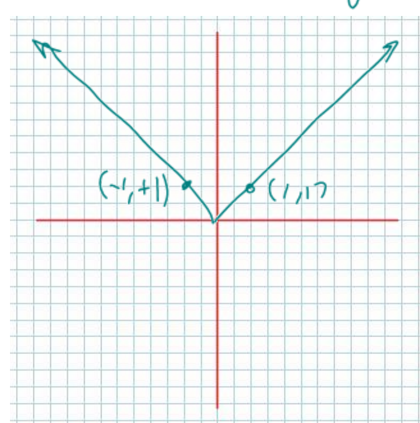
vertical: x = #

horizontal: y = #

$D_f = \{x \in \mathbb{R} \mid x \neq 0\}$

$R_f = \{f(x) \in \mathbb{R} \mid f(x) \neq 0\}$

e) Absolute Value $g(x) = |x|$

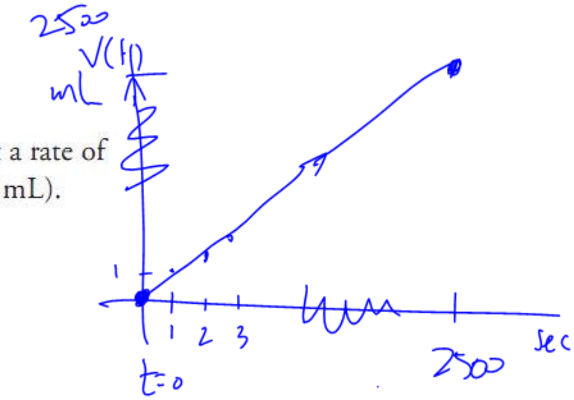


$D = \{x \in \mathbb{R}\}$

$R = \{g(x) \in \mathbb{R} \mid g(x) \geq 0\}$

NOTE: Asymptotes cannot be crossed

Example 1.4.2 (*From Pg. 36 in your text*)



8. Write a function to describe coffee dripping into a 10-cup carafe at a rate of 1 mL/s. State the domain and range of the function (1 cup = 250 mL).

Let t be time (domain)
Let V(t)

then $V(t) = t$

250 mL × 10 cups = 2500

$D_V: \{t \in \mathbb{R} \mid 0 \le t \le 2500\}$

$R_V: \{V(t) \in \mathbb{R} \mid 0 \le V(t) \le 2500\}$

Example 1.4.3 (*From Pg. 37 in your text*)

9. Determine the domain and range of each function.

a) $f(x) = -3x + 8$ LINEAR

Note: All linear fns have unrestricted domains and ranges

$D: \{x \in \mathbb{R}\}$

$R: \{f(x) \in \mathbb{R}\}$

EXCEPTIONS $x = 3$: $D: \{x = 3\}$

$R: \{y \in \mathbb{R}\}$

vertical lines have a single domain value

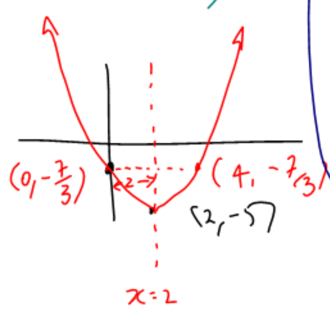
$D: \{x \in \mathbb{R}\}$

$y = 2$: $R: \{y = 2\}$

Horizontal lines have a single range value

d) $p(x) = \frac{2}{3}(x-2)^2 - 5$

QUADRATIC w/ vertex (2, −5)



$D_p: \{x \in \mathbb{R}\}$

$R_p: \{p(x) \in \mathbb{R} \mid p(x) \ge -5\}$

f) $r(x) = \sqrt{5 - x}$

$\sqrt{\text{positive}}$

$5 - x \ge 0$

$5 \ge x$

$x \le 5$

$D_r = \{x \in \mathbb{R} \mid x \le 5\}$

$R_r = \{r(x) \in \mathbb{R} \mid r(x) \ge 0\}$

Example 1.4.4

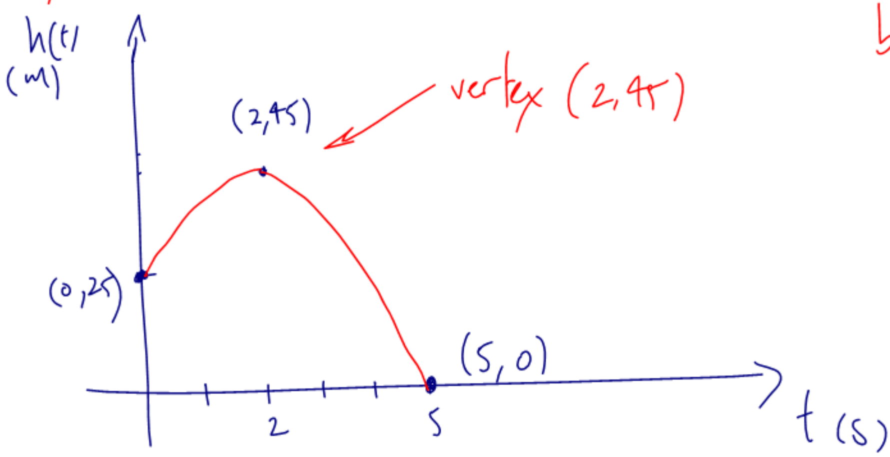
10. A ball is thrown upward from the roof of a 25 m building. The ball reaches a height of 45 m above the ground after 2 s and hits the ground 5 s after being thrown.

a) Sketch a graph that shows the height of the ball as a function of time.

b) State the domain and range of the function.

c) Determine an equation for the function.

a)



b) $D_h = \{t \in \mathbb{R} \mid 0 \le t \le 5\}$

$R_h = \{h(t) \in \mathbb{R} \mid 0 \le h(t) \le 45\}$

c) $h(t) = a(t-h)^2 + k$ $\quad (h, k)$ is vertex

$\Rightarrow h(t) = a(t-2)^2 + 45$ $\quad$ to find 'a' use other info (another point)

using (5,0) (t, h(t)) $\quad 0 = a(5-2)^2 + 45$

$0 = 9a + 45 \Rightarrow a = -5$

$\Rightarrow -45 = 9a \Rightarrow a = -\frac{45}{9}$

$\boxed{\therefore h(t) = -5(t-2)^2 + 45}$

Class/Homework

Read Examples 3 and 4 on pages 32 – 34 in your text

Pg. 35 – 37 #2 (which are functions?), 9bce, 11 (use a graphing calculator if you want!), 12, 13, 14