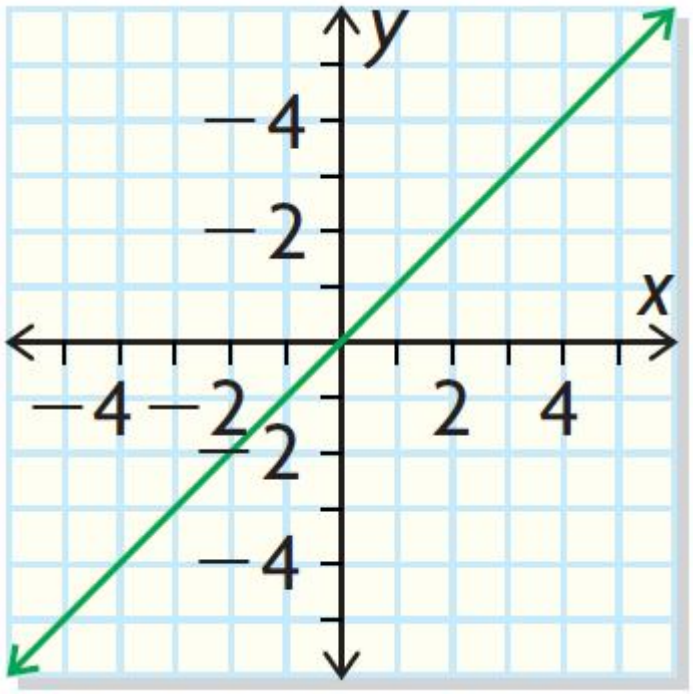
The 5 Parent Functions

- Parent functions are the base form or stripped down version of a type of function.



Linear Function : $f(x) = x$

x	f(x) y
−2	−2
−1	−1
0	0
1	1
2	2

Domain:

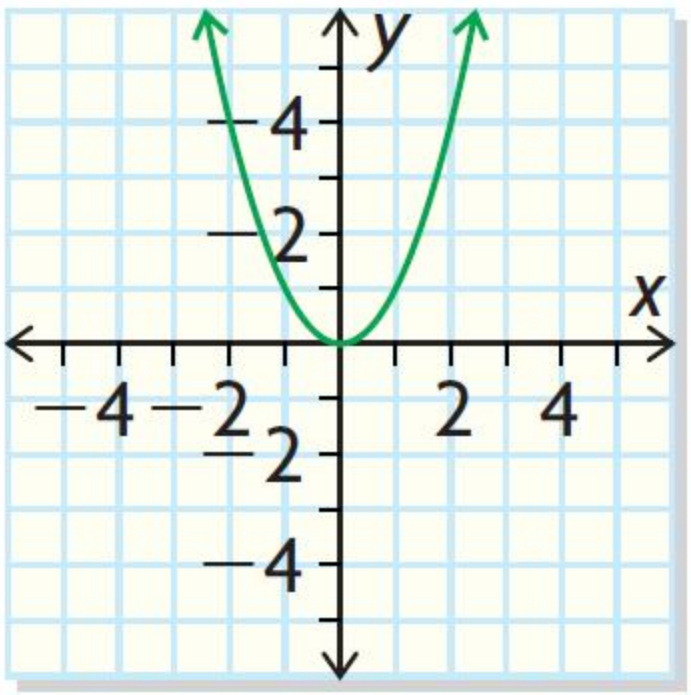
$\{x \in \mathbb{R}\}$

"x can be any #"

belongs to real numbers

Range:

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



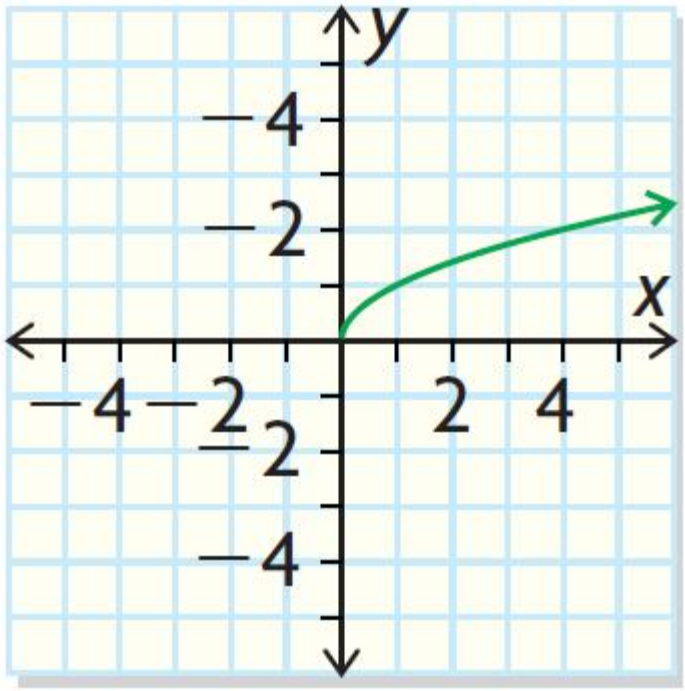
Quadratic Function $f(x) = x^2$

x	y
−2	4
−1	1
0	0
1	1
2	4

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

Range: $\{f(x) \in \mathbb{R} \mid f(x) \geq 0\}$

"so that", "such that"



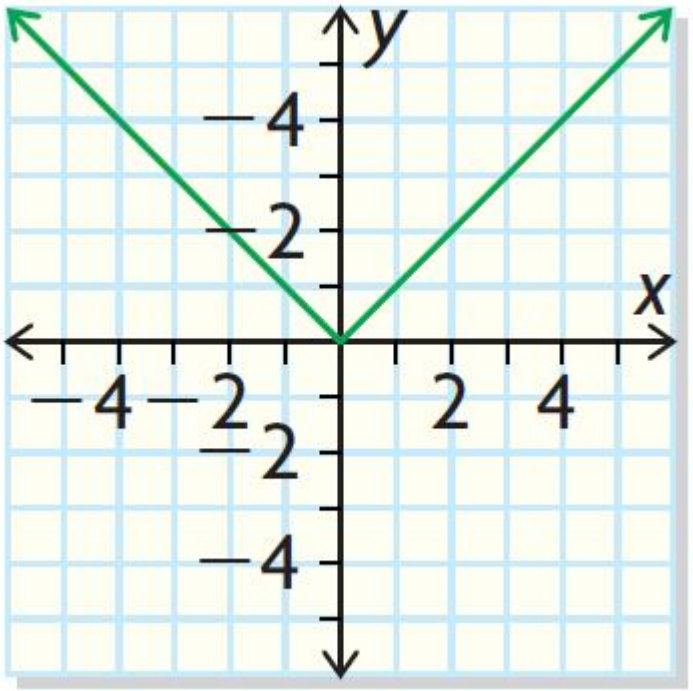
Square Root Function

$f(x) = \sqrt{x}$

x	y
0	0
1	1
4	2
9	3
16	4

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

Range: $\{f(x) \in \mathbb{R} \mid f(x) \geq 0\}$



Absolute Value function

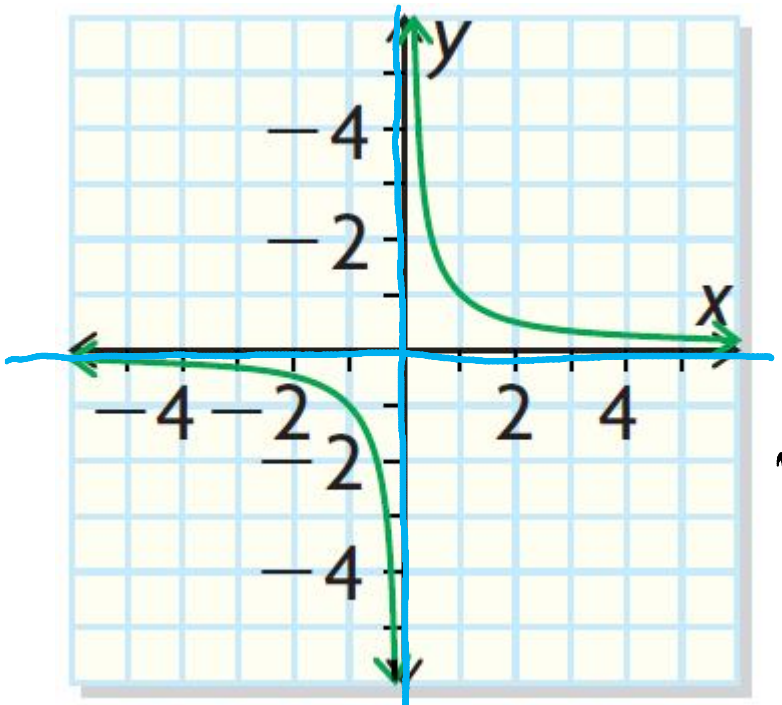
$$f(x) = |x|$$

→absolute value is the distance from x to zero. These values are always positive

x	y
-2	2
-1	1
0	0
1	1
2	2

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

Range: $\{f(x) \in \mathbb{R} \mid f(x) \geq 0\}$



Reciprocal Function

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

does not equal

Domain: $\{x \in \mathbb{R} \mid x \neq 0\}$

Range: $\{f(x) \in \mathbb{R} \mid f(x) \neq 0\}$

x	y
-2	-½
-1	-1
-½	-2
0	0
½	2
1	1
2	½

Asymptote: is a line that "cannot be touched" by the function

→ Hagan calls this the "MC Hammer" line.

$f(x)=af[k(x-d)]+c$

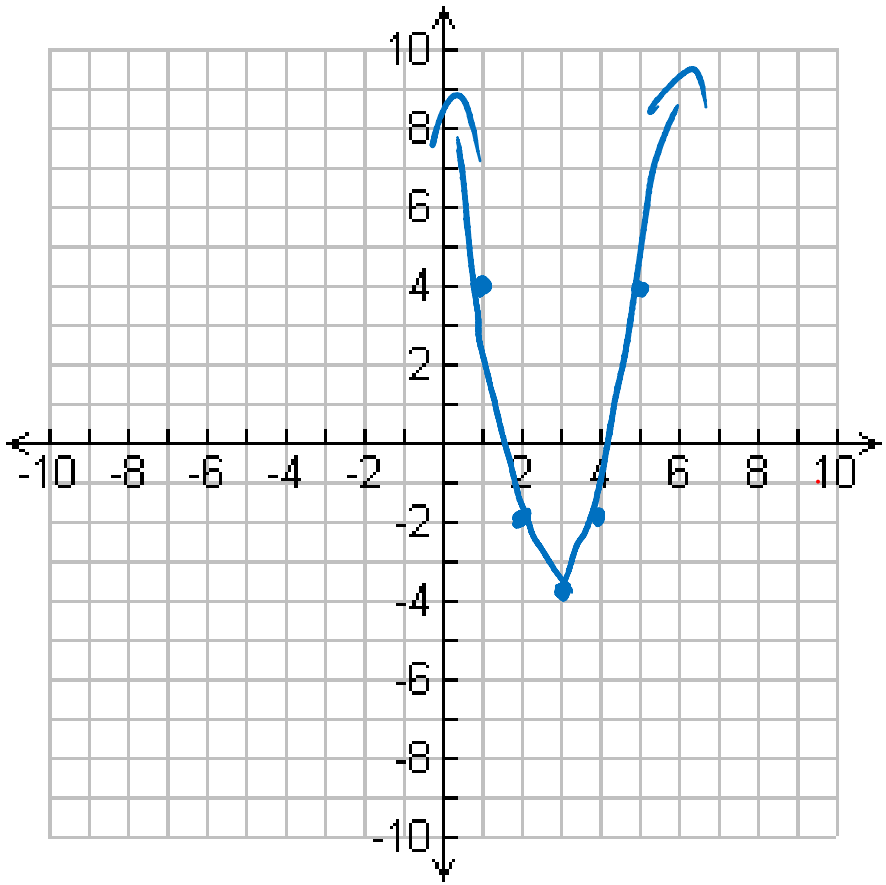
- a = vertical stretch – multiply with f(x) or y
- k = horizontal stretch – divide with x or multiply 1/k with x
- d = horizontal shift – add/subtract with x (always do opposite)
- c = vertical shift – add/subtract with f(x) or y
- Notes:
  - vertical is outside the “function” while horizontal is inside.
  - k must be factored to get d.

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

① V. Stretch of 2

② H. shift of +3

③ V. Shift of −4



$f(x) = x^2$

x	y
-2	4
-1	1
0	0
1	1
2	4

x+3	2y-4
1	4
2	-2
3	-4
4	-2
5	4

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

R: $\{f(x) \in \mathbb{R} \mid f(x) \geq -4\}$

$$f(x) = 2\sqrt{2x+4} - 6$$

Factor 2

$f(x) = 2\sqrt{2(x+2)} - 6$

① V. Stretch of 2

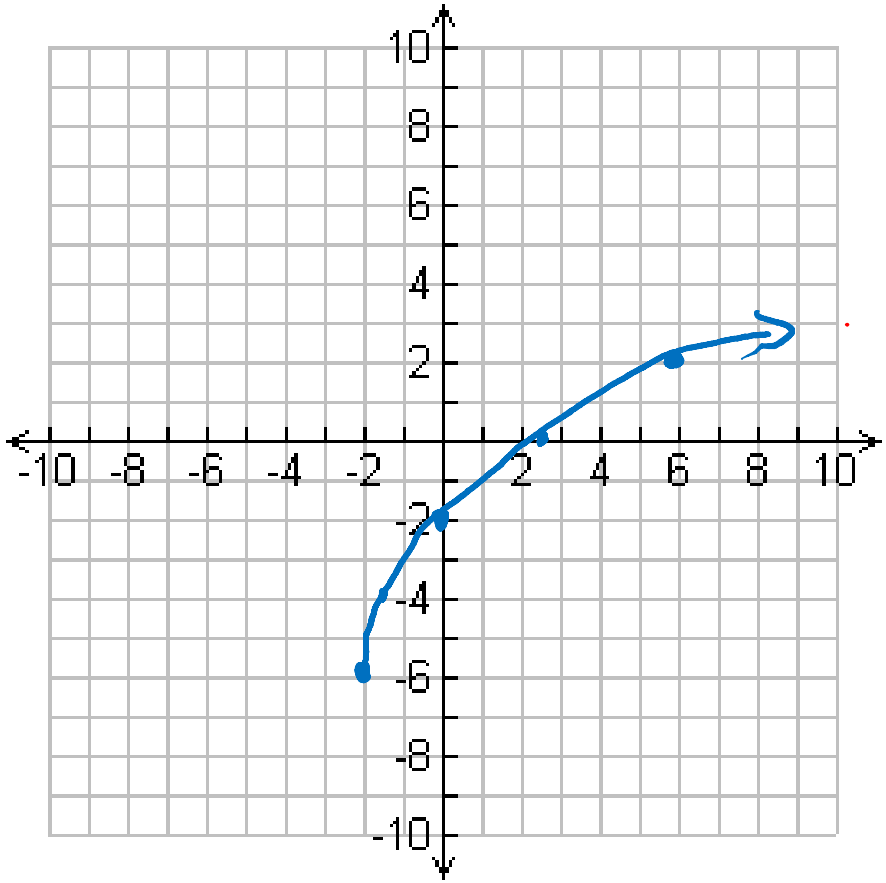
② H. Stretch of $\frac{1}{2}$

③ V. Shift of -6

④ H. Shift of -2

$f(x) = \sqrt{x}$

x	y	$\frac{1}{2}x - 2$	$2y - 6$
0	0	-2	-6
1	1	-1.5	-4
4	2	0	-2
9	3	2.5	0
16	4	6	2

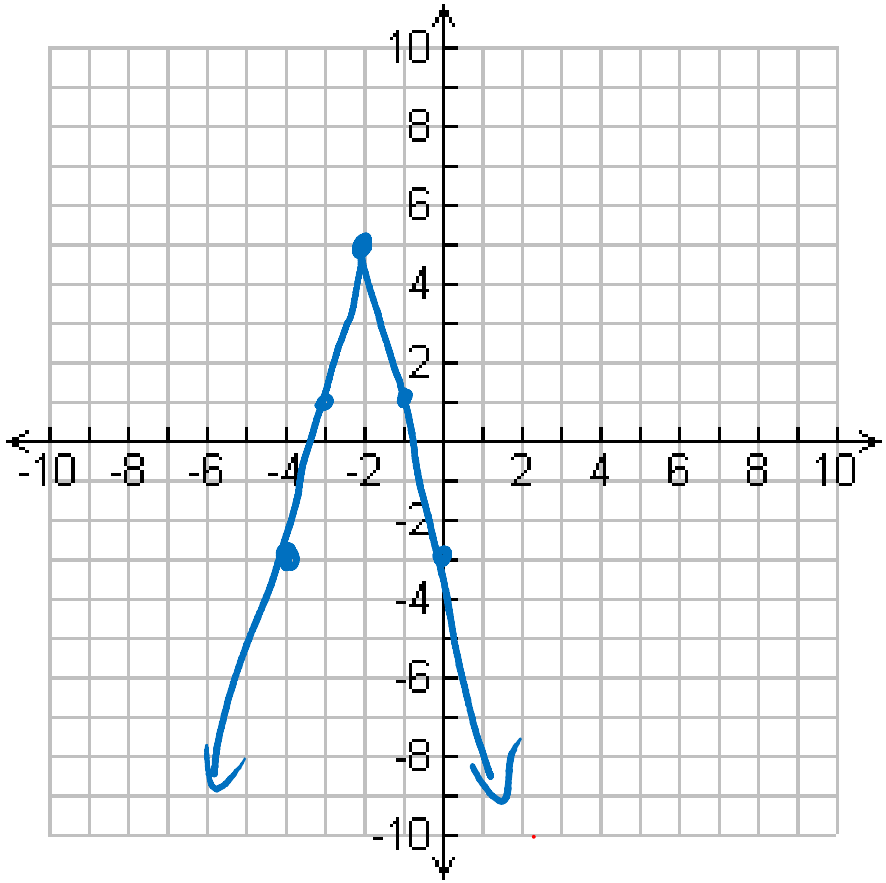


D: $\{x \in \mathbb{R} \mid x \geq -2\}$

R: $\{f(x) \in \mathbb{R} \mid f(x) \geq -6\}$

$$f(x) = -4|x+2|+5$$

1. V. stretch of -4
2. H. Shift of -2
3. V. Shift of $+5$



$f(x) = |x|$

x	$\lvert x \rvert$	$x-2$	$-4\lvert x+5$
-2	2	-4	-3
-1	1	-3	1
0	0	-2	5
1	1	-1	1
2	2	0	-3

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

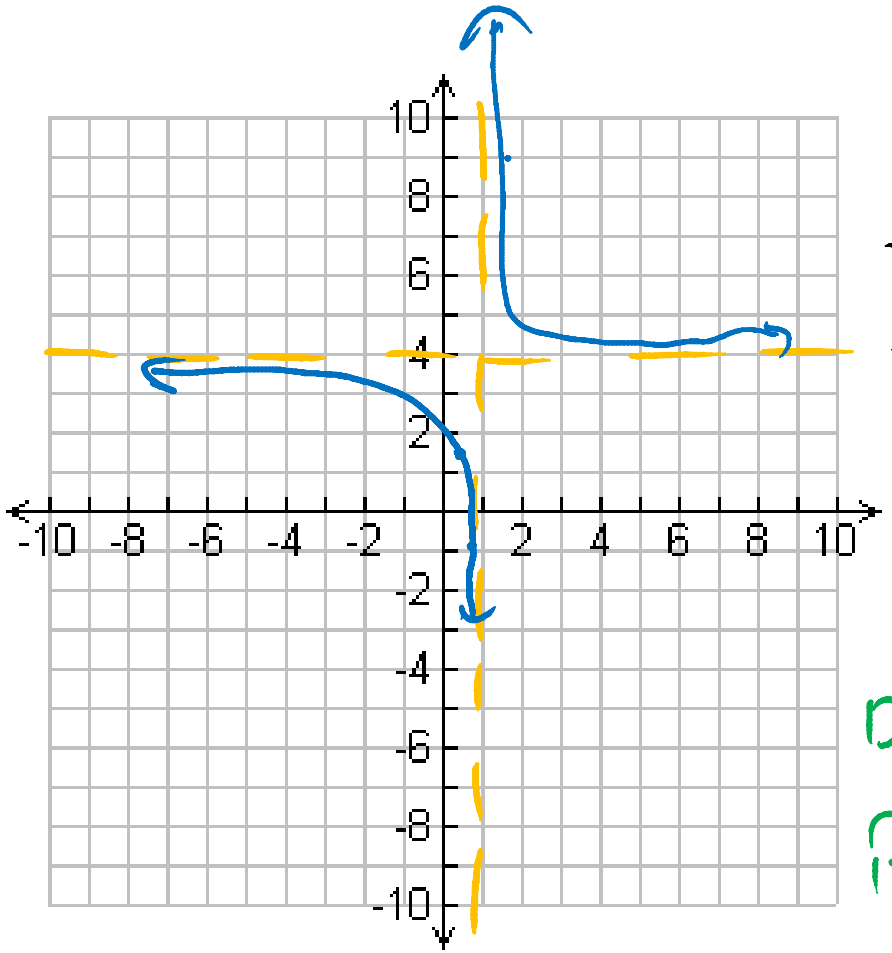
R: $\{f(x) \in \mathbb{R} \mid f(x) \leq 5\}$

$$f(x) = \frac{5}{3x-3} + 4$$

$3(x-1)$

① V. Stretch of 5 ② V. Shift of +4

③ H. Stretch of $\frac{1}{3}$ ④ H. Shift of +1



x	y
-2	-½
-1	-1
-½	-2
0	0
½	2
1	1
2	½

$\frac{1}{3}x+1$	$5y+4$
⅓	1.5
2/3	-1
5/6	-6
1	4
7/6	14
4/3	9
5/3	6.5

D: $\{x \in \mathbb{R} \mid x \neq 1\}$

R: $\{f(x) \in \mathbb{R} \mid f(x) \neq 4\}$