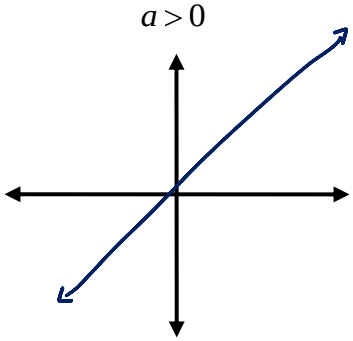
Sept 8th

1.1 *Graphs of Basic Functions*

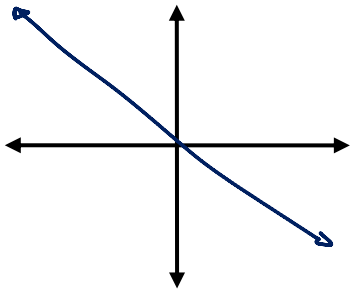
For each of the following functions, sketch a graph and indicate the domain and range

1. $y = ax + b$ *or* $y = mx + b$

$a > 0$



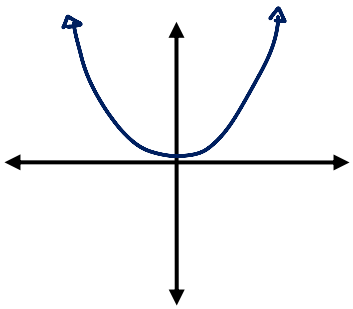
$a < 0$



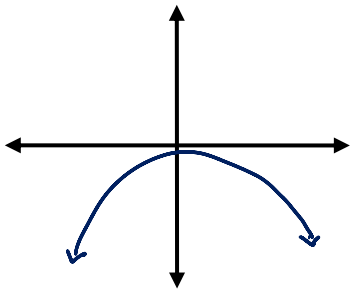
Name of function linear Domain $x = \mathbb{R}$ Range $y = \mathbb{R}$

2. $y = ax^2$

$a > 0$



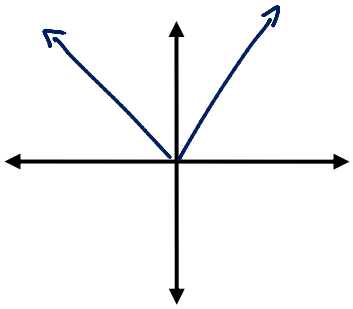
$a < 0$



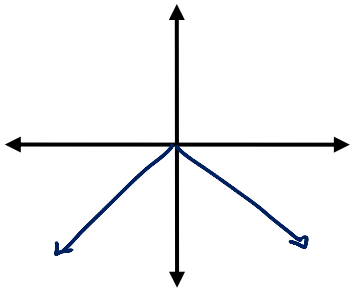
Name of function quadratic Domain $x = \mathbb{R}$ Range $y \geq 0$

3. $y = a|x|$

$a > 0$



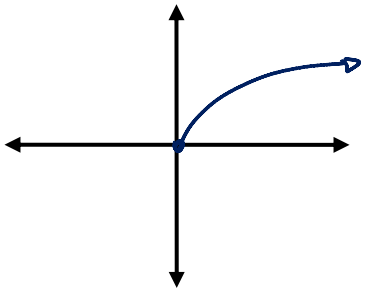
$a < 0$



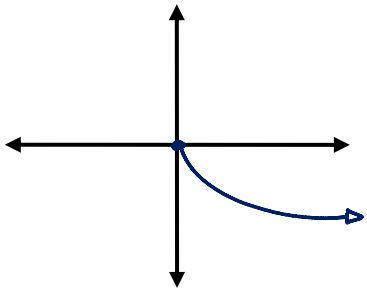
Name of function absolute value Domain $x = \mathbb{R}$ Range $y \geq 0$

4. $y = a\sqrt{x}$

$a > 0$



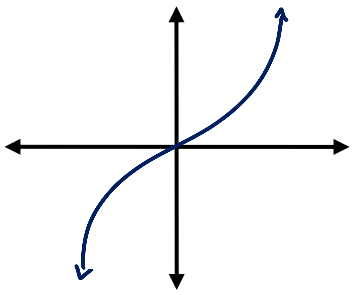
$a < 0$



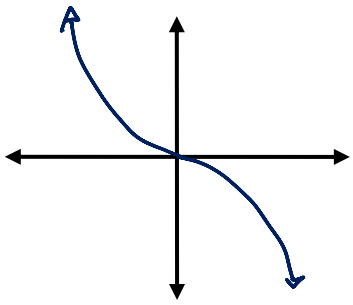
Name of function radical / root Domain $x \geq 0$ Range $y \geq 0$

5. $y = ax^3$

$a > 0$



$a < 0$

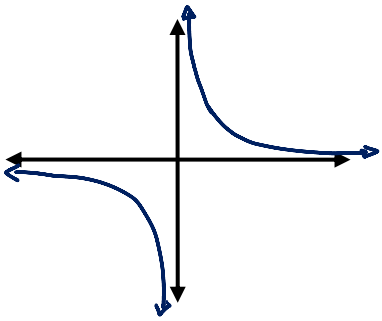


Name of function cubic Domain $x = \mathbb{R}$ Range $y = \mathbb{R}$

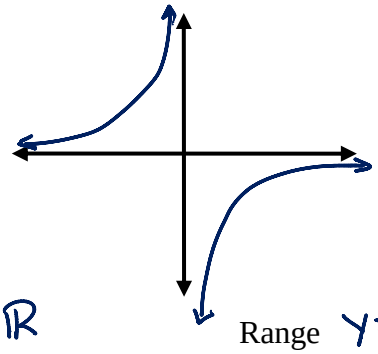
6. $y = \dfrac{a}{x}$

asymptotes

$a > 0$



$a < 0$



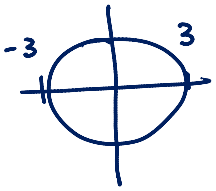
Name of function reciprocal Domain $x = \mathbb{R}$, $x \neq 0$ Range $y = \mathbb{R}$, $y \neq 0$

7. Describe the graph of the following equation: $x^2 + y^2 = r^2$.

eg $x^2 + y^2 = 3^2$
$-x^2 \qquad -x^2$

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

$y = \pm\sqrt{3^2 - x^2}$



$r = 3$

Is this a function? no Why? fails VLT

Give the domain and range.

D: $-3 \leq x \leq 3$ R: $-3 \leq y \leq 3$

Note that the functions $y=\sqrt{r^2-x^2}$ and $y=-\sqrt{r^2-x^2}$ represent the upper and lower halves respectively of the circle $x^2+y^2=r^2$

Polynomial Functions

A polynomial function is a function in the form:

$$f\ \ x\ \ =a_n x^n+\ a_{n-1}x^{n-1}+a_{n-2}x^{n-2}+\ .\ .\ .\ +\ a_2x^2+\ a_1x+a_0$$

Where:

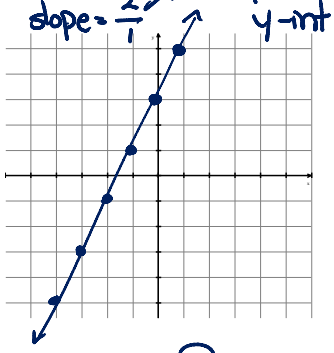
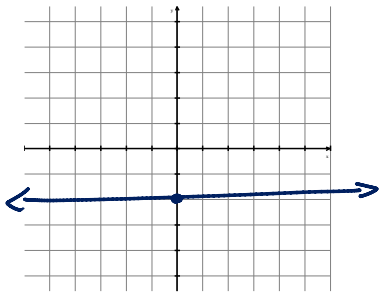
- $a_0\ ,a_1,a_2,\ldots,a_n$ are real (integers) numbers
- n is a natural number

The numbers $a_0\ ,a_1,a_2,\ldots,a_n$ are called coefficients. The coefficient a_n of the highest power x^n is the leading coefficient and a_0 is called the constant. term. The value of n is the degree. of the polynomial.

Linear Functions

A linear function is a degree 1 polynomial function of the form $f\ \ x\ \ =ax+b$.

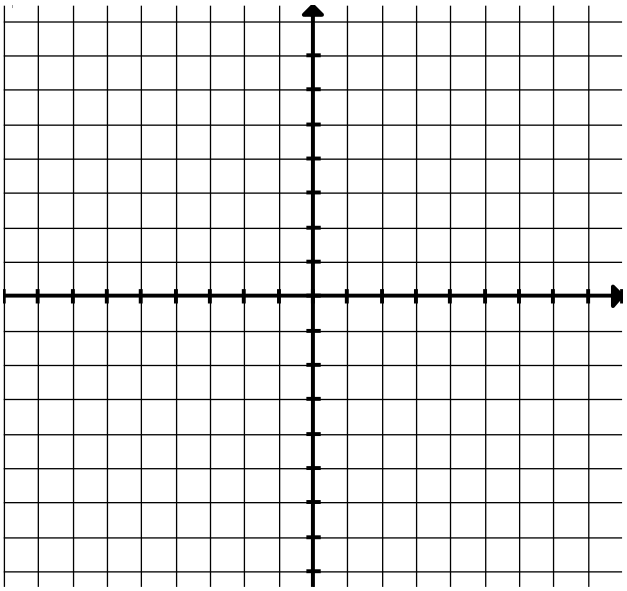
Sketch each of the following linear functions, and state the domain and range.

$f\ \ x\ \ =2x+3$ slope $=\frac{2}{1}$ y-int  What is the domain? $x=\mathbb{R}$ What is the range? $y=\mathbb{R}$	$f\ \ x\ \ =-2$  What is the domain? $x=\mathbb{R}$ What is the range? $y=-2$ What is another name for functions like $f\ \ x\ \ =-2$? constant function

Quadratic Functions

A quadratic function is a polynomial function of degree 2, which can be written in general form:
$f(x) = ax^2 + bx + c$ or standard form: $f(x) = a(x-p)^2 + q$

Example: Sketch the graph of $y = x^2 - 2x - 8$



Determine

i) the zeros (roots, x-intercepts)

- solve by factoring.
- graph → trace, table

ii) the *y*-intercept

- constant term (sub in $x=0$)

iii) the coordinates of the vertex

- find (p,q)
  - convert by completing the square
- find axis of symmetry (between roots) and sub in for x.

iv) the domain and range