CHAPTERS 1 & 2

grade 11

intro TO functions

intro functions

function → relation where each value of the independent variable x corresponds to only one value of the dependant variable y.

relation → set of ordered pairs of values of the indep. variable x paired with values of the dep. variable y.

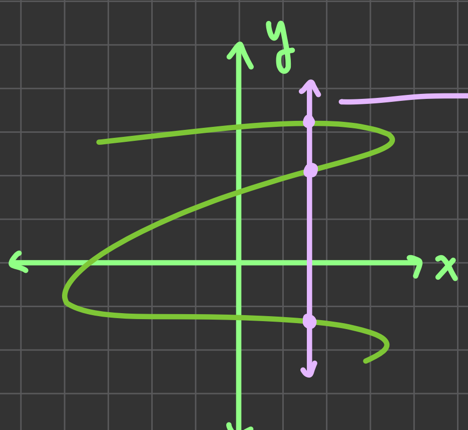
domain → set of all values of the indep. variable x of a relation.

range → set of all values of the dep. variable y of a relation.

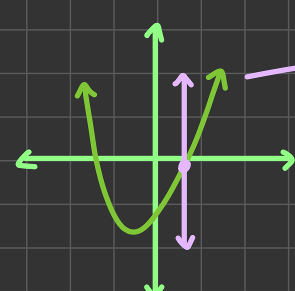
SET NOTATION

$\{(1,2),(3,4),(5,6)\}$ ← a function, bc there's only one y for every x.

$D = \{1,3,5\}$, $R = \{2,4,6\}$



→ vertical line test *failed*; this is a relation, not a function.



→ vertical line test *passed*; this is a function (and relation).

$f(x) =$ * insert function *

↳ kind of like $y =$ * insert function *

$f(x)$ → x, here, is the input into the function that will produce an output of y.

EXAMPLE:

$f(x) = 3x + 2$

→ $f(1) = 3(1) + 2 = 5$

→ $f(0) = 3(0) + 2 = 2$

→ $f(-1) = 3(-1) + 2 = -1$

$f(x) = 4x - 1$

$g(x) = x + 5$ → $g(1) = 1 + 5 = 6$

$\underbrace{f(g(4))}_{\text{can also be written as } (f \circ g)(x) \text{ or, in this case, } (f \circ g)(4)} = f(4+5) = f(9) = 4(9) - 1 = 35$

can also be written as $(f \circ g)(x)$ or, in this case, $(f \circ g)(4)$

varying FUNCTIONS

varying

PARENTAL FUNCTIONS

LINEAR:	QUADRATIC:	CUBIC:	ROOT FUNCTION:
$f(x) = x$	$f(x) = x^2$	$f(x) = x^3$	$f(x) = \sqrt{x}$

RECIPROCAL FUNCTION:	ABSOLUTE VALUE FUNCTION:	STEP FUNCTION:
$f(x) = \frac{1}{x}$	$f(x) = \lvert x \rvert$	$f(x) = \lfloor x \rfloor$ ← floor $f(x) = \lceil x \rceil$ ← ceiling

DOMAIN. RANGE:

ex. $f(x) = x^2$

x can be any $\mathbb{R}$ number:

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

y can be any $\mathbb{R}$ number:

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

ex. $f(x) = \dfrac{(x-3)}{(x+5)}$

x cannot be -5, or else the denominator will be 0:

$D = \{x \in \mathbb{R} \,||\, x \neq -5\}$

y can be any $\mathbb{R}$ number:

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

restrictions

restrictions

like in the previous example, functions can have restrictions:

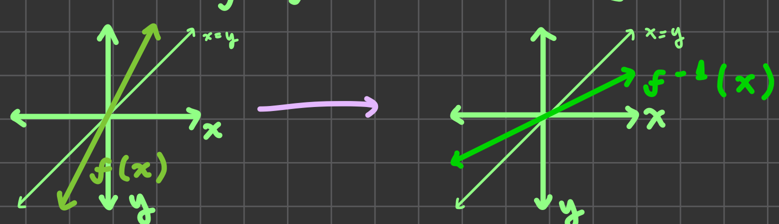
$f(x) = \dfrac{1}{(x+3)(x-1)(x+4)}$, $x \neq -4, -3, 1$ or else the denom. will be 0.

inverse FUNCTIONS

inverse

basically just switching f(x) (or y) and x: $\underbrace{D = R,\ R = D}$

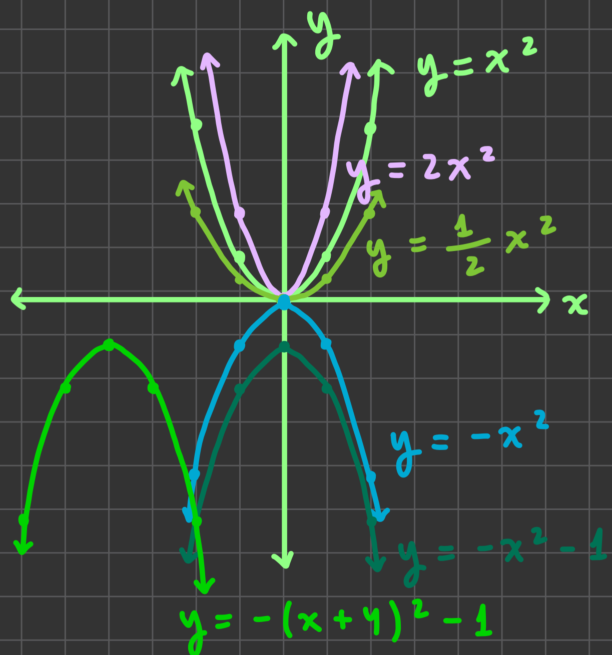
sometimes some of the values create relations, not functions.



graphically, f(x) is reflected over x=y to get its inverse $f^{-1}(x)$

transformations

transformations



quadratic

quadratic

TRANSFORMATIONS

NEW FORM!!

$$y = a\,f(k(x - d)) + c$$

function

horizontal translation left/right

vertical stretch/ compression

horizontal compression/stretch

vertical translation up/down

$y = 3f(x+4) - 7$

$f(x) = |x|$

↳ $f(x) = 3|x+4| - 7$

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

↳ $f(x) = \frac{3}{x+4} - 7$

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

↳ $f(x) = 3\sqrt{x+4} - 7$

operations WITH POLYNOMIALS

operations

ADDITION → combine like terms ← SUBTRACTION

$(4k^2+k)+(-3k^2+5k-1)$

$= 4k^2-3k^2+k+5k-1$

$= k^2+6k-1$

$(4k^2+k)-(-3k^2+5k-1)$

$= 4k^2+3k^2+k-5k+1$

$= 7k^2-4k+1$

MULTIPLICATION → FOIL (First, Outer, Inner, Last)

$(4k^2+k)(-3k^2+5k-1)$

$= -12k^4+20k^3-4k^2$
$-3k^3+5k^2-k$

$= -12k^4+17k^3+k^2-k$

DIVISION → try to factor!

$$\frac{k^2+k-2}{k^2+11k+18} = \frac{\cancel{(k+2)}(k-1)}{(k+9)\cancel{(k+2)}}$$

$$= \frac{k-1}{k+9}$$

solve for x

$4x^2+x-2$

$$\frac{-b \pm \sqrt{b^2-4ac}}{2a}$$

$$= \frac{-1 \pm \sqrt{1-4(4)(-2)}}{2(4)}$$

$$= \frac{-1 \pm \sqrt{33}}{8} = x$$

$$x = \frac{-1+\sqrt{33}}{8} \text{ or } \frac{-1-\sqrt{33}}{8}$$

DIVISION examples

$$\frac{7x+1}{-3x+6} = \frac{7x+1}{-3(x-2)} \longrightarrow \boxed{x \neq 2}$$

$$\frac{(s+4)(3s-1)}{(4s-3)(s+5)} = \frac{3s^2 - s + 12s - 4}{(4s-3)(s+5)}$$

$$= \frac{3s^2 + 11s - 4}{(4s-3)(s+5)}$$

$s \neq -5$

$4s \neq 3$

$s \neq \frac{3}{4}$

$$\boxed{\therefore\ s \neq -5, \frac{3}{4}}$$

ADDITION/ SUBTRACTION examples

$$\frac{x}{4y} + \frac{3x}{-3y^2}$$

$$= \left(\frac{x}{4y} - \frac{x}{y^2}\right)$$

$\cdot \frac{y}{y}$ $\cdot \frac{4}{4}$

$$= \frac{xy}{4y^2} - \frac{4x}{4y^2}$$

$$= \frac{xy - 4x}{4y^2},$$

$$\boxed{y \neq 0}$$

MULTIPLICATION & DIVISION examples

$$\frac{\cancel{(n+4)}}{(n-8)} \cdot \frac{(n+3)}{\cancel{(n+4)}} = \frac{n+3}{n-8} \qquad \boxed{\therefore n \neq -4, 8}$$

$n \neq -4$ $\qquad$ $n \neq 8$

$$\frac{(q-2)}{(3q+1)} \div \frac{(4q+5)}{(x-1)} = \frac{(q-2)}{(3q+1)} \cdot \frac{(x-1)}{(4q+5)}$$

$$= \frac{(q-2)(x-1)}{(3q+1)(4q+5)}$$

$4q \neq -5$ $\qquad$ $3q \neq -1$

$$\boxed{q \neq -\frac{5}{4} \qquad q \neq -\frac{1}{3} \qquad x \neq 1}$$