

Domain and Range

Domain = x-values. For what values of x will the function of x, f(x), exist?

what values of x will work (or give an answer)

points to consider:

- Does f(x) involve
 - finding a square root of x? → can't determine $\sqrt{-x}$
 - division of x value? → can't divide by 0

writing domain of a function denotes it as a set of values

Domain = $\{x \in \mathbb{R}, \dots\}$

'belongs to'

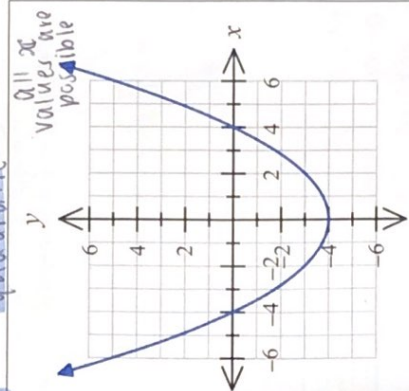
the set of real numbers

constraint

e.g. $x \neq 0$
 $x \geq 0$
 $-2 \leq x \leq 5$

Type of function:

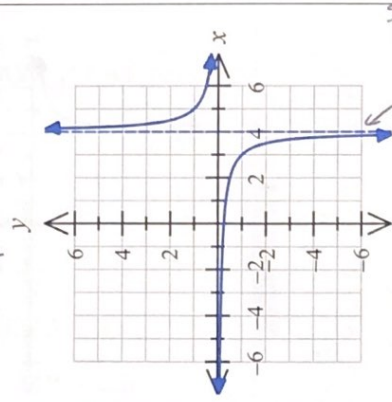
quadratic



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

Equation: $0.25x^2 - 4$

reciprocal

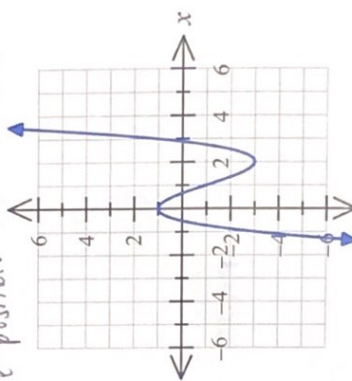


Domain: $\{x \in \mathbb{R}, x \neq 0\}$ (as $x=0$)

Equation: $y = \frac{1}{x-4}$

cubic

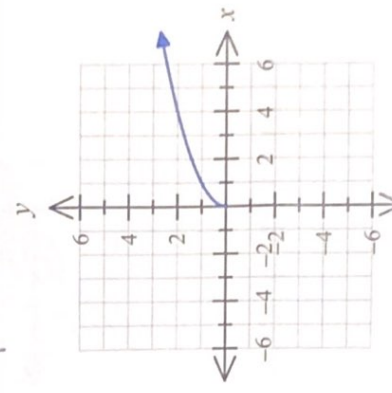
all x values are possible



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

Equation: $x^3 - 3x^2 + 1$

square root function



Domain = $\{x \in \mathbb{R}, x \geq 0\}$

Equation: $y = \sqrt{x}$

Range = y-values. Based on domain, what values of the function are possible?

Points to consider

-the domain! this will help you work out what values of y are/are not possible

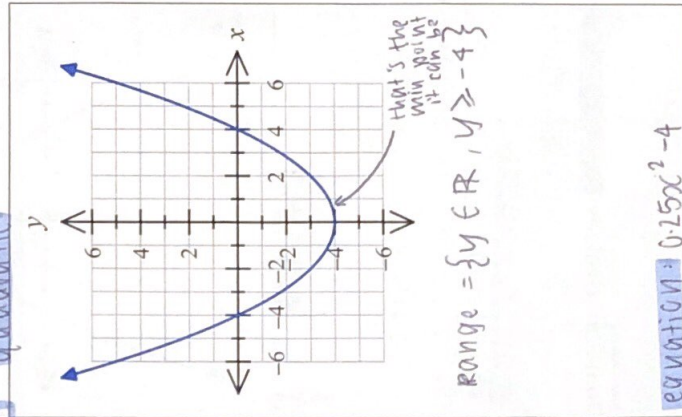
$-\sqrt{x}$ or $\frac{1}{x}$

-does $f(x)$ involve 'power of x '?

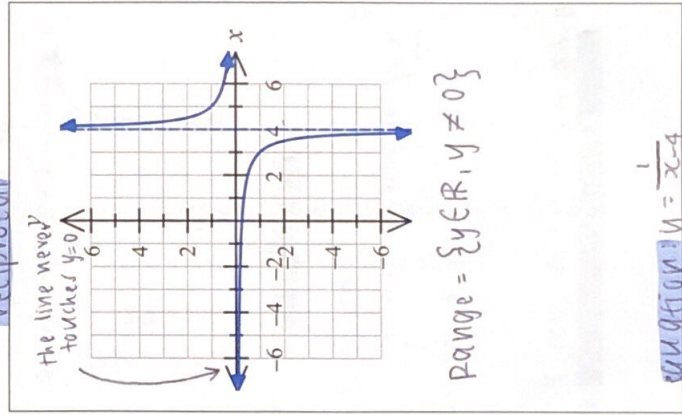
↳ because if $y = a^x$, no matter what x is, y will not be negative ($2^{-1} = \frac{1}{2}$)

Type of function:

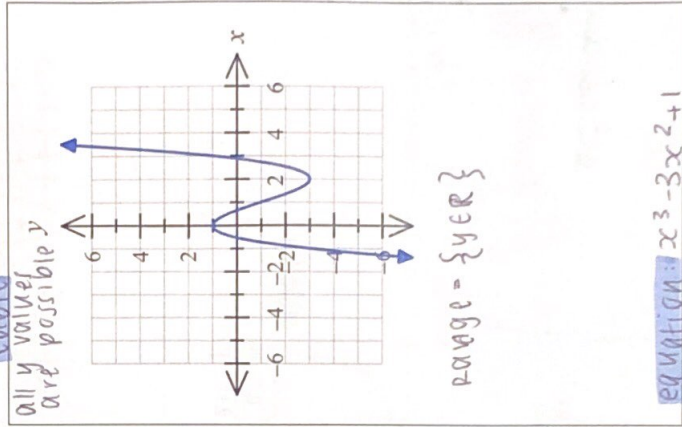
quadratic



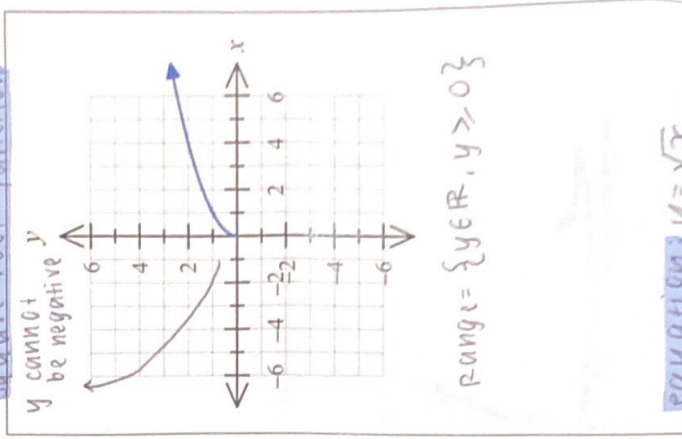
reciprocal



cubic



square root function



Writing range of a function

Range = $\{y \in \mathbb{R}, \dots\}$

'belongs to'

the set of real numbers

denotes it as a set of values

constraint

6 Which numbers can each of the following functions not cope with? (i.e. which numbers must not be included in the domain?)

not 'what is the domain' →
 a $f(x) = \sqrt{x-1}$
 cannot be a negative

$x < 1$
 = won't be in the domain

b $f(x) = x^2 + 1$
 none

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

d $f(x) = \frac{1}{1-x}$
 cannot be 0 so what x value makes it 0??

$x = 1$
 does not exist

7 Which numbers is it impossible for each of the following functions to output? (i.e. which numbers will not be included in the range?)

not 'what is the range' →
 a $f(x) = \sqrt{x-1}$
 $f(x) < 0$
 does not exist

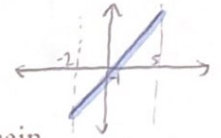
b $f(x) = x^2 + 1$
 $f(x) < 1$
 does not exist

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

d $f(x) = \frac{1}{1-x}$
 what value of x makes the f(x) not work?
 $f(x) \neq 0$

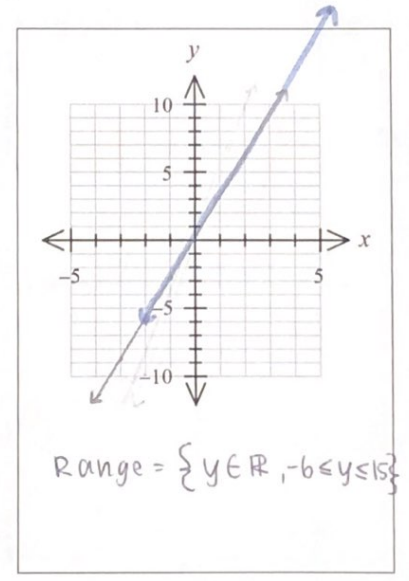
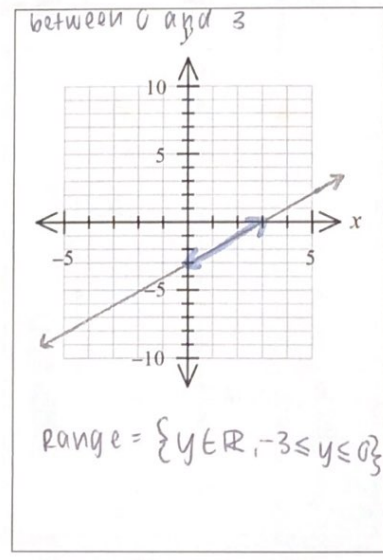
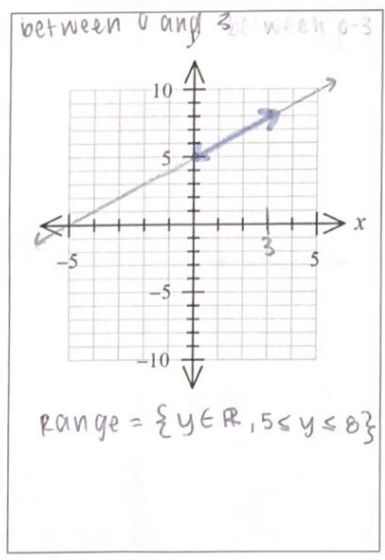
Defining the Domain

- sometimes we need to define the domain based on the context of the question (e.g. $x > 0$)
 - sometimes the domain is defined for us. For example, $y = 3x - 1; -2 \leq x \leq 5$

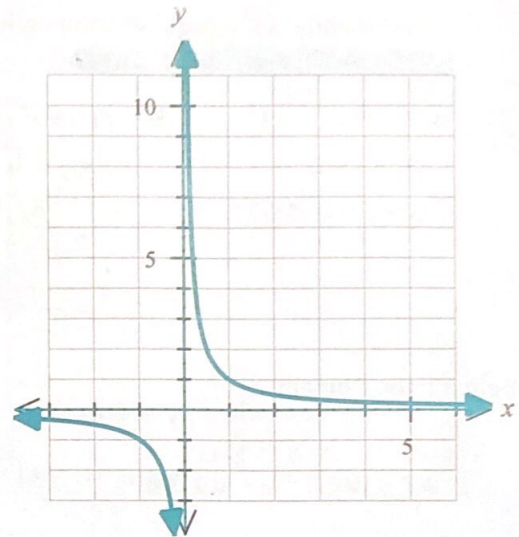
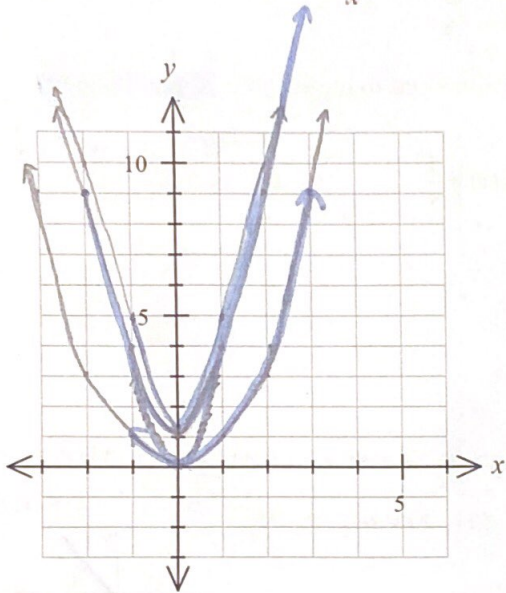


For questions 8 to 22 state the range of each function for the given domain.

- 8 Function: $f(x) = x + 5$, Domain: $\{x \in \mathbb{R}; 0 \leq x \leq 3\}$
- 9 Function: $f(x) = x - 3$, Domain: $\{x \in \mathbb{R}; 0 \leq x \leq 3\}$
- 10 Function: $f(x) = 3x$, Domain: $\{x \in \mathbb{R}; -2 \leq x \leq 5\}$



- 14** Function: $f(x) = x^2$, Domain: $\{x \in \mathbb{R} : -1 \leq x \leq 3\}$
 Range: $\{y \in \mathbb{R} : 0 \leq y \leq 9\}$
- 15** Function: $f(x) = (x+1)^2$, Domain: $\{x \in \mathbb{R} : -2 \leq x \leq 3\}$
 Range: $\{y \in \mathbb{R} : 0 \leq y \leq 16\}$
- 16** Function: $f(x) = x^2 + 1$, Domain: $\{x \in \mathbb{R} : -1 \leq x \leq 3\}$
- 17** Function: $f(x) = \frac{1}{x}$, Domain: $\{x \in \mathbb{R} : 1 \leq x \leq 4\}$



For questions 23 to 28 state whether the function is one-to-one or many-to-one for the stated domain.

23 $f(x) = x$, domain: \mathbb{R}

24 $f(x) = x^2$, domain: $\{x \in \mathbb{R} : 0 \leq x \leq 3\}$

25 $f(x) = x^2$, domain: $\{x \in \mathbb{R} : -3 \leq x \leq 3\}$

26 $f(x) = x^2$, domain: \mathbb{R}

