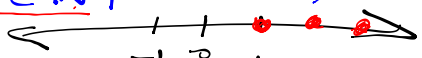
$A \setminus B = \{1, 2, 3\}$ $A \cup B = \{1, 2, 3, 4\}$

Set

A: $\{1, 2, 3\}$ B $\{4\}$ $A \cap B = \{\emptyset\}$

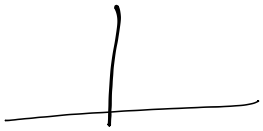
A' $A = \{x \in \mathbb{N} \mid 0 < x \leq 4\}$ $A \cap B = \{\ \}$



$A' = \{x \in \mathbb{N} \mid x \geq 5$ and $x = 0\}$

- listing
- Set builder not.
- venn diagrams
- graphing
- interval notation

$\mathbb{R}$



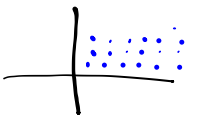
$[1, 3]$

Unit 5: Cartesian Product

↳ the product of two sets

↳ a set of ordered pairs (x, y)

(Cartesian Plane)



e.x.

$$A \times B = \{ (x, y) \in A \times B \mid x \in A \text{ and } y \in B \}$$

set builder notation

ordered pair — source set — target set

$A = \{0, 1, 2\}$

$B = \{5, 6\}$

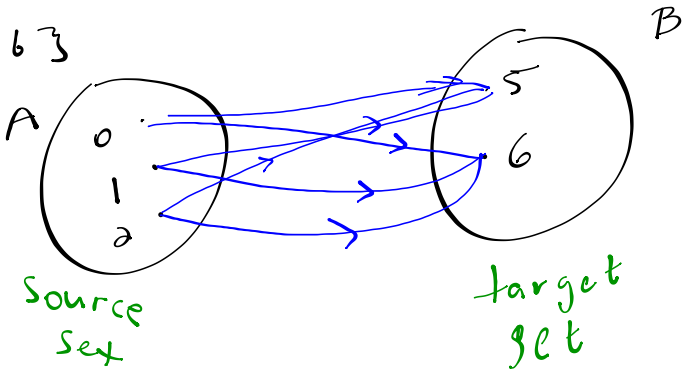
listing

$$A \times B = \{(0,5), (0,6), (1,5), (1,6), (2,6), (2,5)\}$$

Arrow Diagrams: a graphical representation of the Cartesian Product

$A = \{0, 1, 2\}$

$B = \{5, 6\}$



$\{0, 5\}$

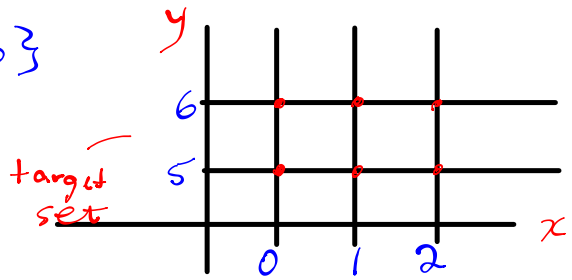
Cartesian Graph

↳ a more pratical graphical way to represent the cartesian product

$A = \{0, 1, 2\}$

$B = \{5, 6\}$

$A \times B$



↳ source set

0, 5

$\mathbb{R} \times \mathbb{R}$ → the cartesian product most often used

$\mathbb{R}\times\mathbb{R} = \{(1,2),$

$(0,1)$

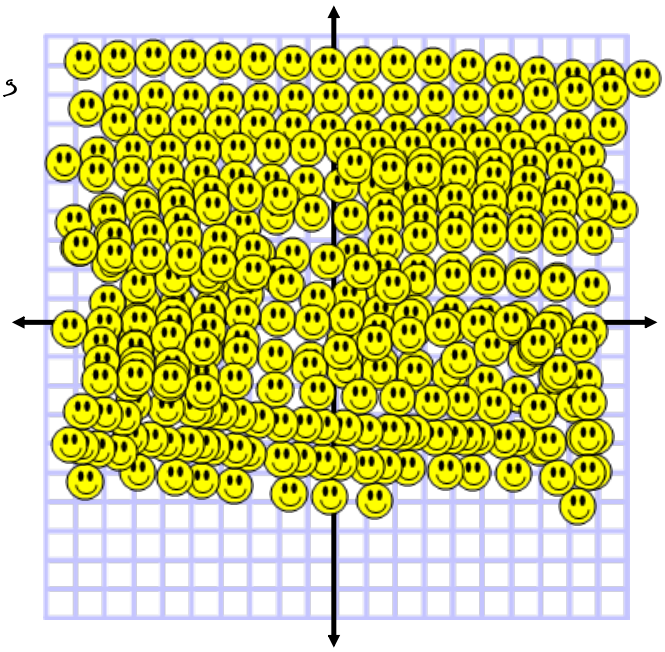
$(-1,5)$

$(\frac{1}{2}, \sqrt{2})$

$(-\frac{3}{2}, 25)$

$(-2,4)$

$\ldots\}$

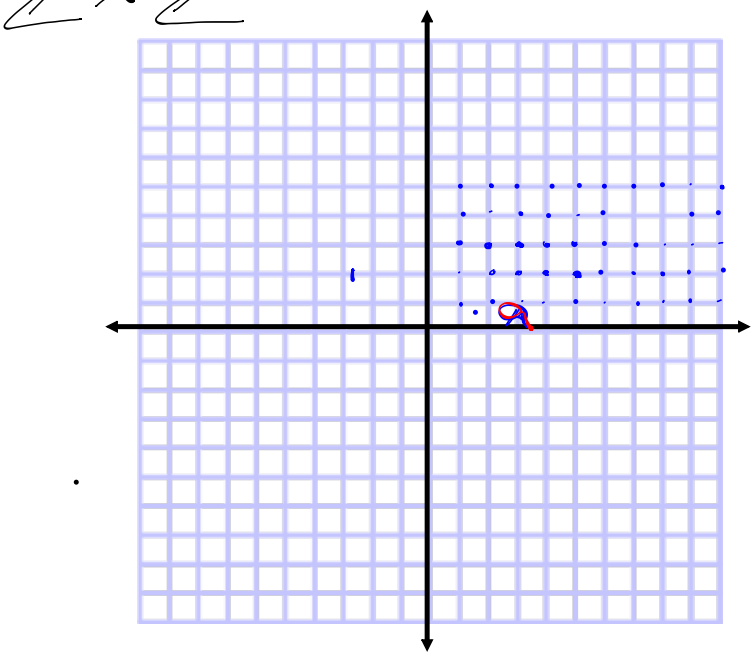


The elements of $\mathbb{R}\times\mathbb{R}$ are everywhere.

They cover all of the graph.

$\mathbb{Z} \times \mathbb{Z}$

$\mathbb{Z} \times \mathbb{Z}$



$\mathbb{N} \times \mathbb{N}$

Unit 6: Relations

Definition: A relation is a subset of the cartesian product. A set of ordered pairs that satisfy a given rule of correspondance (formula/equation)

e.x. $R = \{(x,y) \in A \times B \mid y = 2x\}$

$R \subseteq A \times B$

listing

$R = \{(1,2), (2,4), (3,6), (4,8), (0,0)\}$

$A = \{x \in \mathbb{N} \mid x < 10\}$

$A = \{0, 1, 2, 3, 4, 5 \ldots 9\}$

$B = \{y \in \mathbb{N} \mid y < 10\}$

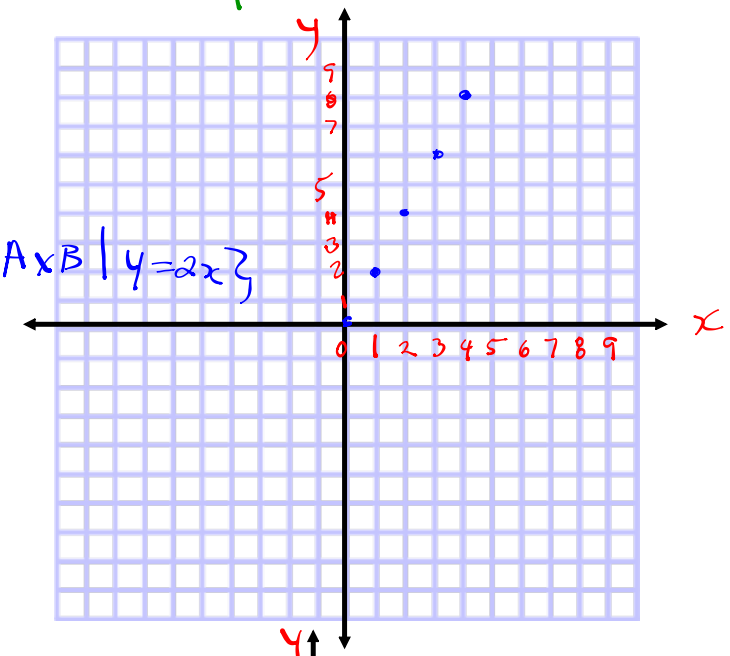
$A \times B = \{(1,2), (3,1), (6,8), (4,6) \ldots\}$

Graphing

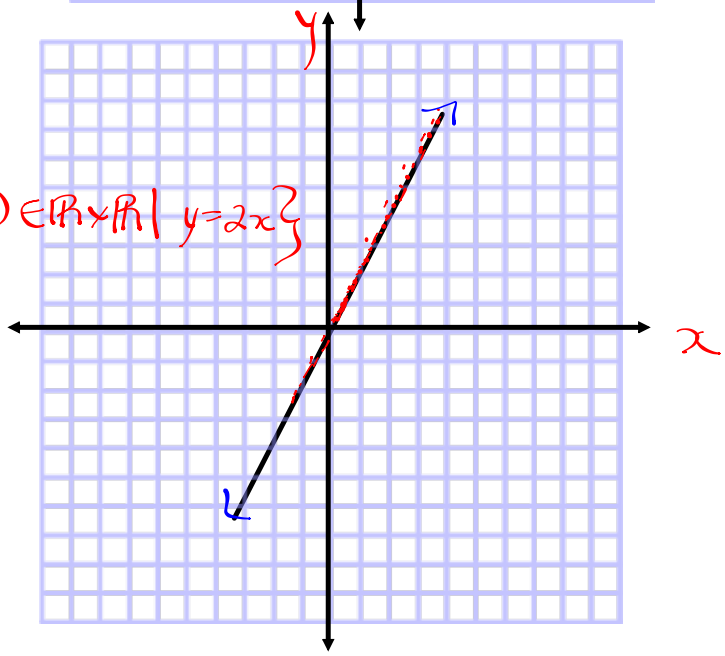
↳ a graphical way to represent a relation.

$y = 2x$

$R = \{(x, y) \in A \times B \mid y = 2x\}$



$R = \{(x, y) \in \mathbb{R} \times \mathbb{R} \mid y = 2x\}$

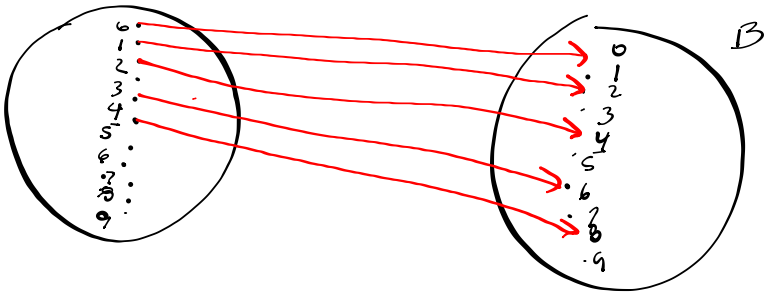


Arrow Diagrams

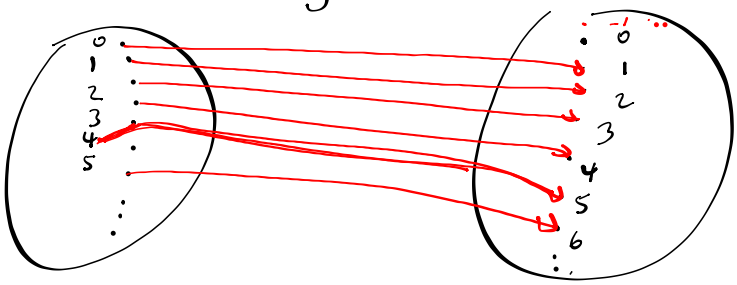
↳ a graphical way to represent a relation

$R = \{(x, y) \in A \times B \mid y = 2x\}$

$A = \{x \in \mathbb{N} \mid x < 10\}$



Put the following Relation in set Builder Notation



(x, y)

≥ 0

$(1, 1)$

$R = \{(x, y) \in A \times B \mid y = x + 1\}$

$A = \{x \in \mathbb{N} \mid x \geq 0\}$

$B = \{y \in \mathbb{N} \mid y \geq 0\}$

$R = \{(x, y) \in \mathbb{N} \times \mathbb{N} \mid y = x + 1\}$

Graph the following relation

$$R = \{(x, y) \in \mathbb{R} \times \mathbb{R} \mid 2x + 3y = 6\}$$

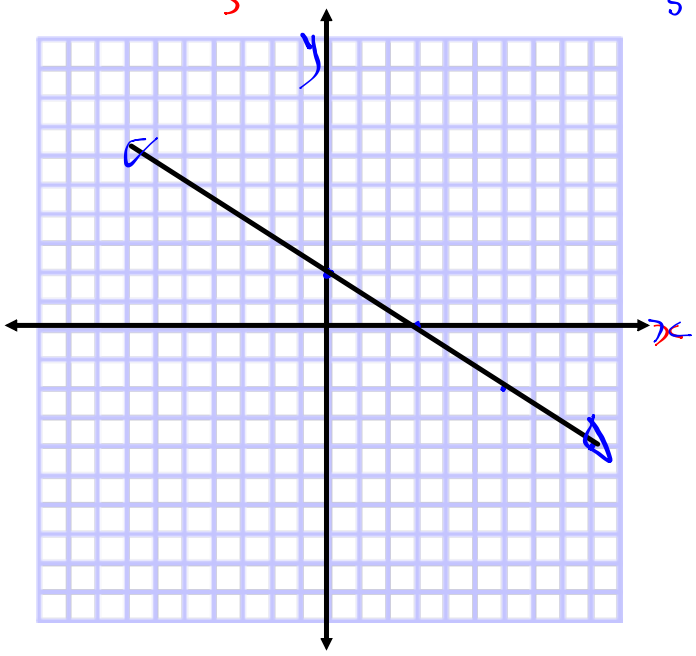
isolate y: perform the opposite operation to both sides

$$2x + 3y = 6 - 2x$$

$$\frac{3y}{3} = \frac{-2x + 6}{3}$$

$$y = -\frac{2}{3}x + 2 \rightarrow m = -\frac{2}{3} \quad \frac{\text{rise}}{\text{run}}$$

To graph
① put equation in $y = mx + b$
slope y-int



Relations as Inequalities

" $<$ " " $>$ " "dotted"
" $\leq$ " " $\geq$ " "solid"

↳ graphed it's the shading on one side of a line.

e.x. $R = \{(x, y) \in \mathbb{R} \times \mathbb{R} \mid x - y \geq 2\}$

$x - y = 2$

Steps to graph inequalities

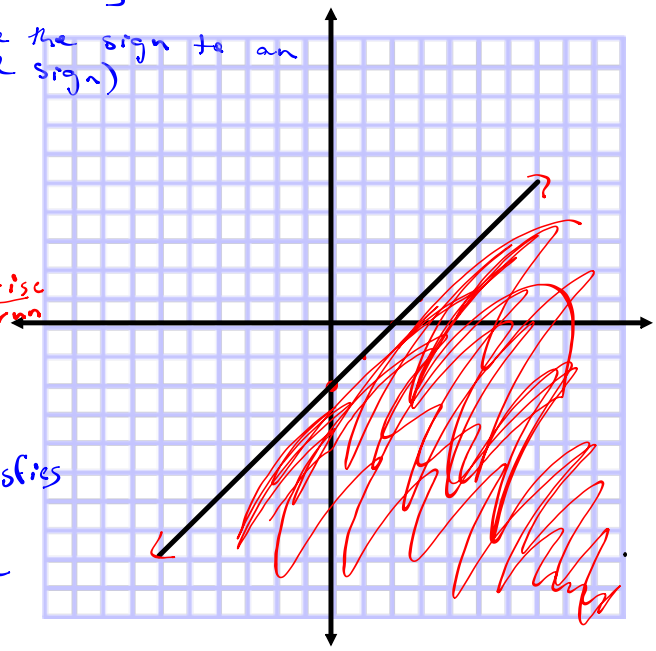
Step ①: Graph the corresponding equality (i.e. change the sign to an equal sign)

e.x. $x - y \geq 2$ $+y$ $+y$

$x \geq 2 + y$

$x - 2 \geq y$

$y \leq x - 2$ $\quad b = -2$



Step ②: To figure out where to shade, use a test point and see if it satisfies the inequality. If the test satisfies the inequality shade where the point is. If not, shade where the point is not.

$m = \frac{1}{1}$ rise / run

(0,0)

use the original inequality

$x - y \geq 2$ sub in (0,0)

$0 - 0 \geq 2$

$0 \geq 2$ FALSE

(0,0) does not satisfy.

Graph the following inequality

$R = \{ (x, y) \in \mathbb{R} \times \mathbb{R} \mid 2y - 4x > 4 \}$

* since there's no line under the inequality sign, you draw a dotted line for step ①.

$R = \{(x, y) \in \mathbb{N} \times \mathbb{N} \mid x - y > 2\}$

5.5 - 1.5 7 2

4 7 2

Step ①:

$x - y = 2$ (−2, +y)

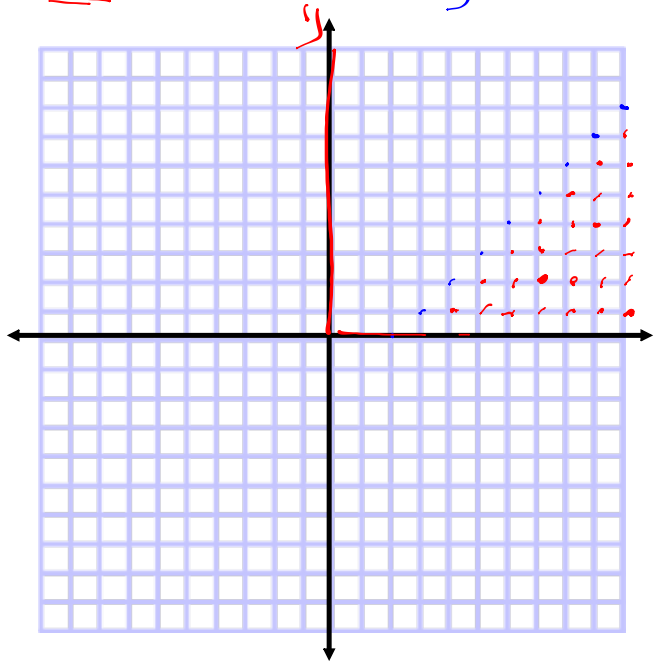
$x - 2 = y$

$y = x - 2$

Step ② : Test (0, 0)

$0 - 0 > 2$

$0 > 2$ FALSE



Graph the following Relation

$$R = \{ (x, y) \in \mathbb{R} \times \mathbb{R} \mid \frac{x}{2} - \frac{y}{4} < 1 \}$$

$$\frac{x}{2} - \frac{y}{4} = 1 \quad (-\frac{x}{2})$$

$$-4\left(+\frac{y}{4}\right) = \left(-\frac{x}{2} + 1\right)(-4)$$

$$y = 2x - 4$$

$$\frac{-x}{2} \cdot \frac{-4}{1} \quad 4x = 2x$$