Section 1.1 continued

Set builder notation

Set builder notation is a way to construct sets out of other sets.

$$A = \{x \in \mathbb{Z} : x \geq 0\} \text{ or } A = \{x : x \in \mathbb{Z}, x \geq 0\}$$

- A is the set of integers that are greater than or equal to zero

$\{n \in \mathbb{Q} : n/2 \in \mathbb{Z}\}$

$$E = \{2n : n \in \mathbb{Z}\}$$

- E is the set of things of the form $2n$ where n is an integer

$\{x \in \mathbb{Z} : x \text{ is prime}\}$

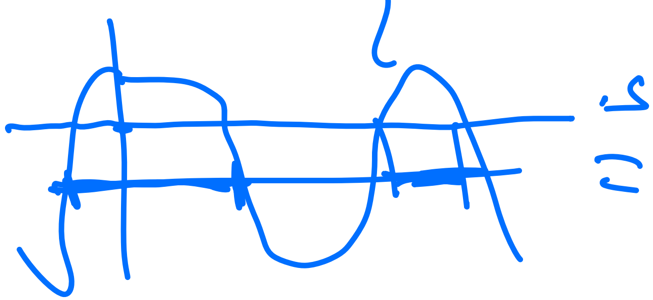
Set builder notation continued

More generally, set builder notation looks like this:

$$X = \{\text{expression} : \text{rule}\}$$

and it captures all values of the expression that satisfy the rule.

$$\left\{ \cos x \;\middle|\; \begin{array}{l} \cos x \geq .5 \\ x \in \mathbb{R} \end{array} \right\}$$



$= \{$real numbers from $.5$ to $1\}$

Intervals of $\mathbb{R}$

Intervals are examples of sets given by set builder notation.

- $(a, b) = \{x \in \mathbb{R} : x > a \text{ and } x < b\}$ "open"
- $[a, b) = \{x \in \mathbb{R} : x \geq a \text{ and } x < b\}$ "half open"
- $(a, b] = \{x \in \mathbb{R} : x > a \text{ and } x \leq b\}$ "half open"
- $[a, b] = \{x \in \mathbb{R} : x \geq a \text{ and } x \leq b\}$ "closed"
- $[a, \infty) = \{x \in \mathbb{R} : x \geq a\}$ "infinite"
- $(a, \infty) = \{x \in \mathbb{R} : x > a\}$ "infinite"
- $(\infty, a) = \{x \in \mathbb{R} : x < a\}$ "infinite"
- $(\infty, a] = \{x \in \mathbb{R} : x \leq a\}$ "infinite"