Sets

Collection of elements

$A = \{a, b, g, h\}$ $B = \{2, 0, 1, 5\}$

Union of sets

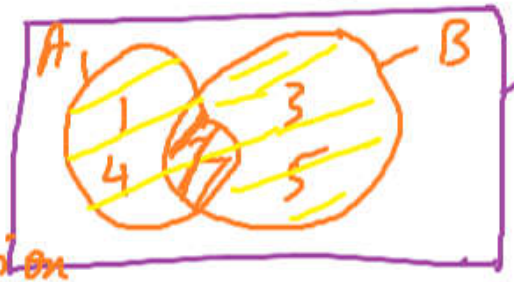
$A \cup B = \{x \mid x \in A \text{ or } x \in B\}$

x belongs to A or B

repetitive elem write only once

$A = \{1, 2, 4\}$ $A \cup B = \{1, 2, 4, 3, 5\}$

$B = \{2, 3, 5\}$



/// Union

/// intersection

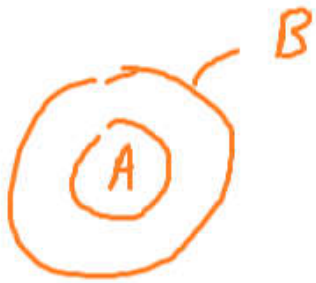
Intersection of sets $A \cap B$

elements that belong to A and B

$A \cap B = \{2\}$ common elements write only once

$A \subset B$ A is subset of B

i.e. A is inside B



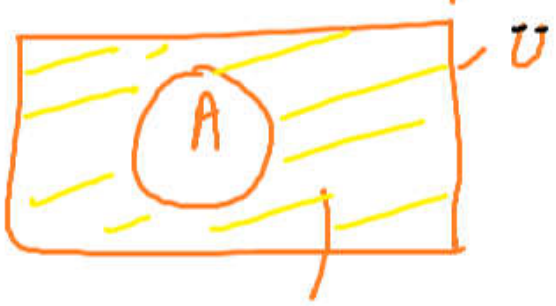
$\emptyset$: Null set $= \{\}$ empty set

$X = \{2, 3, 5, 7\}$ $Y = \{1, 3, 5, 7, 8\}$ $\{0\}$ X Not empty

$X \cup Y = \{2, 3, 5, 7, 1, 8\}$

$X \cap Y = \{3, 5, 7\}$

A^c : complement of A set of all elements not in A



$A \cup A^c = U$

$A \cap A^c = \emptyset$

A

$x^2 - 4 = 0$ $x^2 = 4$

$x = \pm\sqrt{4} = \pm 2$

$x^2 - 3x + 2 = 0$

$x = 2, 1$

$A = \{2, -2\}$

$B = \{2, 1\}$

$A \cup B = \{2, -2, 1\}$

3 ✓

$\mathbb{N}$ Natural no $\{1, 2, 3, \ldots\} = \mathbb{N}$

$\mathbb{W}$ whole no $\{0, 1, 2, 3, \ldots\} = \mathbb{W}$

$\mathbb{Z}$ Integers $\{\ldots, -3, -2, -1, 0, 1, \ldots\} = \mathbb{Z}$

Q: Rational no $\left\{ \frac{p}{q} \mid p, q \in \mathbb{Z}, q \neq 0 \right\}$

Any finite decimal / Any fraction

or infinite decimal with repeating pattern

$\frac{2}{3}$, $\frac{1}{3}$, $2 = \frac{2}{1}$ $\quad \sqrt{2}$ X $\quad 0.33\overline{3} = \frac{1}{3}$ ✓

$2.5 = 2.5\frac{10}{10} = \frac{25}{10} = \frac{5}{2}$ ✓ $\quad 261.\overline{761}$ ✓

$\mathbb{I}$ Irrational no { Any thing that is not rational }

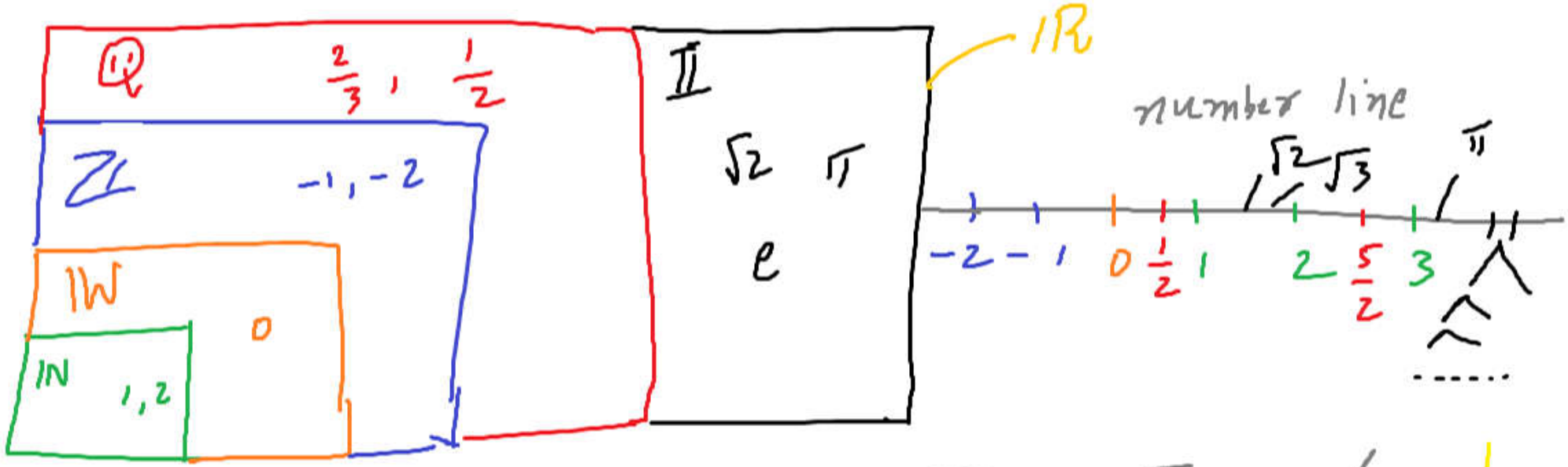
Any infinite decimal with no repeating pattern

$\sqrt{2}, \sqrt{3}, \sqrt{5}, \sqrt{4} = 2$ ✗

$\frac{1}{\sqrt{2}}, \pi, e$ $\qquad \sqrt{2} = 1.414\text{---}$

$\mathbb{R}$ Real no set of all no's

$1.2, \sqrt{2}, 4, \frac{2}{3}, 0$



$\mathbb{N} \subset \mathbb{W} \subset \mathbb{Z} \subset \mathbb{Q}$ $\quad \mathbb{Q} \cap \mathbb{II} = \emptyset$

$\mathbb{R} = \mathbb{Q} \cup \mathbb{II}$

Absolute value

$|4| = 4$

$|-4| = 4$

$|4| = 4 \quad 4 \geq 0$

$|-4| = --4 \quad -4 < 0$

$= 4$

$$|x| = \begin{cases} x & x \geq 0 \\ -x & x < 0 \end{cases}$$

— useful to solve abs value eqns with variables.

$|3-5| = 2$ ✓

$||3| - |-5|| = |3-5| = |-2| = 2$ ✓

$||3| + |-5|| = |8| = 8$ ✓

$|x| = 2$

$x = 2, -2$

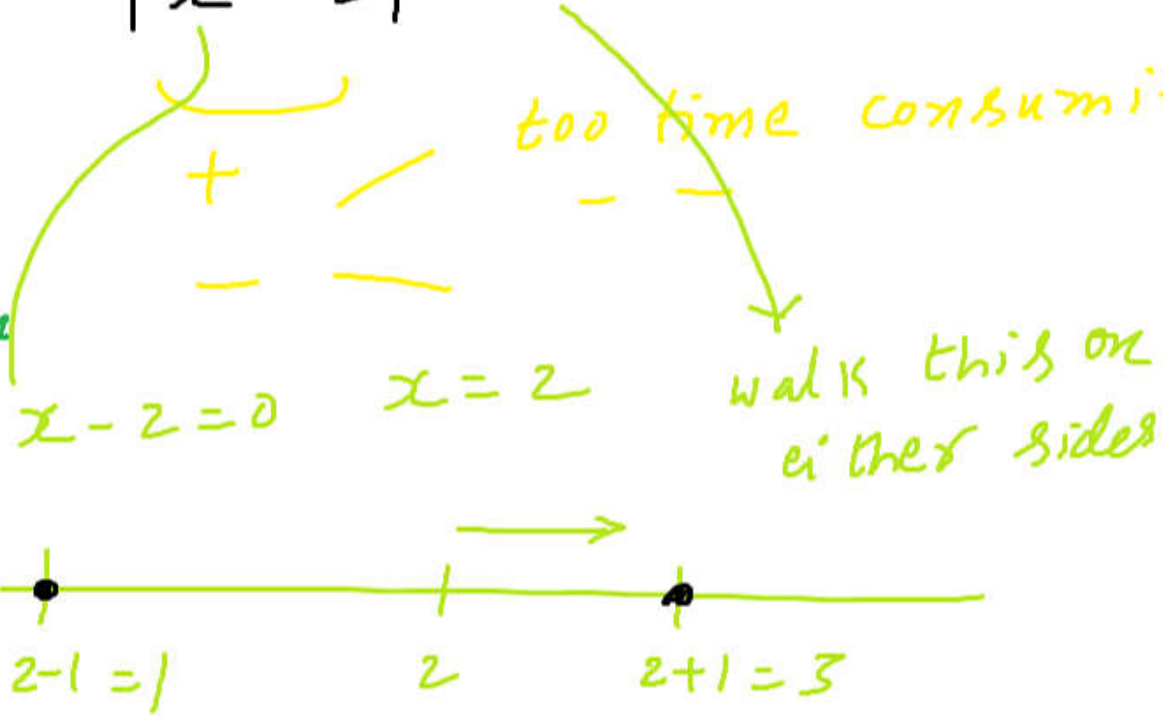
Abs value eqns can have more than one soln

$|x+1| \leq 2$

∞ solns

$|x-2| = 1$

too time consuming



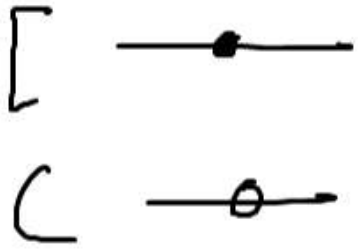
$x = 3, 1$

$|x+1| \leq 2$

$x+1 = 0$

$x = -1$

soln $[-3, 1]$



$\leq$ shade inside

$\geq$ shade outside

$\left|p - \frac{1}{2}\right| > \frac{3}{2}$

$p - \frac{1}{2} = 0$

$p = \frac{1}{2}$

$(-\infty, -1) \cup (2, \infty)$

$\pi = 3.14$

$e = 2.72$

$\sqrt{2} = 1.414$

$\sqrt{3} = 1.73$

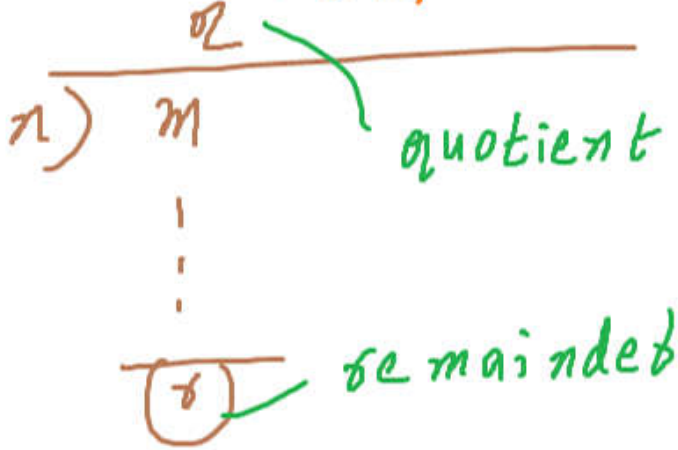
$\sqrt{5} = 2.23$

$|x| < \pi$

$|x| < 3.14$

$x = 0$

dividend $\left(\frac{m}{n}\right)$ divisor



$+ \times + = +$

$+ \times - = -$

$- \times + = -$

$- \times - = +$

$(-)(-)(-) \text{ ---odd} = -$

$\text{even} = +$

$(-)(-)(-) = -$

$(-)(-)(-)(-) = +$

$a + b = b + a$ commutative $+$

$a \cdot b = b \cdot a$ Associative $+$

$a + (b + c) = (a + b) + c$ comm $\times$

$a \cdot (b \cdot c) = (a \cdot b) \cdot c$ Assoc $\times$

consecutive		$n, n+1, n+2, \cdots$	
"	odd	$n, n+2, n+4, \cdots$	$1, 3, 5, \cdots$
"	even	$n, n+2, n+4, \cdots$	$2, 4, 6, \cdots$

$$n + (n+1) + (n+2) < 75$$

$$3n + 3 < 75$$

$$3n < 72$$

$$n < 24$$

$23, 22, 21, \cdots$

$2 < x < 4$

$3 < x < 7$

3

6

9

3.999999

6.9999

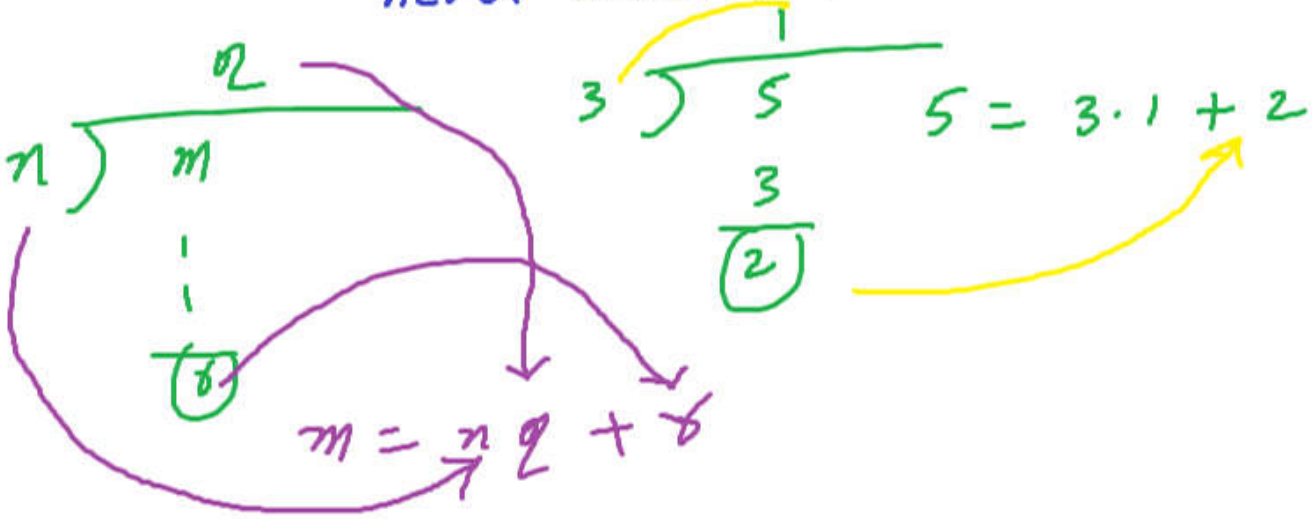
10.9998 → never reaches 11

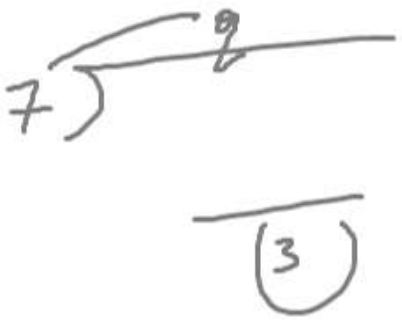
$x + y$ is $\mathbb{Z}$

$3.5 \quad 6.5 \quad 10$

Remainder Thm

$\frac{m}{n}$





$7q + 3 < 100$

$7q < 97$

$q < 13.8$

$q =$ 0, 1 - - - 11, 12, 13

14 no's

$7q + 3 < 5000$

$7q < 4997$

$q < 713.8$

$q =$ 0, 1, - - - 713

714 no's

6 factors are 1, 2, 3, 6

6 multiples are 12, 18, 24, ---

Prime no's: Has factors only 1 and itself, and 1 and itself are different

ex: 2, 3, 5, 7, ---

Composite no's Has more than two factors

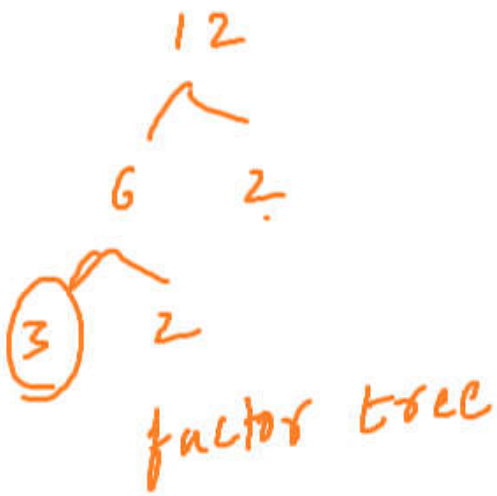
ex: 4, 6, 8, ---

1, 2, 4

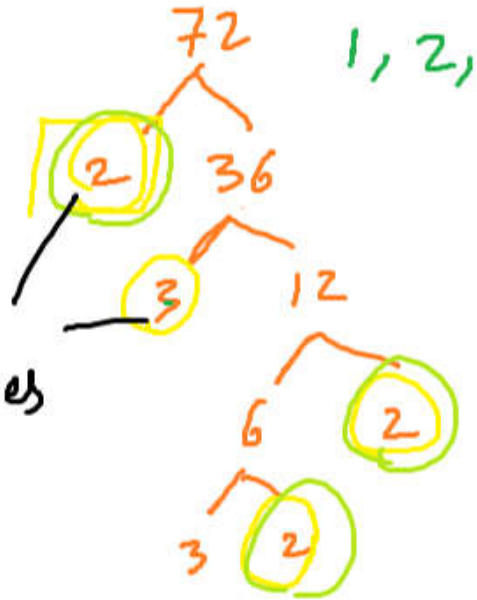
1: neither prime nor comp

2: only prime that is even

Finding factors



factor tree



leaves

1, 2, 3, 4, , 18, 24, 36, 72

6, 8, 9, 12

Prime factorization : (any no write as product of primes only)

$12 = 2^2 \cdot 3$

$72 = 2 \cdot 3 \cdot 3 \cdot 2 \cdot 2$
$= 2^3 \cdot 3^2$

$2 \times 3 = 6$

$2 \# 3 = 6$

multiply

$4 \# 4 = 16$

$\lceil a \rceil \equiv$ smallest prime factor of a

$\lceil 35 \rceil = 5$

$\lceil 10 \rceil = 2$

$\lceil 15 \rceil = 3$

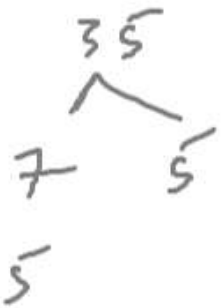
$\lceil 45 \rceil = 3$

$\lceil 55 \rceil = 5$

$\equiv$ defn

$=$ equal

proved



LCM (36, 48)

Find LCM of

6, 8

9, 12

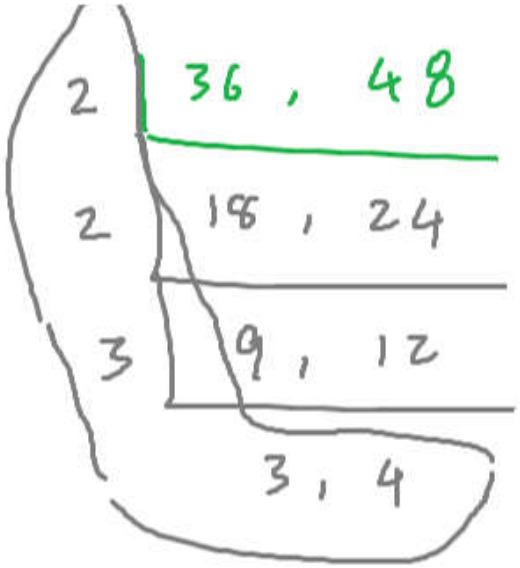
8, 14

6, 15

4, 12, 27

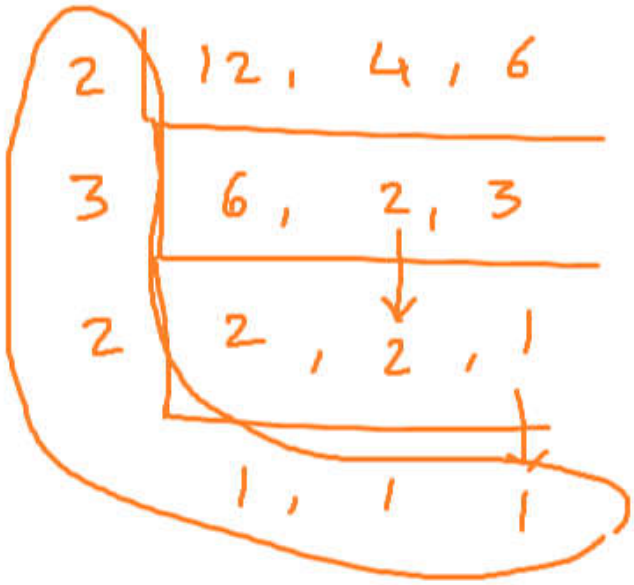
24, 30

12, 16



$2 \cdot 2 \cdot 3 \cdot 3 \cdot 4$

$= 144$



$2 \cdot 3 \cdot 2 = 12$