REAL NUMBERS

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» **Prime numbers** - Numbers which do not have any factors except 1 and the number itself.
Eg - 2, 3, 5, 7, 11, 13, etc.

» **Composite numbers** - Numbers which have more factors, including 1, number itself and one or more other numbers.
Eg - 4, 6, 8, 9, 10, 12, 14, 15, etc.

» 1 is neither prime nor composite.
» 2 is smallest prime number.
» Smallest composite even number - 4
» Smallest composite odd number - 9

» Composite number = product of prime numbers
» **Co-prime numbers** - if two or more numbers have no common factor other than 1, then they are co-prime numbers. (HCF is 1)

» **HCF (Highest Common Factor)** - Product of the smallest power of each prime factor.

» **LCM (Least common Multiple)** - Product of the greatest power of each prime factor.

» Smallest prime even number = 2 (2 is the only even prime number)
» Smallest prime odd number = 3

Divisibility Rules

(2) - last digit even
(3) - sum of digits divisible by 3
(4) - last 2 digits divisible by 4
(5) - last digit 5 or 0
(6) - divisible by both 2 and 3
(7) - last digit × 2, subtract from remaining number should be divisible by 7
(8) - Last 3 digits divisible by 8
(9) - Sum of digits divisible by 9
(10) - Last digit 0

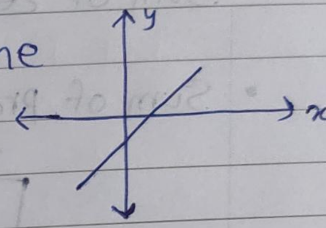
15/3/25
Saturday

POLYNOMIALS

Degree	Name	No. of zeroes	Standard form
0	Constant	–	ax^0
1	Linear	$1 \rightarrow \alpha$	$ax + b$
2	Quadratic	$2 < \alpha, \beta$	$ax^2 + bx + c$
3	Cubic	$3 < \alpha, \beta, \gamma$	$ax^3 + bx^2 + cx + d$
4	Biquadratic	4	$ax^4 + bx^3 + cx^2 + dx +$

* Geometrical meaning of zeroes of a polynomial

››› Linear Polynomial $\xrightarrow{\text{graph}}$ Straight line

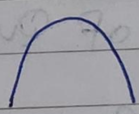


››› Quadratic Polynomial $\xrightarrow{\text{graph}}$ Parabola

$ax^2 + bx + c = 0$

if $a > 0 \rightarrow$ upward

if $a < 0 \rightarrow$ downward



* Zeroes of the polynomials

››› Linear polynomials

$ax + b = 0$

$\boxed{x = -\frac{b}{a}} = \frac{-\text{Constant}}{\text{Coefficient of } x}$

››› Quadratic polynomial

$ax^2 + bx + c = 0$

Zeroes

α β

›››› (Cont..)

Sum of zeroes $\boxed{\alpha + \beta = \frac{-b}{a}} = \frac{-\text{Coefficient of } x}{\text{Coefficient of } x^2}$

Product of zeroes $\boxed{\alpha\beta = \frac{c}{a}} = \frac{\text{Constant}}{\text{Coefficient of } x^2}$

» Cubic polynomials

$ax^3 + bx^2 + cx + d$

Zeroes

α β γ

- Sum of zeroes $\boxed{\alpha + \beta + \gamma = \frac{-b}{a}} = \frac{-\text{Coefficient of } x^2}{\text{Coefficient of } x^3}$
- Sum of product of zeroes

$\cancel{\alpha\beta + \beta\gamma + \gamma\alpha}$

$$\boxed{\alpha\beta + \beta\gamma + \gamma\alpha = \frac{c}{a}} = \frac{\text{Coefficient of } x}{\text{Coefficient of } x^3}$$

- Product of zeroes $\boxed{\alpha\beta\gamma = \frac{-d}{a}} = \frac{-\text{Constant}}{\text{Coefficient of } x^3}$

* Formation of Quadratic and Cubic Polynomials -

(i) If α and β are zeroes of quadratic polynomials

$p(x) = x^2 - (\text{Sum of zeroes})x + \text{product of zeroes}$

$p(x) = x^2 - (\alpha+\beta)x + \alpha\beta$

(ii) If α, β, and γ are zeroes of cubic polynomials

$p(x) = x^3 - (\text{Sum of zeroes})x^2 + (\text{Sum of product of zeroes})x - \text{product of zeroes}$

$$p(x) = x^3 - (\alpha+\beta+\gamma)x^2 + (\alpha\beta + \beta\gamma + \gamma\alpha)x - \alpha\beta\gamma$$

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Monday

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LINEAR EQUATIONS IN TWO VARIABLE

Two methods

- graphical method
- algebric method
  - Substitution method
  - Elimination method

1) Substitution method

Step 1: Consider the linear equation

$$a_1x + b_1y + c_1 = 0 \rightarrow (1)$$
$$a_2x + b_2y + c_2 = 0 \rightarrow (2)$$

Step 2: Choose any one equation and find value of any one variable

Step 3: Substitute this value in other equation

Step 4: Find x and y.

2] Elimination Method

Step 1 : Consider equations

$$a_1x + b_1y = c_1$$
$$a_2x + b_2y = c_2$$

Step 2 : Multiply both sides to make the coefficient of variable to be numerically equal.

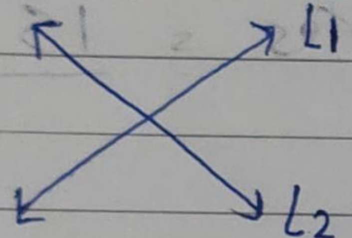
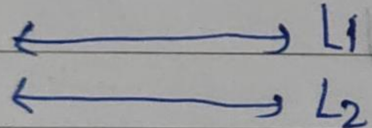
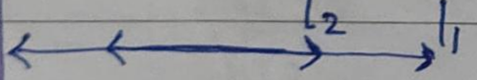
Step 3 : Add or subtract two equations

Step 4 : Find the value of one variable and put these values in either eq ① or ②.

Step 5 : Find x and y.

Graphical method for Linear equations

$$a_1x + b_1y + c_1 = 0 \rightarrow (1)$$
$$a_2x + b_2y = c_2 = 0 \rightarrow (2)$$

Pair of lines	Compare ratio	Solution
Intersecting 	$\frac{a_1}{a_2} \neq \frac{b_1}{b_2}$	Exactly one solution [consistent]
Parallel 	$\frac{a_1}{a_2} = \frac{b_1}{b_2} \neq \frac{c_1}{c_2}$	No solution [inconsistent]
Coincident 	$\frac{a_1}{a_2} = \frac{b_1}{b_2} = \frac{c_1}{c_2}$	Infinitely many Solutions [consistent]

Saturday

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QUADRATIC EQUATION

$$ax^2 + bx + c = 0$$

Coefficient of x^2

Coefficient of x

Constant

Variable

Find the Roots

- Factorisation method
  - Middle-term Splitting
- Quadratic formula method [$ax^2+bx+c=$
  - $\boxed{\text{Step 1:}}$
  - Find discriminant $D = b^2 - 4ac$
    - $D > 0$: Two distinct real roots
      - $x = \dfrac{-b+\sqrt{D}}{2a}$
      - $x = \dfrac{-b-\sqrt{D}}{2a}$
    - $D = 0$: Two equal roots
      - $x = \dfrac{-b}{2a}$
      - $x = \dfrac{-b}{2a}$
    - $D < 0$: No real roots
      - no solution

$$x = \frac{-b \pm \sqrt{D}}{2a}$$

esday

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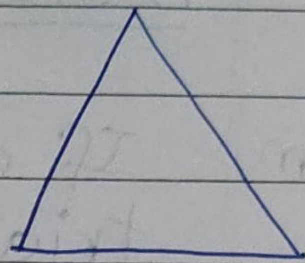
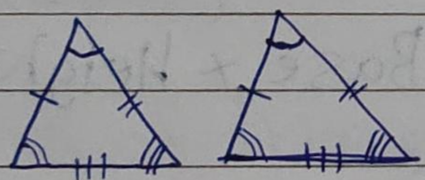
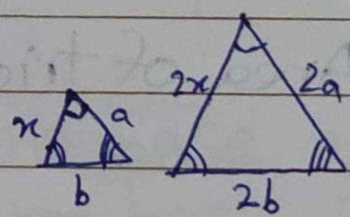
TRIANGLES



Figures

- Congruent
  - Same shape
  - Same size
  - Angles equal
  - Sides equal
- Similar
  - Same shape
  - Size in ratio ~~(proportional)~~
  - Angles equal
  - Sides are proportional





→ All congruent figures are similar, but all similar figures are not congruent.

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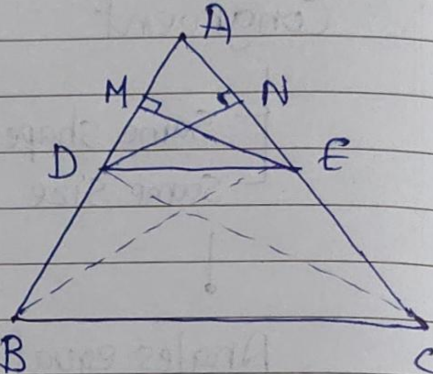
Basic Proportionality Theorem / Thales theorem

Theorem 6.1 (BPT) If a line is drawn parallel to one side of a triangle intersecting the other two sides, then it divides the two sides in the same ratio.



Given: $DE \parallel BC$

Prove: $\frac{AD}{DB} = \frac{AE}{EC}$

Construction: Draw $EM \perp AB$ and $DN \perp AC$

Area of triangle $= \frac{1}{2} \times \text{Base} \times \text{Height}$

In ΔADE

$ar(\Delta ADE) = \frac{1}{2} \times b \times h$

$ar(\Delta ADE) = \frac{1}{2} \times AD \times EM$

In ΔEDB

$ar(\Delta EDB) = \frac{1}{2} \times b \times h$

$ar(\Delta EDB) = \frac{1}{2} \times DB \times EM$

$$\frac{ar(\Delta ADE)}{ar(\Delta EDB)} = \frac{\cancel{\frac{1}{2}} \times AD \times EM}{\cancel{\frac{1}{2}} \times DB \times EM} = \boxed{\frac{AD}{DB}} \rightarrow (1)$$

In ΔADE

$ar(\Delta ADE) = \frac{1}{2} \times b \times h$

$ar(\Delta ADE) = \frac{1}{2} \times AE \times DN$

In ΔDEC

$ar(\Delta DEC) = \frac{1}{2} \times b \times h$

$ar(\Delta DEC) = \frac{1}{2} \times EC \times DN$

$$\frac{ar(\Delta ADE)}{ar(\Delta DEC)} = \frac{\cancel{\frac{1}{2}} \times AE \times \cancel{DN}}{\cancel{\frac{1}{2}} \times EC \times \cancel{DN}} = \boxed{\frac{AE}{EC}} \rightarrow ②$$

Areas of triangles on the same base are equal.
ΔEDB and ΔDEC are on same base DE.

$\therefore \boxed{ar(\Delta EDB) = ar(\Delta DEC)} \rightarrow ③$

From eq ①, ②, ③

$$\frac{ar(\Delta ADE)}{ar(\Delta EDB)} = \frac{ar(\Delta ADE)}{ar(\Delta DEC)}$$

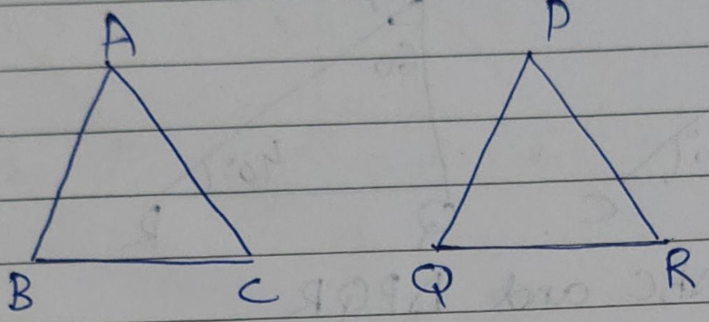
$$\boxed{\frac{AD}{DB} = \frac{AE}{EC}}$$

$\therefore$ Proved

$$\boxed{\frac{AD}{AB} = \frac{AE}{AC}}$$

$$\boxed{\frac{DB}{AB} = \frac{EC}{AC}}$$

Similarity criteria



(1) SSS criteria –

$$\left.\frac{AB}{PQ} = \frac{AC}{PR} = \frac{BC}{QR}\right\}\ SSS$$

(2) AAA criteria –

$$\left.\begin{aligned} \angle A &= \angle P \\ \angle B &= \angle Q \\ \angle C &= \angle R \end{aligned}\right\}\ AAA$$

(3) AA criteria –

$$\left.\begin{aligned} \angle A &= \angle P \\ \angle B &= \angle Q \end{aligned}\right\}\ AA$$

(4) SAS criteria –

$$\left.\begin{aligned} \frac{AB}{PQ} &= \frac{BC}{QR} \\ \angle B &= \angle Q \end{aligned}\right\}\ SAS$$

In such cases,

$$\boxed{\Delta ABC \sim \Delta PQR}$$

/6/25
Monday

STATISTICS

Statistics
- Mean ($\bar{x}$)
  - Direct method
  - Assumed mean method
  - Step deviation method
- Median (M)
- Mode (Z)

Mean

$$\boxed{Z = 3M - 2\bar{x}}$$

1) Direct Method

$$\bar{x} = \frac{\Sigma f_i x_i}{\Sigma f_i}$$

where, Σf_i = Sum of all frequencies
x_i = class mark
$x_i = \frac{\text{upper limit} + \text{lower limit}}{2}$

2) Assumed mean method

$$\bar{x} = a + \frac{\Sigma f_i d_i}{\Sigma f_i}$$

$d_i = x_i - a$

where, x_i = class mark
a = assumed class mark

3) Step deviation method

>>>>

$$\bar{x} = a + \frac{\Sigma f_i u_i}{\Sigma f_i} \times h$$

$$u_i = \frac{x_i - a}{h}$$

where, x_i = classmark
a = assumed classmark
h = class size
= upper limit − lower limit

Mode

$$Z = l + \left[\frac{f_1 - f_0}{2f_1 - f_0 - f_2}\right] \times h$$

(class with highest frequency)

where l = lower limit of modal class
f_1 = frequency of modal class
f_0 = frequency of above modal class
f_2 = frequency of below modal class
h = class size

Median

$$M = l + \left[\frac{\left(\frac{n}{2}\right) - cf}{f}\right] \times h$$

where, l = lower limit of median class
n = total frequencies
cf = cumulative frequency above median class
f = frequency of median class
h = class size

Ungrouped data

Mean = $\dfrac{\text{Sum of all observations}}{\text{Total observations}}$

Mode = Maximum repeated observation

Median – First, arrange all observations in ascending ord

Case 1 : Total observations (n) is EVEN

$$\text{Median} = \frac{\left(\frac{n}{2}\right)^{th}\text{ observation} + \left(\frac{n}{2}+1\right)^{th}\text{ observa}}{2}$$

Case 2 : Total observations(n) is ODD

$$\text{Median} = \left(\frac{n+1}{2}\right)^{th}\text{ observation}$$

8/4/25
Monday

[Ch-14]

PROBABILITY

$\boxed{Coin = 2^n}$
$\boxed{Dice = 6^n}$

$0 \leq P(E) \leq 1$

$P(E) + P(\bar{E}) = 1 \quad (\frac{1}{2}+\frac{1}{2})$

$P(E) = \dfrac{\text{No. of favourable outcomes}}{\text{Total no. of outcomes}}$

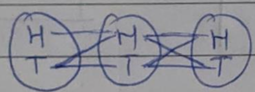
→ 1 Coin $\{H, T\}$ = 2 outcomes H

→ 2 Coins

4 outcomes

~~(HH) (HT)~~ $\{HH, HT, TH, TT\}$

→ 3 Coins



8 outcomes

{ HHH, HTH, THH, TTH
HHT, HTT, THT, TTT }

Formula – $\boxed{Coin = 2^n}$

→ 1 Dice $\{1, 2, 3, 4, 5, 6\}$ = 6 outcomes

→ 2 Dice
(1,1) (1,2) (1,3) (1,4) (1,5) (1,6)
(2,1) (2,2) (2,3) (2,4) (2,5) (2,6)
(3,1) (3,2) (3,3) (3,4) (3,5) (3,6)
(4,1) (4,2) (4,3) (4,4) (4,5) (4,6)
(5,1) (5,2) (5,3) (5,4) (5,5) (5,6)
(6,1) (6,2) (6,3) (6,4) (6,5) (6,6)
36 outcomes

Formula – $\boxed{Dice = 6^n}$

52 Cards

Red colour (26) | Black colour (26)

Heart (13) ♡	Diamond (13) ◇	Spade (13) ♠	Club (13) ♣
A	A	A	A
2	2	2	2
3	3	3	3
4	4	4	4
5	5	5	5
6	6	6	6
7	7	7	7
8	8	8	8
9	9	9	9
10	10	10	10
J	J	J	J
Q	Q	Q	Q
K	K	K	K

Face cards (12)

Year

Leap year

366 days

52 weeks + 2 days extra

53 Mondays = $\boxed{\frac{2}{7}}$

Non-leap year

365 days

52 weeks + 1 day extra

53 Mondays = $\boxed{\frac{1}{7}}$

Birthday

	Same day	Diff. day
Non leap	$\boxed{\frac{1}{365}}$	$\boxed{\frac{364}{365}}$
Leap	$\boxed{\frac{1}{366}}$	$\boxed{\frac{365}{366}}$

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5 Mondays Month

- Jan 31 days: ~~31 days~~ 4 week + 3 days extra = $\boxed{\frac{3}{7}}$
- April 30 days: 4 week + 2 days extra = $\boxed{\frac{2}{7}}$
- Feb 28 days: 4 week + 0 days = $\frac{0}{7}$ = $\boxed{0}$
- 29 days: 4 week + 1 day = $\boxed{\frac{1}{7}}$