GRE

Ankit Singhai...

Date

Maths.

Geometry

* Types of Angles –

1) Acute 0° to 90°

2) Right 90°

3) Obtuse 90° to 180°

4) Straight 180°

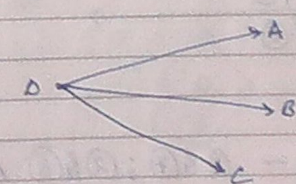
5) Reflex 180° to 360°

6) Complete 360°

* Complementary Angles → Sums up to 90° $\{\angle A + \angle B = 90^\circ\}$

* Supplementary Angles → Sums up to 180° $\{\angle A + \angle B = 180^\circ\}$

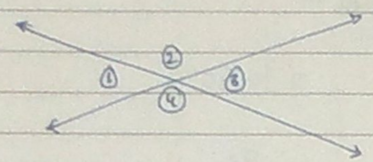
* Adjacent Angles –
  1) Share common side & a common vertex.
  2) Do not share any interior points (or) one angle not contained in other angle.



[$\angle AOB$ & $\angle BOC$ are adjacent angles.]

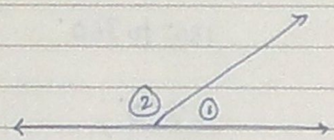
Date

* Vertical Angles — Angles opposite to each other. They are always equal in measure.

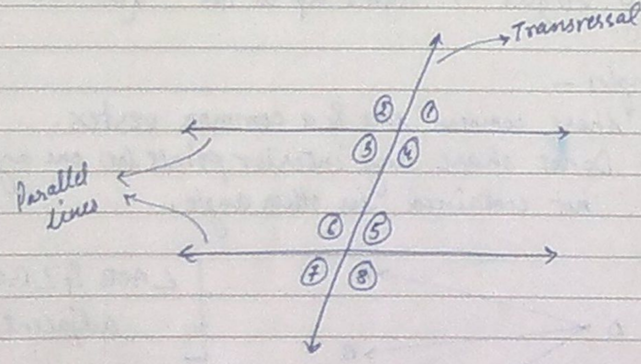


1 & 3, 2 & 4 } Vertical Angles ; Also, 1 = 3 & 2 = 4

Linear Pairs <on a line>



1 & 2 are linear pairs.
Also, $\angle 1 + \angle 2 = 180°$



Alternate Exterior Angles — 1 & 7 ; 2 & 8. Also, 1 = 7 ; 2 = 8.

Alternate Interior Angles — 3 & 5 ; 4 & 6. Also, 3 = 5 ; 4 = 6

Date

Corresponding Angles — 2 & 6 ; 1 & 5

Also, 2 = 6 & 1 = 5.

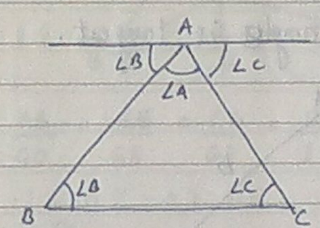
* Transversal is a line intersecting two or more line {lines may or may not be parallel}

POLYGONS :—

Sum of Interior Angles = $(n-2) \times 180°$ $\{n \geq 3\}$

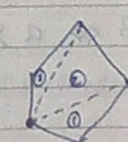
Sum of Exterior Angles = $360°$ → Always [when taken in one direction]

* Why sum of Interior Angles of a Δ equals 180°?



So, $\angle A + \angle B + \angle C = 180°$

*<Kisi bhi polygon me (n-2) triangles hote hain>



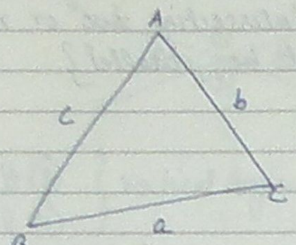
Pentagon → 3 triangles.

Regular Polygon → 1} All sides equal in length.
2} All angles equal in measure.

Date

*< A circle is a polygon with infinite sides { length of each side is infinitesimally small}.

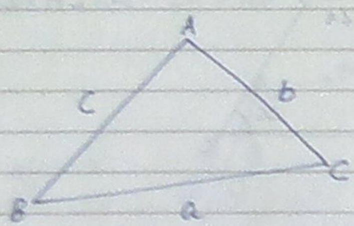
TRIANGLES —



[At least two angles of a Δ must be acute.]

$a+b > c$	$a-b \not< c$
$b+c > a$	$b-c \not< a$
$a+c > b$	$c-a \not< b$

* Side opposite to largest angle is longest.



$\angle A > \angle C > \angle B \Leftrightarrow a > c > b$.

Date

Categories of Δ's

Based on Sides

1.> Scalene (All sides diff.)

2.> Isosceles (Two sides equal)

3.> Equilateral (All sides equal)

Based on Angles.

1.> Acute Angled (All angles acute)

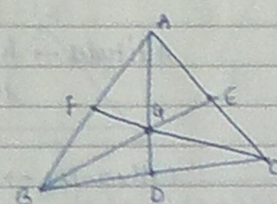
2.> Right Angled (One Angle 90°)

3.> Obtuse Angled (One Angle obtuse)

* Points and lines in a triangle —

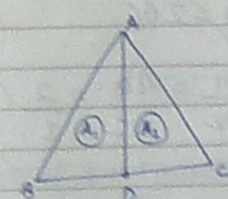
1.> Centroid & Median.

$\left.\begin{array}{l} BD = DC \\ BF = FA \\ AE = EC \end{array}\right] \rightarrow$



- Median → divides the side of Δ into halves.
- Centroid → POI of medians.
- Median also divides the area of Δ into two equal parts.

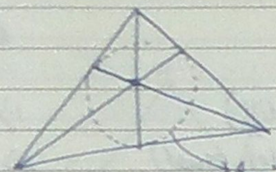
$$\frac{AG}{GD} = \frac{BG}{GE} = \frac{CG}{GF} = \frac{2}{1}.$$



$$\frac{A_1}{A_2} = \frac{BD}{DC} = \frac{1}{1}.$$

Appolonius Theorem for Medians → $AB^2 + AC^2 = 2[AD^2 + BD^2]$

= Angle Bisectors and Incentre →



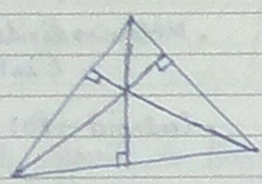
→ Incircle

Angle Bisector → divides the angles into 2 equal parts.

Incentre → POI of AB

Radius of Incircle = r. ; $r = \frac{\text{Area of } \Delta}{s}$ { $s = \frac{a+b+c}{2}$ → Semiperimeter }

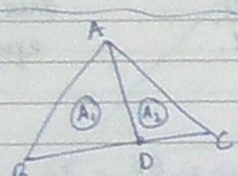
= Altitude & Orthocentre –



Altitudes → height of Δ ; perpendicular dropped from an Apex to opposite side.

Orthocentre → POI of Altitudes.

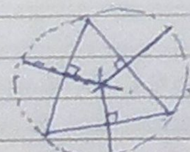
⇒



Let, BD = 2DC

$\frac{A_1}{A_2} = \frac{BD}{DC} = \frac{2}{1}$.

= Perpendicular Bisector & Circumcentre →



→ Circumcircle.

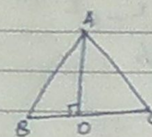
Radius of Circumcircle = R. ; $R = \frac{a \cdot b c}{4 \text{ Area of } \Delta}$.

⇕

Area of $\Delta = \frac{a \cdot bc}{4R}$

= AREA OF TRIANGLE –

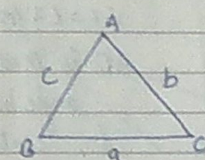
1.)



AD = h
BC = b

$\text{Area} = \frac{1}{2} bh$ ⟨ half base × height ⟩

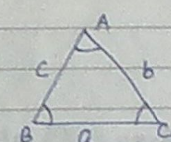
2.)



$S = \frac{a+b+c}{2}$

$\text{Area of } \Delta = \sqrt{S(S-a)(S-b)(S-c)}$

3.)



$\text{Area of } \Delta = \frac{1}{2} ab \sin C = \frac{1}{2} bc \cdot \sin A = \frac{1}{2} ac \cdot \sin B$

Sine formula / Lami's Theorem ⇒ $\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C} = 2R$.

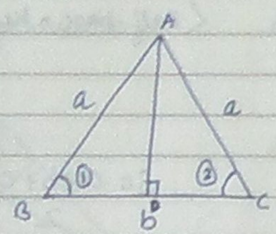
where, R = radius of circumcircle.

Cosine formula — $\cos A = \dfrac{b^2+c^2-a^2}{2bc}$

$$\cos B = \frac{a^2+c^2-b^2}{2ac}$$

$$\cos C = \frac{b^2+a^2-c^2}{2ab}$$

ISOSCELES TRIANGLES —



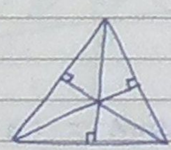
$\angle 1 = \angle 2 \Leftrightarrow AB = AC$

AD is Median, Altitude, angle bisector & $\perp$ bisector.

So, centroid, orthocentre, incentre & circumcentre ~~coincide~~ are colinear. < lie on same line >

$$\text{Area of } \Delta = \frac{b}{4}\sqrt{4a^2-b^2}$$

Equilateral Δ —



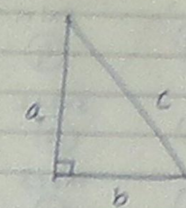
$$\text{Area} = \frac{\sqrt{3}}{4}a^2$$

$$\text{Height} = \frac{\sqrt{3}}{2}a.$$

Median, Altitude, Angles Bisector & $\perp$ bisectors are all same, so, centroid, orthocentre, incentre & circumcentre coincide < are same >

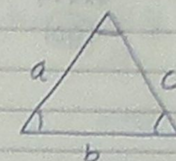
PYTHAGORUS THEOREM —

1)



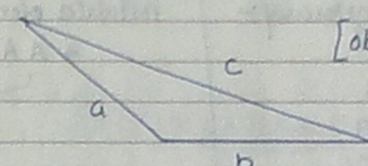
$a^2+b^2=c^2$
[Right Δ]

2)



[Acute Angled Δ] $a^2+b^2>c^2$

3)

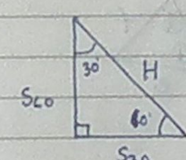


[obtuse Angled Δ]

$a^2+b^2<c^2$

SPECIAL Δ'S —

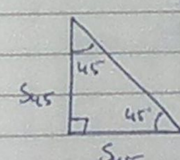
1)



[30°-60° Δ]

$S_{30} = \dfrac{H}{2}$; $S_{60} = \dfrac{\sqrt{3}}{2}H$.

2)



[45°-45° Δ]

$$S_{45} = \frac{H}{\sqrt{2}}$$

[other Pythogorean Triplets → 8,15,17 & 7,24,25]

Date

Pythogorean Triplets — {Also called odd triplets}

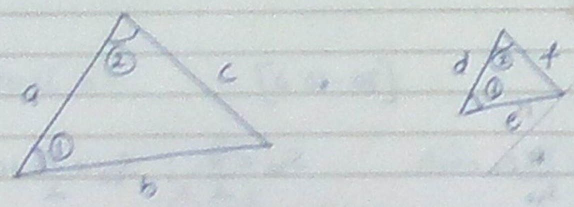
3, 4, 5	— 1 (first odd) →	3	4 ($3\times1+1$)	5 ($4+1$)
5, 12, 13	— 2 (second odd) →	5	12 ($5\times2+2$)	13 ($12+1$)
7, 24, 25	— 3 (3^{rd} odd) →	7	24 ($7\times3+3$)	25 ($24+1$)
9, 40, 41	— 4 (4^{th} odd) →	9	40 ($9\times4+4$)	41 ($40+1$)

[8, 15, 17]

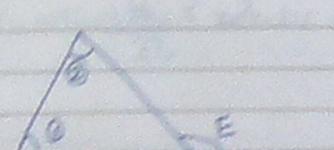
* Congruent & Similar Δ's —

Postulates for Congruency:-
1) SSS
2) SAS
3) ASA
4) RHS

Postulates for Similar Δ's —
→ AA
→ AAA



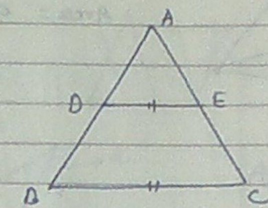
so, By Similar Δ's → $\frac{a}{d} = \frac{b}{e} = \frac{c}{f}$



$E = 1 + 2$ {Exterior angle is equal to sum of opposite interior angles}

Date

BASIC PROPORTIONALITY THEOREM —



$\frac{AD}{AB} = \frac{AE}{AC} = \frac{DE}{BC}$

{∵ ΔABC & ΔADE are similar}

\# Sin, Cos & tan in diff. Quadrants —

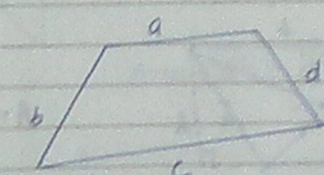
II	I
sin(+)	All(+)
tan(+)	cos(+)
III	IV

{Add Sugar To Coffee}

QUADRILATERALS

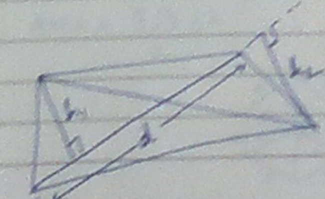
Polygon with 4 sides. → Sum of Interior Angles = 360°
Sum of Ext. Angles = 360°

1)



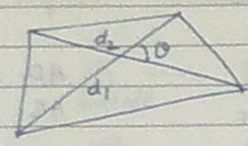
Area $= \sqrt{(s-a)(s-b)(s-c)(s-d)}$, $s = \frac{a+b+c+d}{2}$

2)



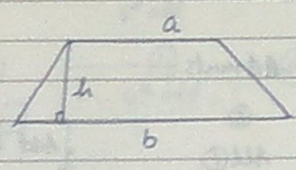
Area $= \frac{d}{2}(h_1 + h_2)$

(3)



Area = $\frac{d_1 \cdot d_2 \cdot \sin\theta}{2}$

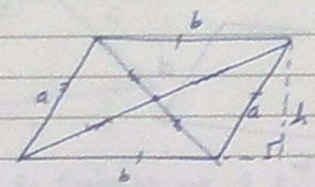
* Trapezium —



Area = $\frac{1}{2}(a+b)h$

Isosceles Trapezium → 1.> Non-parallel sides have equal length.
2.> length of diagonals is same
3.> Diagonals intersect each other in same ratio.

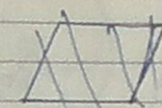
* Parallelogram —



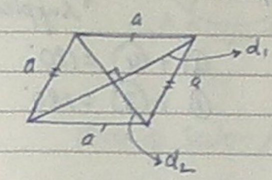
Area = bh

1.> length of Diagonals is not same.
2.> But, diagonals ~~do~~ bisect each other.

* Rhombus —

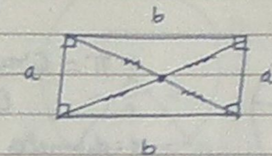


1.> Diagonals ⇒ ⊥ bisectors.
2.> Not of Equal length.



Area = $\frac{d_1 d_2}{2}$

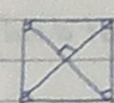
* Rectangle —



1.> Diagonals bisect.
2.> Equal in length (diagonals)

Area = ab ; Perimeter = $2(a+b)$

* Square —

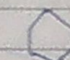


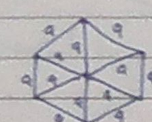
1.> Diagonals ⇒ ⊥ bisectors.
2.> Equal in length (diagonals)

Area = $a^2 = \frac{d^2}{2}$

* Regular Hexagon — 1.> Polygon with 6 sides
2.> All sides & angles are equal.

Area = $\frac{3\sqrt{3}}{2}a^2$

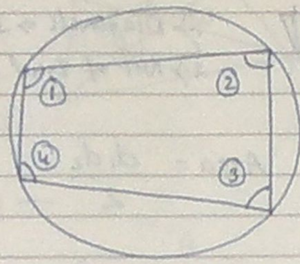




[6-equilateral Δ of side a formed]

Date

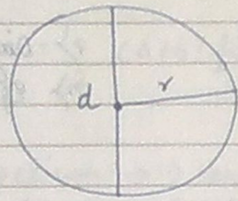
* Cyclic Quadrilateral -



opposite angles are supplementary.

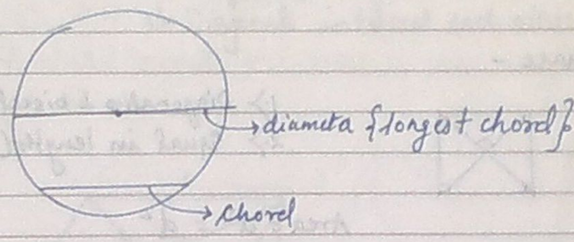
② + ④ = 180°
① + ③ = 180°

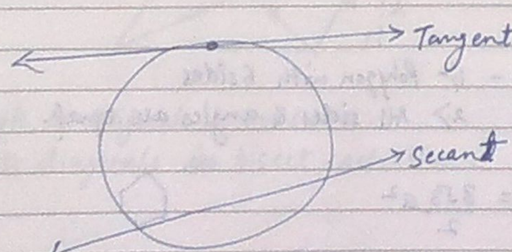
CIRCLES -



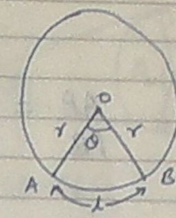
$\pi = \frac{\text{Circumference}}{\text{Diameter}} = \frac{22}{7} \simeq 3.14$

d: diameter ; r = radius
$[d = 2r]$





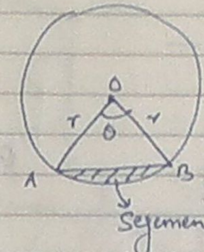
Date



$\widehat{AB}$ = Arc AB
θ = measure(m) of arc = m $\widehat{AB}$
l = length (l) of arc = l $\widehat{AB}$

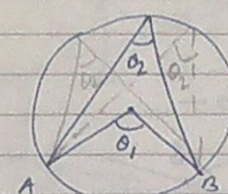
Area enclosed by $\widehat{AB}$ = Sector.

Area of Sector AB = $\frac{\theta}{360} \times \pi r^2$; l $\widehat{AB} = \frac{\theta}{360} \times 2\pi r$



Area of Segment = Area of Sector AB − Area of ΔAOB

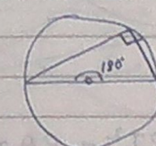
$= \frac{\theta}{360} \times \pi r^2 - \frac{1}{2} r^2 \sin\theta$



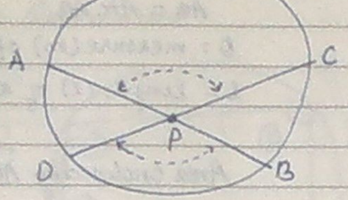
$\theta_1 = 2\theta_2$
θ_1 = Centre Angle
θ_2 = Inscribed Angle.

* Angle inscribed in same segement are equal.

* Angle inscribed in Semicircle is 90°



Date

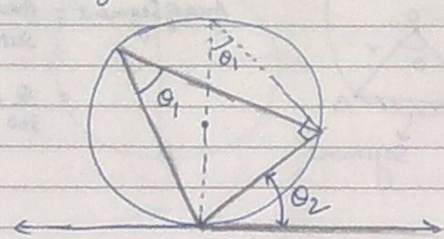


$$\frac{AP}{PB} = \frac{CP}{PD}.$$

$\cancel{\frac{AP}{PB} = \frac{DP}{CP}}$

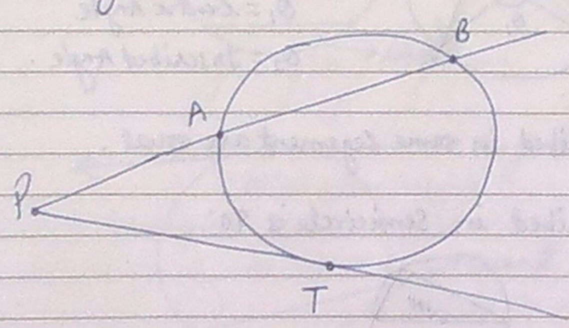
THEOREMS —

1.) Alternate Segement theorem —



$\theta_1 = \theta_2$

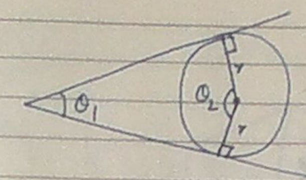
2.) Tangent Secant Theorem —



$$PT^2 = PA \times PB.$$

Date

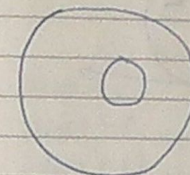
#



$\theta_2 = 2\theta_1$.

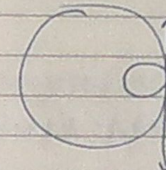
COMMON TANGENTS —

1.)



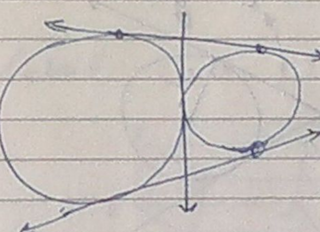
No common tangent.

2.)



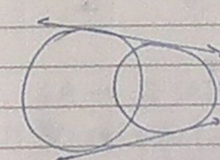
One Common tangent

3.)



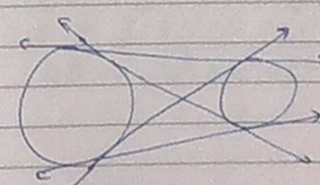
Three Common Tangents.

4.)



Two Common Tangents.

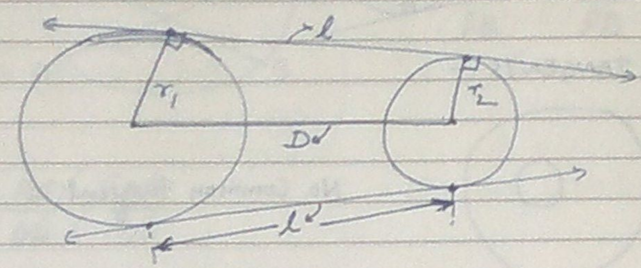
5.)



Four Common Tangents.

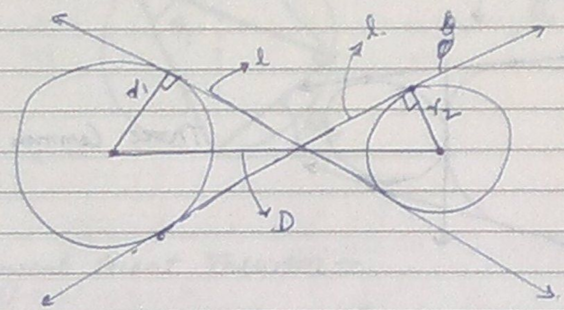
Date

DIRECT COMMON TANGENT—



$$l = \sqrt{D^2 - (r_1 - r_2)^2}$$

TRANSVERSE COMMON TANGENT—

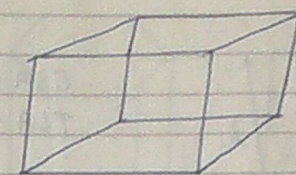


$$l = \sqrt{D^2 - (r_1 + r_2)^2}$$

Date

3D

* Cube



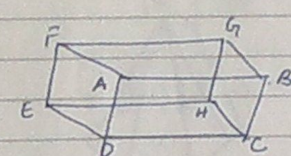
All sides equal in length.
let, length = a.

Faces – 6	SA $\rightarrow 6a^2$
Vertex – 8	V $\rightarrow a^3$
Edges – 12	P $\rightarrow 12a$

Length of Face Diagonal (FD) = $a\sqrt{2}$

Length of Body Diagonal (BD) = $a\sqrt{3}$

* Cuboid



AB = a
HC = c
BC = b

SA $\rightarrow 2(ab + bc + ac)$

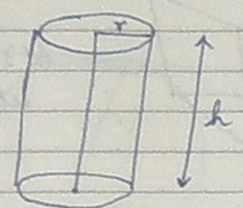
V $\rightarrow a \cdot b \cdot c$

FD $\rightarrow \sqrt{a^2+b^2}$; $\sqrt{b^2+c^2}$; $\sqrt{c^2+a^2}$

BD $\rightarrow \sqrt{a^2+b^2+c^2}$

Date

Cylinder {Right Circular Cylinder}



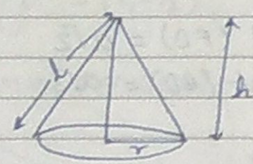
$CSA \rightarrow 2\pi r h$

$TSA \rightarrow 2\pi r h + 2\pi r^2$

$= 2\pi r(r+h)$

$V \rightarrow \pi r^2 h.$

* Cone {Right Circular Cone}



l = Slant height

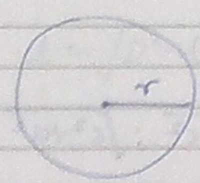
$= \sqrt{h^2+r^2}$

$CSA \rightarrow \pi r l \quad \left\{ \left[\frac{2\pi r + 0}{2}\right] \times l \right\}$

$TSA \rightarrow \pi r(l+r)$

$V \rightarrow \frac{1}{3}\pi r^2 h$

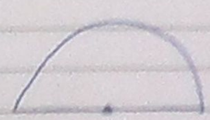
* Sphere –



$CSA | TSA | SA \rightarrow 4\pi r^2$

$V \rightarrow \frac{4}{3}\pi r^3$

* Hemisphere –



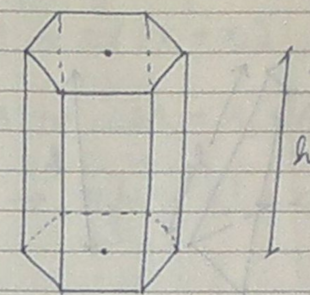
$CSA \rightarrow 2\pi r^2$

$TSA \rightarrow 3\pi r^2$

$V \rightarrow \frac{2}{3}\pi r^3$

Date

PRISM –



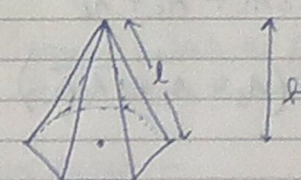
{P = Perimeter
A = Base Area.}

Lateral Surface Area (LSA) $\rightarrow Ph$

$TSA \rightarrow LSA + 2A$

$V \rightarrow A.h$

PYRAMID –



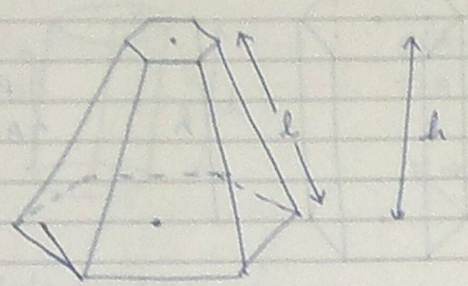
$LSA \rightarrow \frac{P.l}{2}$

$TSA \rightarrow LSA + A$

$V \rightarrow \frac{1}{3} A.h$

Date

* FRUSTUM OF PYRAMID —



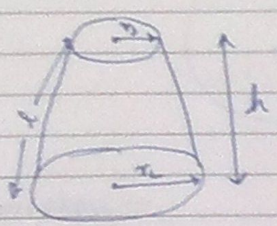
{ $P_s \rightarrow$ Perimeter of small base | $A_s \rightarrow$ Area of small base
$P_L \rightarrow$ Perimeter of large base | $A_L \rightarrow$ Area of large base. }

$$LSA \rightarrow \left(\frac{P_s + P_L}{2}\right) l$$

$$TSA \rightarrow LSA + A_s + A_L$$

$$V \rightarrow \frac{h}{3} \cdot \left(A_s + A_L + \sqrt{A_s A_L}\right)$$

* FRUSTUM OF CONE —



$$LSA \rightarrow \left(\frac{P_s + P_L}{2}\right) \cdot l$$

$$TSA \rightarrow LSA + A_s + A_L$$

$$V \rightarrow \frac{h}{3}\left(A_s + A_L + \sqrt{A_s A_L}\right)$$

Date

formulae in Reduce forms of Frustum of Cone —

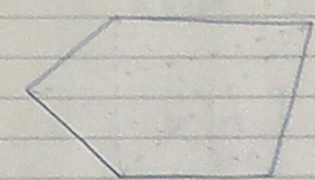
$$LSA \rightarrow \pi l (r_1 + r_2)$$

$$TSA \rightarrow LSA + A_s + A_L \rightarrow LSA + \pi r_s^2 + \pi r_L^2$$

$$V \rightarrow \frac{\pi h}{3} \cdot \left(r_L^2 + r_s^2 + r_s r_L\right)$$

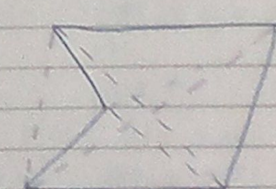
CONVEX & CONCAVE POLYGONS :—

1) CONVEX POLYGON :—



a) All diagonals within the figure.
b) All interior angles less than 180°

2) CONCAVE POLYGON :—
↳ (Caves in)



a) At least one diagonal lies outside the figure.
b) At least one angle is greater than 180°.

No. of sides	Name of Polygon
3	Triangle
4	Quadrilateral
5	Pentagon
6	Hexagon
7	Heptagon
8	Octagon
9	Nonagon
10	Decagon

WORD PROBLEMS

1) Profit & Loss
2) Simple Interest & Compound Interest
3) Mixtures
4) Work & Time
5) Time, Speed & Distance.

PROFIT & LOSS –

* $SP = CP + P$ | $SP = CP - L$
  $CP = SP - P$ | $CP = SP + L$
  $P = SP - CP$ | $L = CP - SP$

* $P\% = \frac{P}{CP} \times 100$; $L\% = \frac{L}{CP} \times 100$

* $SP = CP\left[1 \pm \frac{x}{100}\right]$ $\left\{\begin{array}{l} +ve \text{ for profit} \\ -ve \text{ for loss} \end{array}\right\}$

* Concept of same Selling Price –

	S_1	S_2
SP →	200	200
P/L →	10% ↑	10% ↓
CP →	$\frac{200}{1.1} = 181.81$	$\frac{200}{0.9} = 222.22$

Total CP = 404.04
Total SP = 400
$\Rightarrow$ Always a loss is incurred

$$\left[\text{Loss}\% = \left(\frac{\text{Common Loss \& Gain}\%}{10}\right)^2 = \frac{x^2}{100}\right]$$

Date

= Concept of false weighing:-

Assume SP = CP & profit gained by using false weights only

$$\text{Gain\%} = \frac{\text{Error}}{\text{True Value} - \text{Error}} \times 100$$

= Marked / Tagged / Listed / Asking Price :- <MP>

SP = MP − Discount = MP − x% of MP.

$$SP = MP\left[1 - \frac{x}{100}\right]$$

= Successive Discounts:-

* first x% discount & than y% discount.

$$SP = MP\left(1 - \frac{x}{100}\right)\left(1 - \frac{y}{100}\right)$$

Net Discount after successive discounts of x% & y% −

$$\Rightarrow x + y - \frac{xy}{100} \quad \left\{ 100 - \left[100\left(1-\frac{x}{100}\right)\left(1-\frac{y}{100}\right)\right]\right.$$

* SIMPLE INTEREST & COMPOUND INTEREST:-

* Simple Interest —

$$SI = \frac{PRT}{100}$$

Date

$$\text{Amount }(A) = P + SI = P\left(1 + \frac{RT}{100}\right)$$

* Compound Interest :-

1.) Compounded Anually −

$$\text{Amount }(A) = \left\{P\left(1 + \frac{r}{100}\right)^T\right.$$

$$CI = A - P$$

2.) Compounded half yearly −

$$A = P\left(1 + \frac{r/2}{100}\right)^{2T}$$

3.) Compounded Quaterly −

$$A = P\left(1 + \frac{r/4}{100}\right)^{4T}$$

4.) Compounded Monthly −

$$A = P\left(1 + \frac{r/12}{100}\right)^{12T}$$

= Difference in CI & SI for different years on same Principal −

1.) One Year ⇒ $CI_1 - SI_1 = 0$

2.) Two Years ⇒ $CI_2 - SI_2 = P\left(\frac{R}{100}\right)^2$

3.) Three Years

$$CI_3 - SI_3 = \frac{PR^2\,(300+R)}{100^3}$$

4.) Four Years

$$CI_4 - SI_4 = P\left[6\left(\frac{R}{100}\right)^2 + 4\left(\frac{R}{100}\right)^3 + \left(\frac{R}{100}\right)^4\right]$$

* MIXTURES :-

* Price of mixtures always lies between cheaper & dearer.

Mixture's Price is never less than cheaper & never more than dearer.

Q_C ———————— Q_D

P_C (50) — P_m (75) — P_D (100)

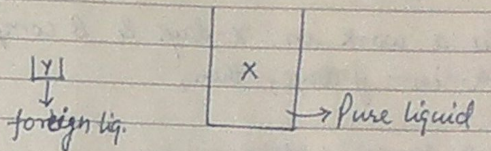
$$\frac{Q_C}{Q_D} = \frac{P_D - P_m}{P_m - P_C}$$

CP of unit Quantity of Dearer (P_D) — CP of unit quantity of cheaper (P_C)

Mean Price (P_m)

$(P_D - P_m)$ — $(P_m - P_C)$

Mixtures of Liquids :-



Suppose a container contains X units of liquid from which Y units are taken out & replaced by another liquid. After n-operations, the quantity of pure liquid can be given as-

$$\text{Quantity of Pure liquid after n-operations } (Q_F) = Q_I\, X\left(1 - \frac{Y}{X}\right)^n$$

Q_F = Final Quantity of liquid
Q_I = Initial Quantity of liquid

Also, $$\frac{Q_F}{Q_I} = \left(\frac{x-y}{x}\right)^n$$ { Q_I may be x or other }

Also, If replacement is first done a-times by y lt vessel, than b-times by w lt vessel & c-times by z lt vessel,

$$\frac{Q_F}{Q_I} = \left(\frac{x-y}{x}\right)^a \left(\frac{x-w}{x}\right)^b \left(\frac{x-z}{x}\right)^c$$

* WORK & TIME :-

$$\text{Rate of doing Work} = \frac{\text{Work Done}}{\text{Time}} \Rightarrow R = \frac{W}{T}$$

When $w=1 \Rightarrow R = \frac{1}{T}$ & $T = \frac{1}{R}$.

* A completes a work in x-days & B completes a work in y-days, then,

1.) A & B together done in –

$$\text{Work in one day} = \frac{1}{x} + \frac{1}{y} = \frac{x+y}{xy}$$

$$\text{So, Total Days} = \frac{xy}{x+y}.$$

2.) A & B together ~~simultaneously~~ alternately – $\left[\begin{array}{l} \text{Let; } A \to 8 \text{ days} \\ B \to 12 \text{ days} \end{array}\right]$

a.) A starts the work –

$$\text{Work done @ end of first day} = \frac{1}{8} \to A$$

$$\text{Work done @ end of second day} = \frac{1}{8} + \frac{1}{12} \to B$$

$$= \frac{5}{24}.$$

So, work done in two days $= \frac{5}{24}$.

Now,	2 days	4 days	6 days	8 days	10 days.
	$\frac{5}{24}$	$\frac{10}{24}$	$\frac{15}{24}$	$\frac{20}{24}$	$\frac{25}{24} \to >1$

So, work is completed after 8 days but before 10-days.

@ 8 days $\to W = \frac{20}{24}$.

@ 9th day A will do the work $\to W = \frac{20}{24} + \frac{1}{8}$

$$\text{Work left to be done} = 1 - \frac{20}{24} = \frac{4}{24} = \frac{1}{6}.$$

On 9th day A will do $\frac{1}{8}$ work.

$$\text{So, work left for 10th day} = \frac{1}{6} - \frac{1}{8} = \frac{1}{24}.$$

@ 10th day B will come & will do the remaining $1/24$ work.

$$\text{Time reqd. by B to do } \frac{1}{24} \text{ work} = \frac{1/24}{1/12} = 0.5 \text{ days}.$$

So, work will be finished in 9.5 days if A starts the work & A & B work on alternate days.

b.) B starts the work – Again work done in 8-days $= \frac{20}{24}$

$$\text{Work left to be done} = \frac{1}{6}$$

@ 9th day B comes and does $1/12$ work, so, work left to be done by A on 10th day $= \frac{1}{6} - \frac{1}{12} = \frac{1}{12}$.

Time taken by A to do $1/12$ work $= \frac{1/12}{1/8} = 0.67$ days. So, total time reqd $= 9.67$ days.

Date

* WORK EQUIVALENCE CONCEPT –

$A \to x \uparrow \;;\; B \to y \uparrow \;;\; C \to z \downarrow$

Rate of filling $= \frac{1}{x} + \frac{1}{y} - \frac{1}{z}$

Rate of Emptying $= \frac{1}{z} - \left[\frac{1}{x} + \frac{1}{y}\right]$

* TIME, SPEED & DISTANCE :–

$S = \frac{D}{T} \;;\; T = \frac{D}{S} \;;\; D = S \times T.$

for $T =$ constant $\rightarrow D \propto S \Rightarrow \frac{D_1}{S_1} = \frac{D_2}{S_2} = K$

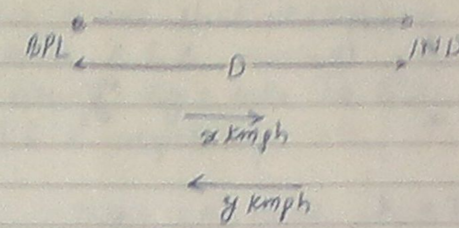
for $S =$ constant $\rightarrow D \propto T \Rightarrow \frac{D_1}{T_1} = \frac{D_2}{T_2} = K$

for $D =$ Constant $\longrightarrow S \propto \frac{1}{T} \Rightarrow S_1 T_1 = S_2 T_2 = K.$

* 1 km/hr $= \frac{5}{18}$ m/s ; 1 m/s $= \frac{18}{5}$ km/hr

* Average Speed $= \frac{\text{Total Distance travelled}}{\text{Total time taken}}$

Date



Avg. Speed $= \frac{d + d}{\frac{d}{x} + \frac{d}{y}} = \frac{2xy}{x+y}.$

* RELATIVE SPEED :–

1.) In same direction – $\xrightarrow{\;u\;}$ $\xrightarrow{\;v\;}$

Relative Speed $= |u - v|$

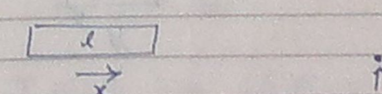
2.) In opposite direction –

a.) $\xrightarrow[u]{}$ $\xleftarrow[v]{}$

b.) $\xleftarrow[u]{}$ $\xrightarrow[v]{}$

Relative speed $= u + v.$

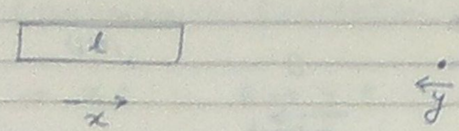
* TRAINS :– {6 cases possible}

I) 

$T = \frac{l}{x}$

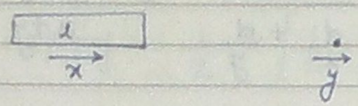
Date

II)



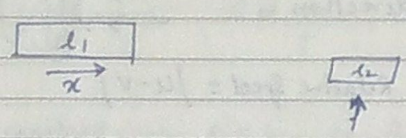
$$T = \frac{l}{x+y}.$$

III)



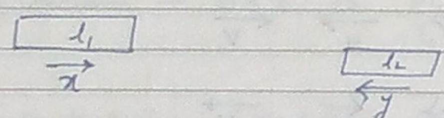
$$T = \frac{l}{x-y}$$

IV)



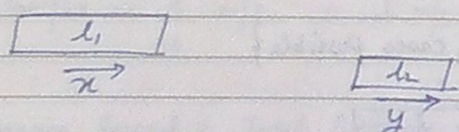
$$T = \frac{l_1 + l_2}{x}$$

V)



$$T = \frac{l_1 + l_2}{x+y}$$

VI)

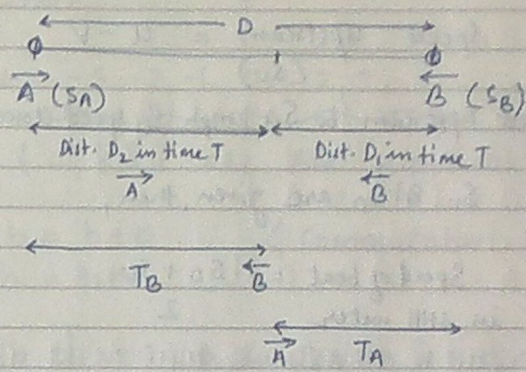


$$T = \frac{l_1 + l_2}{x+y}$$

Date

4 If two trains start at the same time from two points A & B towards each other and after crossing they take T_a & T_b hours in reaching B & A respectively.

Then, A's speed : B's speed = $\sqrt{T_b} : \sqrt{T_a}$



$$T = \frac{D_1}{S_B} = \frac{D_2}{S_A}$$

$$T_A = \frac{D - D_2}{S_A} = \frac{D_1}{S_A}$$

$$T_B = \frac{D - D_1}{S_B} = \frac{D_2}{S_B}.$$

So, $\frac{T_B}{T_A} = \left(\frac{S_A}{S_B}\right)^2 \Rightarrow \frac{S_A}{S_B} = \sqrt{\frac{T_b}{T_a}}$

$\therefore$, $T \propto \frac{1}{S^2} \Rightarrow S \propto \frac{1}{\sqrt{T}}$

Date

* BOATS & STREAMS :-

Let, speed of boat = u kmph
Speed of stream = v kmph.

So, Speed downstream = u + v
(S_D)

Speed upstream = u − v
(S_U)

~~If Speed upstream be Sa kmph & speed downstream~~

If S_U & S_D are given, then,

Speed of boat in still water $= \frac{S_D + S_U}{2}$

Speed of Stream $= \frac{S_D - S_U}{2}$

Date

Arithematic & Fractions:-

* Real number is any number that can be represented on number line.

→ All number are either positive or negative except zero.

→ Integers ← ..., −3, −2, −1, 0, 1, 2, 3, ...

→ Properties {a, b & c are real numbers}.

1) $a + b = b + a$ ⟨Commutative Property⟩
$a \times b = b \times a$

* $a - b \neq b - a$ ⇒ Substraction is not commutative.

Only, If $a = b$, then $a - b = b - a$

Also, $a \div b \neq b \div a$

2) Associative Properties -

$$(a+b)+c = a+(b+c)$$

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

* $(a-b)-c \neq a-(b-c)$
& $(a \div b) \div c \neq a \div (b \div c)$

3) Distributive Property -
$a(b+c) = ab + ac$
$a(b-c) = ab - ac$

Date

4) $1 \times a = a$

$a \div 1 = a$

$a \times 0 = 0$

$a + 0 = a$

$a \div a = 1 \quad \{a \neq 0\}$

$a + (-b) = a - b$

$a - (-b) = a + b$

* Adding Positive Number → Move right along the number line.
* Subtracting Positive Number → Move left along no. line.
* Multiplying & Dividing Signed Numbers:-

$+ \quad + \quad = +$

$+ \quad - \quad = -$

$- \quad + \quad = -$

$- \quad - \quad = -$

→ 2 like signs produce a positive number.

→ 2 unlike sign produce a negative number.

Date

COMBINATION OPERATIONS -

→ Order of Operation = PEMDAS | BEDMAS.

P		B
E		E
MD	(left to right)	DM
AS		A

< Evaluate expression from left to right.

→ Absolute value of x:-

$|x|$

* It is the numbers distance from zero on the number line.

* Absolute value of a number is the simply the positive version of that number. Absolute value is always positive.

$|-4| = 4 \quad ; \quad |5| = 5$

DECIMALS:-

$743 = 7 \times 100 + 4 \times 10 + 3 \times 1$

1's

10's

100's

Date

$82.743 = 8\times10 + 2\times1 + 7\times\frac{1}{10} + 4\times\frac{1}{100} + 3\times\frac{1}{1000}$

(10's, 1's, $\frac{1}{10}$'s, $\frac{1}{100}$, $\frac{1}{1000}$)

* Rounding Decimals –

If next digit is 0, 1, 2, 3 or 4 → round down.

If next digit is 5, 6, 7, 8, or 9 → round up.

Eg :–

1) 7.38241 rounded to nearest tenth

$7.3\underset{\uparrow}{8}241 = 7.4$ (Round Up)

2) 15.02318 rounded to nearest thousandth –

$15.023\underset{\uparrow}{1}8 = 15.023$ (Round Down)

FRACTIONS :–

$\frac{3}{4}$ 3 → Numerator, 4 → Denominator.

* Equivalent fraction –

$\frac{1}{2} = \frac{5}{10} = \frac{15}{30} = \ldots$; $\frac{7}{9} = \frac{14}{18} = \frac{21}{27}$ ~

Date

To create equivalent fraction - multiply or divide the numerator or denominator by same number.

* Lowest Number :–

$\frac{2}{3} = \frac{10}{15} = \frac{22}{33} = \frac{14}{21} = \frac{90}{135}$

$\frac{2}{3}$ ↓ Lowest term.

* Converting entire fraction / improper fraction to mixed number :–

[* Num > Dino] $\frac{7}{2} = 3\frac{1}{2} \rightarrow \frac{2\times3+1}{2}$

$3\frac{1}{2}$ ↓ mixed no.

* Fractions to Decimal Convertion –

* $\frac{1}{4} = 0.25$ (Treat fraction as division)

* $\frac{5}{6} = 0.8\overline{3}$

✯ $\frac{1}{2} = 0.5$	$1/6 = 0.166$	$1/10 = 0.1$
$1/3 = 0.33$	$1/7 = 0.1428$	$1/11 = 0.0909$
$1/4 = 0.25$	$1/8 = 0.125$	
$1/5 = 0.20$	$1/9 = 0.11$	

Date

* Decimal to fraction conversation —

$0.35 = \frac{35}{100} = \frac{7}{20}$.

$0.004 = \frac{4}{1000} = \frac{1}{250}$

* Properties of fraction —

$n = \frac{n}{1}$; $\frac{n}{0}$ = Not defined

$\frac{n}{n} = 1$ $(n \neq 0)$; $\frac{1}{a/b} = \frac{b}{a}$ $(a \neq 0, b \neq 0)$

$\frac{a}{b} \times \frac{b}{a} = 1$; $\frac{a}{b} \div \left(\frac{a}{b}\right) = 1$ $(a \neq 0, b \neq 0)$

* Bigger Numirator ⇒ Bigger value.

$\frac{3}{11}$ & $\frac{4}{11}$ ⇒ $\frac{4}{11} > \frac{3}{11}$.

↳ Smaller Numirator ⇒ Smaller Number/Value.

* Bigger Dinominator ⇒ Smaller value.

$\frac{2}{3}$ & $\frac{2}{4}$ ⇒ $\frac{2}{4} < \frac{2}{3}$

↳ Smaller Dinominator ⇒ Bigger Value.

Date

* Increase Numirator & Dinominator by same amount ⟶ fraction approaches to 1

$\frac{2}{7} \xrightarrow{+10} \frac{12}{17} \xrightarrow{+1000} \frac{1012}{1017}$

closer to 1 — more closer to 1.

PROPERTIES OF FRACTIONS —

→ $\frac{abc}{def} = \frac{a}{d} \times \frac{b}{e} \times \frac{c}{f}$

→ $\frac{a+b+c}{d+e+f} \neq \frac{a}{d} + \frac{b}{e} + \frac{c}{f}$.

→ $\frac{a+b}{c} = \frac{a}{c} + \frac{b}{c}$

→ $\frac{a-b}{c} = \frac{a}{c} - \frac{b}{c}$

→ $\frac{a+b}{c+d} = \frac{a}{c+d} + \frac{b}{c+d}$

→ $\frac{a-b}{c-d} = \frac{a}{c-d} - \frac{b}{c-d}$

→ If $\frac{a}{b} = \frac{c}{d}$ ⇒ $ad = cb$

PERCENTAGE & RATIOS :-

* Percent = per 100

↳ $19\% = \frac{19}{100} = 0.19$

↳ $0.43\% = \frac{0.43}{100} = 0.0043$

↳ $300\% = \frac{300}{100} = 3$.

→ Decimal to Percentage ⇒ More decimal to two places to right.

+ $0.00007 = 0.007\%$; + $0.456 = 45.6\%$

+ $3.5 = 350\%$.

→ Percentage to Decimal ⇒ more decimal to two places to left.

$9.63\% = 0.0963$; $125\% = 1.25$

→ Fraction to Percentage ⇒ Fraction to Decimal to Percentage.

$\frac{3}{8} = 0.375 = 37.5\%$

Fraction	Decimal	Percentage.
1/2	0.5	50%.
1/3	0.3333	33.33%.
1/4	0.25	25%.
1/5	0.20	20%.
1/6	0.1666	16.66%.
1/7	0.1428	14.28%.
1/8	0.125	12.5%.
1/9	0.1111	11.11%.
1/10	0.10	10%.
1/11	0.0909	9.09%.

+ $\frac{3}{8} = 3 \times \frac{1}{8} = 3 \times 0.125 = 0.375 = 37.5\%$

+ $\frac{2}{9} = 2 \times \frac{1}{9} = 2 \times 0.1111 = 22.22\%$

Date

* $\frac{\text{Part}}{\text{Whole}} = \frac{\text{Percent}}{100}$

* $p\%$ of a number 'x' $= y \iff \frac{p}{100} \cdot x = y$.

→ Percentage Increase & Decrease –

$$\% \text{ change} = \frac{\text{change}}{\text{original value}} \times 100$$

→ Increase or Decrease :-

If price is increased or decreased by some %age.

$$\text{New Price} = \left(1 \pm \frac{\text{Percent change}}{100}\right) \times \text{original price}.$$

$+ \rightarrow$ increase ; $- \rightarrow$ decrease.

→ Simple Interest & Compound Interest :–

1) $SI = \frac{PRT}{100}$; Amount (A) = $P + SI$.

2) $A = P\left(1 + \frac{r}{100}\right)^n$; $CI = A - P$.

(or)

$$A = P\left(1 + \frac{r}{100c}\right)^{nc}$$

Date

P = Principal
r = rate in %age.
C = No. of times the interest is compounded per year (or) no. of compounding per year.

n = No. of years.

↳ Compounded half yearly → 2 compounding per year.

$$A = P\left(1 + \frac{r}{200}\right)^{2n}$$

↳ Quaterly → $A = P\left(1 + \frac{r}{400}\right)^{4n}$

↳ Monthly → 12 compounding per year.

$$A = P\left(1 + \frac{r}{1200}\right)^{12n}$$

RATIOS :-

* Proportioning of Ratios :-

15 cookies total ; $K : A = 2 : 1 \rightsquigarrow 2 + 1 = 3$

$K = \frac{2}{3} \times 15$ & $A = \frac{1}{3} \times 15$

Date

* Combining Ratios –

Boxers : Poodles — Boxers : Terriers.

$\cancel{2} : 5$ — $3 : 4$

B : P — B : T.

$\Downarrow$

P : B — B : T

5 : 2 — 3 : 4

(×3) — (×2)

15 : $\cancel{1}$6 — 6 : 8

$\Downarrow$

P : B : T

15 : 6 : 8

Power & Roots :–

* Exponents & Bases

2^5 (5 → Exponent; 2 → Base)

* $1^x = 1$; $0^x = 0$ $(x \neq 0)$ (0^0 = not defined)

* $x^0 = 1$; $x^1 = x$

Date

Even & Odd Exponents :–

→ Negative no. raised to even power results in a positive outcome

$$(-9)^2 = 81$$

→ Negative no. raised to odd power results in a negative outcome.

$$(-3)^3 = -27$$

→ An odd exponent preserves sign of base –

$(-2)^3 = -8$; $(10^5) = 100000$

→ An even exponent always results in +ve no. –

$(-2)^4 = 16$; $10^3 = 1000$

** $\begin{cases} x^3 = 8 \Rightarrow x = 2 \\ x^2 = 4 \Rightarrow x = 2 \text{ or } x = -2 \end{cases}$

* Powers to memorize :–

$2^1 = 2$	$3^1 = 3$	$4^1 = 4$	$5^1 = 5$
$2^2 = 4$	$3^2 = 9$	$4^2 = 16$	$5^2 = 25$
$2^3 = 8$	$3^3 = 27$	$4^3 = 64$	$5^3 = 125$
$2^4 = 16$	$3^4 = 81$	$4^4 = 256$	$5^4 = 625$
$2^5 = 32$			
$2^6 = 64$			
$2^7 = 128$			

Date

* Exponential Growth →

Positive Bases

base > 1 | 0 < base < 1

If $x > 1$, then value of x^n increases as value of n ↑s

{Moves away from 1}

If $0 < x < 1$; the value of x^n ↓'s as the value of n ↑'s

{Moves closer to 1}

* Similar pattern in observed in negative bases but sign oscillates from ⊕ & ⊖

⊕ ↓ even power

⊖ ↓ odd power

EXPONENT LAW:-

1.) Product Law -

$$x^a \cdot x^b = x^{a+b}$$ {requires equal bases}

2.) Quotient Law -

$$x^a \div x^b = \frac{x^a}{x^b} = x^{a-b}$$ (requires same/equal bases)

3.) Power of power Law:-

$$(x^a)^b = x^{a \cdot b}$$

Date

4.) $x^{-n} = \frac{1}{x^n}$ 5.) $\left(\frac{a}{b}\right)^{-n} = \left(\frac{b}{a}\right)^n$

6.) Power of Product law:-

$$(x^a \cdot y^b)^n = x^{an} \cdot y^{bn}$$

7.) Power of Quotient Law:-

$$\left(\frac{x^a}{y^b}\right)^n = \frac{x^{an}}{y^{bn}}$$

8.) Combining Base law:-

$$x^n y^n = (xy)^n \; ; \; \frac{x^n}{y^n} = \left(\frac{x}{y}\right)^n$$

THE UNIT DIGIT QUESTIONS:-

1.) look for repeating pattern.

2.) figure out where that pattern will be at desired power.

* The unit digit of any product will be influenced only by unit digits of two factors.

* Square Roots and Squares:-

$$\sqrt{2} = 1.414 \simeq 1.4$$
$$\sqrt{3} = 1.732 \simeq 1.7$$
$$\sqrt{5} = 2.236 \simeq 2.2$$

Date

$1^2 = 1$	$11^2 = 121$
$2^2 = 4$	$12^2 = 144$
$3^2 = 9$	$13^2 = 169$
$4^2 = 16$	$14^2 = 196$
$5^2 = 25$	$15^2 = 225$
$6^2 = 36$	$16^2 = 256$
$7^2 = 49$	$17^2 = 289$
$8^2 = 64$	$18^2 = 324$
$9^2 = 81$	$19^2 = 361$
$10^2 = 100$	$20^2 = 400$

** If $x > 1$, then $\sqrt{x} < x$

If $0 < x < 1$, then $\sqrt{x} > x$

→ ODD ROOTS:-

1.) We can find the odd roots of a negative no.

2.) The odd root of negative no. will be negative.

3.) The odd root of positive no. will be positive.

→ EVEN ROOTS:-

1.) We cannot find even roots of a negative no.

2.) Even root of +ve no. will be positive.

<All roots have <u>atmost</u> 1 value.>

Date

* $\sqrt[n]{x} = x^{1/n}$

PROPERTIES OF ROOTS:-

1.) $\sqrt[n]{x} \cdot \sqrt[n]{y} = \sqrt[n]{xy} \Leftrightarrow \sqrt[n]{xy} = \sqrt[n]{x}\,\sqrt[n]{y}$

2.) $\dfrac{\sqrt[n]{x}}{\sqrt[n]{y}} = \sqrt[n]{\dfrac{x}{y}} \Leftrightarrow \sqrt[n]{\dfrac{x}{y}} = \dfrac{\sqrt[n]{x}}{\sqrt[n]{y}}$

3.) $x^{a/b} = \sqrt[b]{x^a} \Leftrightarrow x^{a/b} = (\sqrt[b]{x})^a$

4.) $a^x = a^y \Rightarrow x = y$ $\langle a \neq 0$ & $a \neq 1\rangle$

Rationalization :- <Eliminating roots from denominator>

$$\frac{5}{3+\sqrt{2}} = \frac{5(3-\sqrt{2})}{(3+\sqrt{2})(3-\sqrt{2})} = \frac{15-5\sqrt{2}}{7}$$

* $(3-\sqrt{2})$ is conjugate of $(3+\sqrt{2})$

Date

ALGEBRA EQUATIONS & INEQUALITIES:-

1) $(a+b)^2 = a^2 + 2ab + b^2$

2) $(a-b)^2 = a^2 - 2ab + b^2$

3) $a^2 - b^2 = (a+b)(a-b)$

4) $(x+a)(x+b) = x^2 + (a+b)x + ab$.

$$x^2 + \underset{(a+b)}{\underset{\downarrow}{n}}x + \underset{ab}{\underset{\downarrow}{p}} = (x+a)(x+b)$$

{Solutions of equation = Roots of equation}

5) Quadratic Equation -

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

$$\Rightarrow x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

(i) $b^2 - 4ac = 0$ {One unique soln / both roots same}

(ii) $b^2 - 4ac > 0$ {two soln / roots}

(iii) $b^2 - 4ac < 0$ {No soln / roots exist}

Date

NUMBERS OF SOLUTIONS OF SYSTEM OF LINEAR EQUATIONS:-

A system of 2 eqn with 2 variables can have zero solutions, one solution or infinately many solutions.

1) Infinately many solutions -

$$3x + 2y = 9$$
$$6x + 4y = 18$$

$$\Rightarrow \begin{array}{r} 6x + 4y = 18 \\ (-)\ 6x + 4y = 18 \\ \hline 0\cdot x + 0\cdot x = 0 \end{array}$$

< Infinate no. of solution >

(2) Zero Solution:-

$$3x + 2y = 9$$
$$6x + 4y = 11$$

$$\Rightarrow \begin{array}{r} 6x + 4y = 18 \\ (-)\ 6x + 4y = 11 \\ \hline 0\cdot x + 0\cdot y = 7 \end{array}$$

< Zero Solution >

Date

(3.) One Solution –

$$3x + y = 17$$
$$2x - 2y = 6$$

$$\Rightarrow \quad 6x + 2y = 34$$
$$(+) \quad 2x - 2y = 6$$
$$8x = 40$$
$$x = 5$$

$\rightarrow 2x - 2y = 6 \Rightarrow 2 \times 5 - 2y = 6$

$\Rightarrow y = 2$.

* EQUATIONS WITH SQUARE ROOTS :–

* $\sqrt{x-2} = 3 \Rightarrow x - 2 = 9 \Rightarrow x = 11$
* $\sqrt{3x-5} = \sqrt{x+10} \Rightarrow 3x - 5 = x + 10 \Rightarrow x = 7.5$

* EXTRANEOUS ROOTS :–

$\sqrt{x+1} = -2 \Rightarrow x + 1 = 4$
$x = 3$.

Now, put $x=3$ in eqn –

$\sqrt{3+1} = -2 \Rightarrow 2 \neq -2$

So, $x=3$ is an extraneous roots.

Date

* Extraneous roots can arise when we square numbers an in above case.

$(\sqrt{K})^2 = K$ for $K \geq 0$.

As $(\sqrt{9})^2 = 9$

but, $(\sqrt{-9})^2 \neq -9$ {as $K \not< 0$}

$\rightarrow \sqrt{5-x} = \sqrt{2x-13}$

$5 - x = 2x - 13 \Rightarrow x = 6 \rightarrow$ Now check for extraneous roots.

$\sqrt{5-x} = \sqrt{2x-13} \Rightarrow \sqrt{-1} = \sqrt{-1}$
↳ This has no real value.

So, $x=6$ is not a solution of the eqn & thus, given pair of eqn have no-solution

$\rightarrow \sqrt{x+14} = x + 2 \Rightarrow x + 14 = (x+2)^2$

$x = -5, \ x = 2$.

Now, check for extraneous roots.

$x = -5 \rightarrow \sqrt{9} = -3 \rightarrow$ Not possible.

$x = 2 \rightarrow \sqrt{16} = 4$. So, $x=-5$ is an extraneous root.
$\therefore x=2$ is the only solution of equation

Date

* EQUATION WITH SQUARE ROOTS :-

1.) Eliminate square root by squaring both sides.
2.) Solve for the variable
3.) Check for extraneous roots.

* Equation with n^{th} root :-

1.) Raise both sides by power n.
2.) Solve for the variable.
3.) If n is even - check for extraneous roots.

EQUATIONS WITH ABSOLUTE VALUE :-

$|x| = x$ if $x \geq 0 \Rightarrow |4| = 4$

$|x| = -x$ if $x < 0 \Rightarrow |-4| = -(-4) = 4$.

In general - $|x| = a \Rightarrow \begin{cases} x = a ; & x \geq 0 \\ x = -a ; & x < 0 \end{cases}$

↳ $|x| = 4 \rightarrow x = 4$ or $x = -4$.

↳ $|x| = 3x-4 \Rightarrow x = 3x-4 \Rightarrow x = 2$
$x = -(3x-4) \longrightarrow x = -1$

Date

* when solving equations with Absolute Values, always check for extraneous roots.

So, checking $|x| = 3x-4$ for extraneous roots -

$x = 2 \rightarrow |2| = 3\times2-4 = 2$ (✓)

$x = +1 \rightarrow |+1| = 3\times1-4 = -1$ (×)

So, $x = 1$ is an extraneous root & thus, $x = 2$ is the only solution.

∴, for Eqns with Absolute value -

1) Apply rule $|x| = a \Rightarrow \begin{cases} x = a \rightarrow x \geq 0 \\ x = -a \rightarrow x < 0 \end{cases}$

2) Solve Eqn for results.
3) Check for extraneous roots.

INEQUALITIES :-

1.) Adding or Substracting ~~to~~ ~~or~~ from both sides does not affect the inequality.

2.) Multiplying & dividing both sides by positive number doesnot affect the inequality.

3.) Multiplying & dividing both sides by negative number reverses the inequality.

* Inequalities can be added.
* Donot ever substract, multiply or divide ~~an~~ inequalities

$$\begin{array}{r} A < B \\ + \quad C < D \\ \hline A+B < C+D. \end{array}$$

Inequalities & Absolute value :-

1.) $|x| < 3 \Rightarrow x < 3$
$\quad x > -3$

$$-3 < x < 3$$

* $|x| < a \Rightarrow -a < x < a$ {where a is +ve}

2.) $|x| \geq 2 \Rightarrow x \geq 2$
$\quad x \leq -2$

* $x > a \Rightarrow x > a$ (or) $x < -a$ {where a is +ve}.

Trick :-

$\|x\| < 5$	$\|x\| > 3$
$-5 < x < 5$	$-3 > x > 3$
	$\Downarrow$
	$x < -3$ (or) $x > 3$.

Trick {Put negative of number to the left of inequality and place inequality sign same as original in b/w them.}

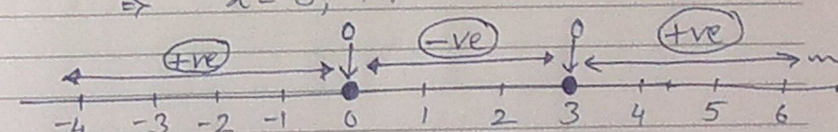
(Trick).

QUADRATIC INEQUALITIES:-

$$x^2-2x-3 > 0$$

$\Rightarrow x^2-2x-3 = 0$

$\Rightarrow x = 3, -1.$



$x=4 \rightarrow x^2-2x-3$ $= 5 > 0 \Rightarrow +ve$	$x=2 \rightarrow x^2-2x-3$ $= -3 < 0 \Rightarrow -ve$
$x=-2 \rightarrow x^2-2x-3$ $= 5 > 0 \rightarrow +ve$	$\boxed{P.T.O}$

Date

So, Solution of Equation $x^2 - 2x - 3 < 0$ is –

$-1 < x < 3$. { In this region the value is < 0 }

Steps :–

1.) Set expression to equal zero.

2.) Find solutions & record them on the number line. The solution will divide the line into 3 regions.

3.) Test a number from each region.

4.) Solve the inequality.

Date