Divisibility Test

(i) x is divisible by 2 if the unit digit is divisible by 2, 4 → last 2 digit div. by 4, 8 → last 3 digit div. by 8

(ii) x is divisible by 3 if sum of its digit is divisible by 3

(iii) x is divisible by 4 if last two digit of the number are divisible by 4

(iv) x is divisible by 5 if digit at unit place is 0 or 5 25 → last 2 digit div. by 25, 125 → last 3 digit div. by 125

(v) x is divisible by 6 if the number is divisible by both 2 and 3 OR difference of 2 × unit digit

(vi) x is divisible by 7 if the sum of 5 times the unit digit and the remaining part of the number is divisible by 7, can be repeated

(vii) x is divisible by 8 if the last 3 digit of the number is divisible by 8.

(viii) x is divisible by 9 if sum of the digit of the number is divisibly by 9

(ix) x is divisible by 11 if the difference b/w the sum of the digits at even places and sum of the digits at odd places is a multiple of 11 (even 0)

Divisibility by (y)	(x)	
		if unit digit of any no. multiply by 'x' and add in remaining part of number is divisible by y, can be repeated
(x) 13	4	
(xi) 17	12	
(xii) 19	2	
(xiii) 23	7	
(xiv) 29	3	

Proportion

When two ratios are equal then the four quantities composing them are proportional

- $a : b :: c : d = a : b = c : d = \frac{a}{b} = \frac{c}{d}$
  $\Rightarrow ad = bc$
- a and d → extremes
  b and c → means
- Product of extremes = Product of means

Invertando

$a : b = c : d \Rightarrow b : a = d : c$

Alternando

$a : b = c : d \Rightarrow a : c = b : d$

Componendo

$a : b = c : b \Rightarrow \frac{a+b}{b} = \frac{c+d}{d}$

Dividendo

$a : b = c : d \Rightarrow \frac{a-b}{b} = \frac{c-d}{d}$

Componendo & Dividendo

$a : b = c : d \Rightarrow \frac{a+b}{a-b} = \frac{c+d}{c-d}$

K method

$\frac{a}{b} = \frac{c}{d} = \frac{e}{f} = \dots = K$ (let)

$\Rightarrow a = bK, \; c = dK, \; e = fK \dots$

- if $\frac{a}{b} = \frac{c}{d} = \frac{e}{f} = \dots$

then each, $\frac{a+c+e+\dots}{b+d+f+\dots} = \frac{\text{Sum of numerator}}{\text{Sum of denominator}}$

what satisfies it ← # Solving Inequalities (Algebric)

step 1 make linear factors in L.H.S and zero is R.H.S

step 2 find critical points corresponding to each linear factor (can be more than 1 for each) & critical point is where the linear factor becomes zero or its nature is changing)

step 3 Plot the critical points on real number li

ste 4 Check the solution region and hence write the solution in set format

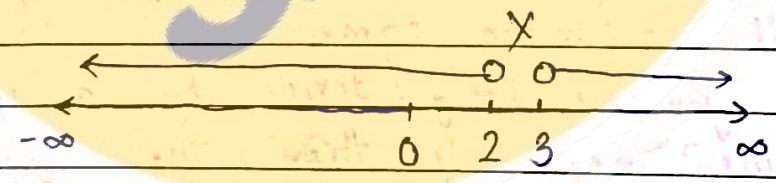
[ ] • → point is included

( ) o → point is not included $[-\infty / \infty \rightarrow ( )]$

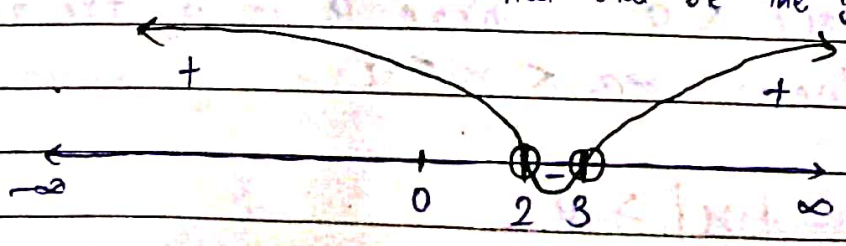
Representation

$$(x-2)(x-3) > 0$$

→ Sign Scheme method



→ Wavy Curve method → can also be used to get an idea what will be the graph of equatio



$D = b^2 - 4ac$

$ax^2 + bx + c \equiv a(x - \alpha)(x - \beta)$

where $\underbrace{\alpha, \beta}_{\text{zeroes/roots}} = \frac{-b \pm \sqrt{D}}{2a}$, $a \neq 0$

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

3. Middle term splitting

$ax^2 + bx + c \equiv a(x - \alpha)(x - \beta)$

$ax^2 + bx + c \equiv a(x - (\alpha + \beta)x + \alpha\beta)$

$\alpha + \beta = \frac{-b}{a}$

$\alpha\beta = \frac{c}{a}$

Relationship between zeroes/roots and coefficients

Graph → Parabolic, if $a > 0$ ∪
if $a < 0$ ∩

if touch x-axis once then 2 same roots
if don't touch x axis → no roots

CUBIC Equations

General Form → $ax^3 + bx^2 + cx + d = 0, a, b, c, d \in R, a \neq 0$

Degree → 3

Roots / Solutions / Zeroes → 3

Calculation & Solving Tricks

1. Order of solving → Bracket ( ) { } [ ]
Of of (x)
Division ÷
Multiplication x
Addition +
Subtraction −

2. Basic Mental Math Tricks

Add : 549 + 678
= 500 + 40 + 9 + 600 + 70 + 8
= 500 + 600 + 40 + 70 + 9 + 8
= 1100 + 110 + 17
= 1227

Subtract : 356 − 189
= 300 + 50 + 6 − 100 − 80 − 9
= 300 − 100 + 50 − 80 + 6 − 9
= 200 − 30 − 3
= 167

Multiply : 76 x 54
= (70 + 6) (50 + 4)
= 3500 + 280 + 300 + 24
= 3500 + 580 + 20 + 4
= 3500 + 600 + 4
= 4104

→ 99 x 80 = (100 − 1) 80
= 8000 − 80
= 7920

Think → not necessarily or when -ve answers are allowed

* not applicable if options have same digit sum
  → consider only last 2 or 3 digit of Question and options (if possible)
    ↖ not really advisable
  → unit digit trick

10. Unit Digit Trick

↳ last digit of any number

1. Consider only last digit of each number and solve to get the last digit of your answer
2. Decimals convert→ fractions
3. for -ve no. → convert to +ve by adding 10
4. $bn = a$ OR $n^2 = ?$ OR $\sqrt{n} = ?$
   use common sense and find such digit that satisfy the problem
5. for $(num)^2$ → only consider unit digit of the square of unit digit of the (num)

* not applicable if options have same unit digit or uneven decimals or divided by zero or when -ve answers are allowed
  → Digit sum trick

Approximation & Estimation

11. Round off numbers acc. to your need

trying not to manipulate the answer too much
→ can be used everywhere especially multiply & divide

- Round off decimals and numbers
- Take all no. and powers separate
- Convert into Scientific notation
- $\pi = 3, \pi^2 = 10, \sqrt{x^n} = x^{n/2}$
- Num ↑ → No. ↑
  Deno ↑ → No. ↓

* Not applicable if the options are too close

Geometry

0. Point (.) 0 Dimensions
1. Line and Angles

Line : a collection of points which has only length neither breadth nor thickness

Line Segment : a part or portion of a line with two end points

Ray : A part of a line with one end point

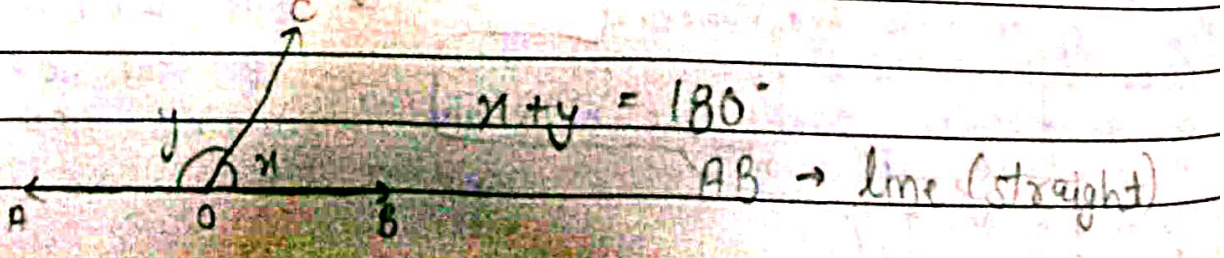
Collinear Points : three or more points lying on the same line

Angle : formed when two rays originate from the same end point called vertex (called arms)

acute angle $< 90°$ ∟ right angle $= 90°$
$180° >$ obtuse angle $> 90°$ reflex angle $> 180°$
straight angle $= 180°$ complete angle $= 360°$

Complimentary Angles → sum is $90°$
Supplementary Angles → sum is $180°$
Adjacent angles → two angles having common vertex and a common arm and non common arms on opposite side of common

→ Linear Pair of angle → pair of adjacent angles whose sum is $180°$



★ – There are exactly two tangents to a circle through a point lying outside the circle

★ – The lengths of tangents drawn from an external point to a circle are equal. (PA=PB)

and, PAOB → cyclic with OP as diameter, △APO ≅ △BPO, OP ⊥ AB

– The tangent at any point of a circle is perpendicular to the radius through the point of contact.

• Arc - major and minor

– If two chords of a circle are equal then corresponding arcs are equal

– If arcs of a circle are equal then corresponding chords are also equal

– Equal arcs subtends equal angles at centre

★ – The angle subtended by an arc at the centre of the circle is twice the angle which is subtended at the remaining part of the circle.

→ angle in semicircle is 90° (converse not true)

→ ★ θ (in radian) $= \frac{l}{r} = \frac{\text{length of arc}}{\text{radius}}$

→ $l = \frac{\theta(\text{in degree})}{360} \times 2\pi r$

→ 2π rad. $= 360°$

→ $1° = 60'$

→ $1' = 60''$

★ – Circumference of circle $= 2\pi r = \pi d$

★ – Area of circle $= \pi r^2$

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Histogram: A graph which displays the data by using vertical bars of various heights to represents frequencies. The horizontal axis can be either the class boundaries, the class marks or the class limits

Frequency Polygon: A line graph. The frequency is placed along the vertical axis and the class mid points are placed along the horizontal axis connected with lines

Ogive: A frequency polygon of the cumulative frequency or the relative cumulative frequency. The vertical axis is the cumulative frequency. The horizontal axis is the class boundaries. The graph always starts at the lowest class boundary and will end up at the total frequency for a cf or 1.00 for a relative cf

→ The median of a grouped data can be obtained graphically as the x coordinate of the point of intersection of more than and less than ogive

Symmetric distribution is when the values of mean, median and mode coincide. In a symmetric distribution frequencies are symmetrically distributed on both sides of the center point of the frequency curve

Skewed distribution is one which is not symmetric