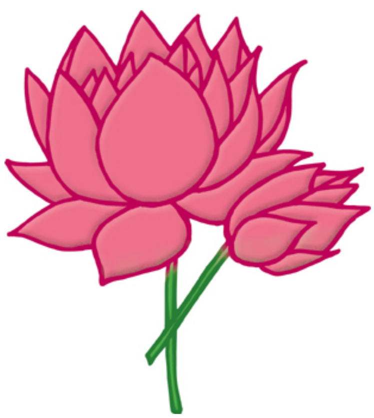
MATHS

X STD

Try , try and try again you will succeed atlast



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1 . SETS AND FUNCTIONS

1. **Commutative property**

   $A \cup B = B \cup A$

   $A \cap B = B \cap A$

2. **Associative property**

   $A \cup (B \cup C) = (A \cup B) \cup C$

   $A \cap (B \cap C) = (A \cap B) \cap C$

3. **Distributive property**

   $A \cup (B \cap C) = (A \cup B) \cap (A \cup C)$

   $A \cap (B \cup C) = (A \cap B) \cup (A \cap C)$

4. **De Morgan's laws**

   i) $(A \cup B)' = A' \cap B'$

   ii) $(A \cap B)' = A' \cup B'$

   iii) $A - (B \cup C) = (A - B) \cap (A - C)$

   iv) $A - (B \cap C) = (A - B) \cup (A - C)$

5. **Cardinality of sets**

   i) $n(A \cup B) = n(A) + n(B) - n(A \cap B)$

   ii) $n(A \cup B \cup C) = n(A) + n(B) + n(C) - n(A \cap B) - n(B \cap C) - n(A \cap C) + n(A \cap B \cap C)$

6. **Representation of functions**

   a set of ordered pairs, a table , an arrow diagram, a graph

7. **Types of functions**

1. **One-One function**

   Every element in A has an image in *B*.

2 **Onto function**

   Every element in *B* has a pre-image in *A*.

3. **One-One and onto function**

   Both a one-one and an onto function.

4. **Constant function**

   Every element of *A* has the same image in *B*.

5. **Identity function**

   An identity function maps each element of *A* into itself.

2. SEQUENCES AND SERIES OF REAL NUMBERS

Arithmetic sequence or Arithmetic Progression (A.P.)

1. **General form** $a, a+d, a+2d, a+3d, \ldots$
2. Three consecutive terms $a-d, a, a+d$
3. The number of terms $n = \frac{l-a}{d} + 1$
4. General term $t_n = a + (n-1)d$
5. The sum of the first *n* terms (if the common difference *d* is given.) $S_n = [2a + (n-1)d]$
6. The sum of the first *n* terms (if the last term *l* is given.) $S_n = [a + l]$

Geometric Sequence or Geometric Progression (G.P.)

7. **General form** $a, ar, ar^2, ar^3, \ldots, ar^{n-1}, ar^n, \ldots$
8. General term $t_n = ar^{n-1}$
9. Three consecutive terms $a/r, a, ar$
10. The sum of the first *n* terms $S_n = \begin{cases} \frac{a(r^n-1)}{r-1} & r \neq 1 \\ na & r = 1 \end{cases}$

Special series

11. The sum of the first *n* natural numbers,

$$1 + 2 + 3 + \ldots + n = \frac{n(n+1)}{2}$$

12. The sum of the first *n* odd natural numbers,

$$1 + 3 + 5 + \ldots + (2k-1) = n^2$$

13. The sum of first *n* odd natural numbers (when the last term *l* is given)

$$1 + 3 + 5 + \ldots + l = \left(\frac{l+1}{2}\right)^2$$

14. The sum of squares of first *n* natural numbers,

$$1^2 + 2^2 + 3^2 + \ldots + k^2 = \frac{n(n+1)(2n+1)}{6}$$

15. The sum of cubes of the first *n* natural numbers,

$$1^3 + 2^3 + 3^3 + \ldots + k^3 = \left[\frac{n(n+1)}{2}\right]^2$$

3. ALGEBRA

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

5 $a^2 + b^2 = (a-b)^2 + 2ab$

8 $a^3 + b^3 = (a+b)(a^2 - ab + b^2)$

9 $a^3 - b^3 = (a-b)(a^2 + ab + b^2)$

10 $a^3 + b^3 = (a+b)^3 - 3ab(a+b)$

11 $a^3 - b^3 = (a-b)^3 + 3ab(a-b)$

12 $a^4 + b^4 = (a^2 + b^2)^2 - 2a^2b^2$

13 $a^4 - b^4 = (a+b)(a-b)(a^2+b^2)$

14 $(a+b+c)^2 = a^2 + b^2 + c^2 + 2(ab + bc + ca)$

15 $(x+a)(x+b) = x^2 + (a+b)x + ab$

16 $(x+a)(x+b)(x+c) = x^3 + (a+b+c)x^2 + (ab+bc+ca)x + abc$

17 Quadratic polynomials $ax^2 + bx + c = 0$

18 sum of zeros $(\alpha + \beta) = -$ coefficient of x / coefficient of $x^2 = \left(\frac{-b}{a}\right)$

19 product of zeros $(\alpha\beta)$ = constant term / coefficient of $x^2 = \left(\frac{c}{a}\right)$

20 Quadratic polynomials with zeros α and β. : $x^2 - (\alpha + \beta)x + (\alpha\beta)$

20 **Relation between LCM and GCD :** LCM x GCD = *f(x)* x *g(x)*

21 **Solution of quadratic equation by formula method** $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$

22 **Nature of roots** $\Delta = b^2 - 4ac$

$\Delta > 0$ Real and unequal

$\Delta = 0$ Real and equal.

$\Delta < 0$ No real roots. (It has imaginary roots)

23 **Formation of quadratic equation when roots are given**

$X^2 -$ (*sum of roots*) x + (*product of roots*) = 0

4. MATRICES

1 **Row matrix** :

A matrices has only one row.

2. **Column matrix** :

A matrices has only one column.

3 **Square matrix** :

A matrix in which the number of rows and the number of columns are equal

4 **Diagonal matrix** :

A square matrix in which all the elements above and below the leading diagonal are equal to zero

5 **Scalar matrix** :

A diagonal matrix in which all the elements along the leading diagonal are equal to a non-zero constant

6. **Unit matrix** :

A diagonal matrix in which all the leading diagonal entries are 1

7 **Null matrix or Zero-matrix** :

A matrices has each of its elements is zero.

8 **Transpose of a matrix** :

A matrices has interchanging rows and columns of the matrix

9 **Negative of a matrix** :

The negative of a matrix A is $-A$

10 **Equality of matrices** :

Two matrices are same order and each element of *A* is equal to the corresponding element of *B*

11 Two matrices of the same order, then the addition of *A* and *B* is a matrix *C*

12 If *A* is a matrix of order *m* x *n* and *B* is a matrix of order *n* x *p*, then the product matrix AB is *m* x *p*.

13 **Properties of matrix addition**

- **Commutative** A +B = B + A
- **Associative** A + (B + C) = (A + B) +C
- **Existence of additive identity** A + O = O + A =A
- **Existence of additive inverse** A + (-A) = (-A) + A = O

14 **Properties of matrix multiplication**

- **Not commutative in general** A B = BA
- **Associative** A(BC) = (AB)C
- **distributive over addition** A(B + C) = AB + AC
  (A + B)C = AC + BC
- **Existence of multiplicative identity** A I = I A = A
- **Existence of multiplicative inverse** AB = BA = I

15 $(A^T)^T = A$; $(A+B)^T = A^T + B^T$; $(AB)^T = B^T A^T$

5. COORDINATE GEOMETRY

1 Distance between Two points AB= $\sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$

2 The line segment joining the two points $A(x_1,y_1)$, and $B(x_2,y_2)$ internally in the ratio $l : m$ is $P\left(\frac{lx_2 + mx_1}{l+m}, \frac{ly_2 + my_1}{l+m}\right)$

3 The line segment joining the two points $A(x_1,y_1)$, and $B(x_2,y_2)$ externally in the ratio $l : m$ is $P\left(\frac{lx_2 - mx_1}{l-m}, \frac{ly_2 - my_1}{l-m}\right)$

4 The midpoint of the line segment $M = \left(\frac{x_1 + x_2}{2}, \frac{y_1 + y_2}{2}\right)$

5 The centroid of the triangle $G = \left(\frac{x_1 + x_2 + x_3}{3}, \frac{y_1 + y_2 + y_3}{3}\right)$

6 **Area of a triangle** $A = \frac{1}{2}\sum x_1(y_2 - y_3)$ sq. unit

or $A = \frac{1}{2}\begin{pmatrix} x_1 & x_2 & x_3 & x_1 \\ y_1 & y_2 & y_3 & y_1 \end{pmatrix}$ sq. unit

7 **Area of the Quadrilateral** $A = \frac{1}{2}\begin{pmatrix} x_1 & x_2 & x_3 & x_4 & x_1 \\ y_1 & y_2 & y_3 & y_4 & y_1 \end{pmatrix}$ sq. unit

7 **Collinear of three points** $\sum x_1(y_2 - y_3) = 0$

(or) Slope of *AB* = Slope of *BC* or slope of *AC*.

8 If a line makes an angle θ with the positive direction of *x*- axis, then the slope $m = \tan\theta$

9 Slope of the non-vertical line passing through the points $m = \frac{y_2 - y_1}{x_2 - x_1}$

10 Slope of the line ax + by + c =0 is $m = -\frac{a}{b}$

11 The straight line ax + by + c =0 , *y*-intercept *c* $y = -\frac{c}{b}$

12 Two lines are parallel if and only if their slopes are equal. : $m_1 = m_2$

13 Two lines are perpendicular if and only if the product of their slopes is -1 : $m_1 m_2 = -1$

Equation of straight lines

14	*x*-axis	$y = 0$
15	*y*-axis	$x = 0$
16	Parallel to *x*-axis	$y = k$
17	Parallel to y-axis	$x = k$
18	Parallel to $ax+by+c=0$	$ax+by+k=0$
19	Perpendicular to $ax+by+c=0$	$bx-ay+k=0$
20	Passing through the origin	$y=mx$
21	Slope *m*, *y*-intercept *c*	$y = mx+c$
22	Slope *m*, a point (x_1, y_1)	$y - y_1 = m(x - x_1)$
23	Passing through two points	$\frac{y-y_1}{y_2-y_1} = \frac{x-x_1}{x_2-x_1}$
24	*x*-intercept *a* , *y*-intercept *b*	$\frac{x}{a} + \frac{y}{b} = 1$

6 GEOMETRY

1 **Basic Proportionality theorem or Thales Theorem**

If a straight 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.

2 **Converse of Basic Proportionality Theorem (Converse of Thales Theorem)**

If a straight line divides any two sides of a triangle in the same ratio, then the line must be parallel to the third side.

3 **Angle Bisector Theorem**

The internal (external) bisector of an angle of a triangle divides the opposite side internally (externally) in the ratio of the corresponding sides containing the angle.

4 **Converse of Angle Bisector Theorem**

If a straight line through one vertex of a triangle divides the opposite side internally (externally) in the ratio of the other two sides, then the line bisects the angle internally (externally) at the vertex.

5 **Similar triangles**

corresponding angles are equal (or) corresponding sides have lengths in the same ratio

1. **AA(Angle-Angle) similarity criterion**

If two angles of one triangle are respectively equal to two angles of another triangle, then the two triangles are similar.

2. **SSS (Side-Side-Side) similarity criterion for Two Triangles**

In two triangles, if the sides of one triangle are proportional (in the same ratio) to the sides of the other triangle, then their corresponding angles are equal

3. **SAS (Side-Angle-Side) similarity criterion for Two Triangles**

If one angle of a triangle is equal to one angle of the other triangle and if the corresponding sides including these angles are proportional, then the two triangles are similar.

6 **Pythagoras theorem (Bandhayan theorem)**

In a right angled triangle, the square of the hypotenuse is equal to the sum of the squares of the other two sides.

7 **Converse of Pythagorous theorem**

In a triangle, if the square of one side is equal to the sum of the squares of the other two sides, then the angle opposite to the first side is a right angle.

8 **Tangent-Chord theorem**

If from the point of contact of tangent (of a circle), a chord is drawn, then the angles which the chord makes with the tangent line are equal respectively to the angles formed by the chord in the corresponding alternate segments.

9 **Converse of Theorem**

If in a circle, through one end of a chord, a straight line is drawn making an angle equal to the angle in the alternate segment, then the straight line is a tangent to the circle.

10 If two chords of a circle intersect either inside or out side the circle, the area of the rectangle contained by the segments of the chord is equal to the area of the rectangle contained by the segments of the other

P A X PB = PC X PD

Circles and Tangents

11 A tangent at any point on a circle is perpendicular to the radius through the point of contact .

12 Only one tangent can be drawn at any point on a circle. However, from an exterior point of a circle two tangents can be drawn to the circle.

13 The lengths of the two tangents drawn from an exterior point to a circle are ual.

14 If two circles touch each other, then the point of contact of the circles lies on the line joining the centres.

15 If two circles touch externally, the distance between their centres is equal to the sum of their radii.

16 If two circles touch internally, the distance between their centres is equal to the difference of their radii.

7 Trigonometry

01 $\sin\theta \operatorname{cosec}\theta = 1$; $\sin\theta = 1/\operatorname{cosec}\theta$; $\operatorname{cosec}\theta = 1/\sin\theta$

02 $\cos\theta \sec\theta = 1$; $\cos\theta = 1/\sec\theta$; $\sec\theta = 1/\cos\theta$

03 $\tan\theta \cot\theta = 1$; $\tan\theta = 1/\cot\theta$; $\cot\theta = 1/\tan\theta$

04 $\tan\theta = \sin\theta / \cos\theta$ $\cot\theta = \cos\theta / \sin\theta$

05	$\sin^2\theta + \cos^2\theta = 1$;	$\sin^2\theta = 1 - \cos^2\theta$;	$\cos^2\theta = 1 - \sin^2\theta$
06	$\sec^2\theta - \tan^2\theta = 1$;	$\sec^2\theta = 1 + \tan^2\theta$;	$\tan^2\theta = \sec^2\theta - 1$
07	$\mathrm{cosec}^2\theta - \cot^2\theta = 1$;	$\mathrm{cosec}^2\theta = 1 + \cot^2\theta$;	$\cot^2\theta = \mathrm{cosec}^2\theta - 1$
08	$\sin(90-\theta) = \cos\theta$	$\mathrm{cosec}(90-\theta) = \sec\theta$	
09	$\cos(90-\theta) = \sin\theta$	$\sec(90-\theta) = \mathrm{cosec}\,\theta$	
10	$\tan(90-\theta) = \cot\theta$	$\cot(90-\theta) = \tan\theta$	
11	Componendo and dividendo rule $\frac{a}{b} = \frac{c}{d}$ then $\frac{a+b}{a-b} = \frac{c+d}{c-d}$		

angle	0	30	45	60	90
Sin θ	0	$\frac{1}{2}$	$\frac{1}{\sqrt{2}}$	$\frac{\sqrt{3}}{2}$	1
Cos θ	1	$\frac{\sqrt{3}}{2}$	$\frac{1}{\sqrt{2}}$	$\frac{1}{2}$	0
Tan θ	0	$\frac{1}{\sqrt{3}}$	1	$\sqrt{3}$	∞

8 MENSURATION

Sl. No	Name	Surface Area (sq.units)	Total Surface Area (sq.units)	Volume (cu.units)
1	Solid right circular cylinder	$2\pi rh$	$2\pi r(h+r)$	$\pi r^2 h$
2	Right circular hollow cylinder	$2\pi(R+r)h$	$2\pi(R+r)(R-r+h)$	$\pi(R^2 - r^2)h$
3	Solid right circular cone	πrl	$\pi r(l + r)$	$\frac{1}{3}\pi r^2 h$
4	Frustum	–	–	$\frac{1}{3}\pi(R^2 + r^2 + Rr)h$
5	Sphere	$4\pi r^2$	–	$\frac{4}{3}\pi r^3$
6	Hollow sphere	–	–	$\frac{4}{3}\pi(R^3 - r^3)$
7	Solid Hemisphere	$2\pi r^2$	$3\pi r^2$	$\frac{2}{3}\pi r^3$
8	Hollow Hemisphere	$2\pi(R^2 + r^2)$	$\pi(3R^2 + r^2)$	$\frac{2}{3}\pi(R^3 - r^3)$

9 **Cone** l = $\sqrt{h^2+r^2}$; h = $\sqrt{l^2-r^2}$; r = $\sqrt{l^2-h^2}$

10 CSA of a cone = Area of the sector

$$\pi rl = \frac{\theta}{360}\pi r^2$$

11 Length of the sector = Base circumference of the cone

$$L = 2\pi r$$

12 Volume of water flows out through a pipe = {Cross section area x Speed x Time }

13 No. of new solids obtained by recasting = $\dfrac{\text{Volume of the solid which is melted}}{\text{volume of one solid which is made}}$

14 1 m^3 = 1000 litres   1000 litres = 1 k.l   1 $d.m^3$ = 1 litres   1000 cm^3 = 1 litres

11 STATISTICS

1 **Range** R = $L - S$

2 coefficient of range Q = $\frac{L-S}{L+S}$

3 **Standard deviation** (**Ungrouped**)

1. **Direct method** $\sigma = \sqrt{\frac{\sum x^2}{n} - \left(\frac{\sum x}{n}\right)^2}$

2. **Actual mean method** $\sigma = \sqrt{\frac{\sum d^2}{n}}$ **Here** d = x - $\bar{x}$

3. **Assumed mean method** $\sigma = \sqrt{\frac{\sum fd^2}{\sum f} - \left(\frac{\sum fd}{\sum f}\right)^2}$ **Here** d = x – A

4. **Step deviation method** $\sigma = \sqrt{\frac{\sum d^2}{n} - \left(\frac{\sum d}{n}\right)^2}$ x C **Here** d = $\frac{x-A}{C}$

4 **Standard deviation** (**Grouped**)

1. **Actual mean Method** $\sigma = \sqrt{\frac{\sum fd^2}{\sum f}}$ **Here** d = x - $\bar{x}$

2. **Assumed mean method** $\sigma = \sqrt{\frac{\sum fd^2}{\sum f} - \left(\frac{\sum fd}{\sum f}\right)^2}$ **Here** d = x – A

3. **Step deviation method** $\sigma = \sqrt{\frac{\sum fd^2}{\sum f} - \left(\frac{\sum fd}{\sum f}\right)^2}$ x C **Here** d = $\frac{x-A}{C}$

5 Standard deviation of the first n natural numbers, $\sigma = \sqrt{\frac{n^2-1}{12}}$

6 Variance is the square of standard deviation.

7 Standard deviation of a collection of data remains unchanged when each value is added or subtracted by a constant.

8 Standard deviation of a collection of data gets multiplied or divided by the quantity k, if each item is multiplied or divided by k.

9 Coefficient of variation, $C.V = \frac{\sigma}{\bar{x}} X 100$

It is used for comparing the consistency of two or more collections of data.

12 PROBABILITY

1 Tossing an unbiased coin once $S = \{ H, T \}$

2 Tossing an unbiased coin twice $S = \{ HH, HT, TH, TT \}$

3 Rolling an unbiased die once $S = \{ 1, 2, 3, 4, 5, 6 \}$

4 The probability of an event A lies between 0 and 1,both inclusive $0 \le P(A) \le 1$

6 The probability of the sure event is 1. $P(S)= 1$

7 The probability of an impossible event is 0. $P(\phi) = 0$

8 The probability that the event A will not occur $P(\bar{A}) = 1 - P(A)$

9 $P(A) + P(\bar{A}) = 1$

10 $P(A \cap \bar{B}) = P(A) - P(A \cap B)$

11 **Addition theorem on probability**

$$P(A \cup B) = P(A) + P(B) - P(A \cap B)$$

12 If A and B are mutually exclusive events, Then $P(A \cap B) = \phi$

Thus $P(A \cup B) = P(A) + P(B)$

Try , try and try again you will succeed atlast

Wish you all the Best

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