

I. Choose the correct answer:

10x1=10

1. The value of $2+4+6+\dots+2n$ is _____.
 a. $\frac{n(n-1)}{2}$ b. $\frac{n(n+1)}{2}$ c. $\frac{2n(2n+1)}{2}$ d. $n(n+1)$
2. The sequence $\frac{1}{\sqrt{3}}, \frac{1}{\sqrt{3}+\sqrt{2}}, \frac{1}{\sqrt{3}+2\sqrt{2}}, \dots$ form an _____.
 a. A.P b. G.P c. H.P d. AGP
3. The n^{th} term of the sequence $\frac{1}{2}, \frac{3}{4}, \frac{7}{8}, \frac{15}{16}, \dots$ is _____.
 a. $2^n - n - 1$ b. $1 - 2^{-n}$ c. $2^{-n} + n - 1$ d. 2^{n-1}
4. The sum of an infinite GP is 18. If the first term is 6, the common ratio is _____.
 a. $\frac{1}{3}$ b. $\frac{2}{3}$ c. $\frac{1}{6}$ d. $\frac{3}{4}$
5. If the point (8,-5) lies on the locus $\frac{x^2}{16} - \frac{y^2}{25} = k$ then the value of K is _____.
 a. 0 b. 1 c. 2 d. 3
6. The image of the point (2,3) in the line $y=-x$ is _____.
 a. (-3,-2) b. (-3,2) c. (-2,-3) d. (3,2)
7. The length of the perpendicular from the origin to the line $\frac{x}{3} - \frac{y}{4} = 1$ is _____.
 a. $\frac{11}{5}$ b. $\frac{5}{12}$ c. $\frac{12}{5}$ d. $\frac{-5}{12}$
8. If one of the lines given by $6x^2 - xy + 4cy^2 = 0$ is $3x+4y=0$ then C equals to _____.
 a. -3 b. -1 c. 3 d. 1
9. The area of the triangle formed by the lines $x^2 - 4y^2 = 0$ & $x=a$ is _____.
 a. $2a^2$ b. $\frac{\sqrt{3}}{2}a^2$ c. $\frac{1}{2}a^2$ d. $\frac{2}{\sqrt{3}}a^2$
10. For any positive numbers a&b we have $G.M^2 =$ _____.
 a. \sqrt{ab} b. ab c. $\frac{a+b}{2}$ d. $\frac{2ab}{a+b}$

II. Answer any 4:

$4 \times 2 = 8$

11. Compute 99^4 .
12. Write the first 4 terms of e^{-2x} .
13. Show that the Sum of $(m+n)^{\text{th}}$ & $(m-n)^{\text{th}}$ term of an A.P is equal to twice the m^{th} term.
14. Find the points on the locus of points that are 3 units from x-axis & 5 units from the point (5,1).
15. Rewrite $\sqrt{3}x + y + 4 = 0$ into normal form.

16. Write the equation of the line through the pt (1, 1) & parallel to $x+3y-4=0$.

III. Answer any 4 of the following:

$4 \times 3 = 12$

17. The slope of one of the St. Lines $ax^2 + 2hxy + by^2 = 0$ is twice that of the other, S.T $8h^2=9ab$.
18. Find the image of the point (-2,3) about the line $x+2y-9=0$.
19. If P (r, c) is midpoint of a line segment between the axes then show that $\frac{x}{r} + \frac{y}{c} = 2$.
20. Prove that $\sqrt[3]{x^3 + 6} - \sqrt[3]{x^3 + 3}$ is approximately equal to $\frac{1}{x^2}$ when x is large.
21. If t_k is the k^{th} term of a G.P then ST t_{n-k}, t_n, t_{n+k} also form a G.P for any positive integer K.
22. In the binomial expansion of $(a+b)^n$ if the co-efficients of 4th and 13th terms are equal the find n.

IV. Answer the following:

$3 \times 5 = 15$

23. a. If a,b,c are respectively the $p^{\text{th}}, q^{\text{th}}$ & r^{th} terms of a G.P, show that $(q-r)\log a + (r-p)\log b + (p-q)\log c = 0$.
 (OR)
 b. If p-q is small compared to either p or q, then show that $n \sqrt[p]{q} \cong \frac{(n+1)p + (n-1)q}{(n-1)p + (n-1)q}$.
24. a. Compute the Sum of first n terms of the series $8+88+888+8888+\dots$.
 (OR)
 b. If the points P(6,2) & Q(-2,1) & R are the vertices of ΔPQR & R is the point on the locus $y=x^2-3x+4$ then find the equation of the locus of centroid of ΔPQR .
25. a. Show that the equation $4x^2 + 4xy + y^2 - 6x - 3y - 4 = 0$ represents a pair of parallel lines. find the distance between them.
 (OR)
 b. Find all the equations of the straight lines in the family of the lines $y=mx-3$ for which m & the x co-ordinate of the point of intersection of the lines with $x-y=6$ are integers.

- The value of $2+4+6+\dots+2n$ is _____.
 a) $\frac{n(n-1)}{2}$ b) $\frac{n(n+1)}{2}$ c) $\frac{2n(2n+1)}{2}$ d) $n(n+1)$
- If $nC_{10} > nC_r$ for all possible r, then a value of n is _____.
 a) 10 b) 21 c) 9 d) 20
- The sequence $\frac{1}{\sqrt{3}}, \frac{1}{\sqrt{3}+\sqrt{2}}, \frac{1}{\sqrt{3}+2\sqrt{2}}, \dots$ form an _____.
 a) AP b) GP c) HP d) AGP
- The length of \perp from the origin to the line $\frac{x}{3} - \frac{y}{4} = 1$ is _____.
 a) $\frac{11}{5}$ b) $\frac{5}{12}$ c) $\frac{12}{5}$ d) $\frac{-5}{12}$
- θ is acute angle between the lines $x^2 - xy - 6y^2 = 0$ then $\frac{2 \cos \theta + 3 \sin \theta}{4 \sin \theta + 5 \cos \theta}$ is _____.
 a) 1 b) $-\frac{1}{9}$ c) $\frac{5}{9}$ d) $\frac{1}{9}$
- If the point (8, -5) lies on the locus $\frac{x^2}{16} - \frac{y^2}{25} = k$ then the value of k is _____.
 a) 0 b) 1 c) 2 d) 3
- _____ of a line is the point at which the line crosses either x-axis or the y-axis.
 a) Intercept b) Distance c) Locus d) Parameter
- If $A = \begin{pmatrix} a & x \\ y & \theta \end{pmatrix}$ and if $xy=1$, then $\det(AA^T)$ is equal to _____.
 a) $(a-1)^2$ b) $(a^2+1)^2$ c) a^2-1 d) $(a^2-1)^2$
- If $A = \begin{pmatrix} \lambda & 1 \\ -1 & -\lambda \end{pmatrix}$ then for what value of λ , $A^2=0$?
 a) 0 b) ± 1 c) -1 d) 1
- A square matrix A is said to be _____.
 a) Skew-symmetric b) diagonal matrix
 c) scalar multiplication d) skew-non-symmetric

II. Answer any 4 from the following:

4x2=8

Q.No.16 is compulsory:

- If $A = \begin{pmatrix} 1 & a \\ 0 & 1 \end{pmatrix}$, then compute A^4 .
- Find the middle term of the expansion $(x+y)^6$
- The number of bacteria in a certain culture doubles every hour. If there were 30 bacteria present in the culture originally, how many bacteria will be present at the end of 2nd hour, 4th hour and nth hour?
- Express the equation $\sqrt{3}x - y + 4 = 0$ in slope and intercept form.

15. Show that $4x^2 + 4xy + y^2 - 6x - 3y - 4 = 0$ represents a pair of parallel lines.

16. Write the first 6 terms of the exponential series, e^{5x} .

III. Answer any 4 from the following:

4x3=12

Q.No.22 is compulsory:

- Solve for x if $[x \ 2 \ -1] \begin{pmatrix} 1 & 1 & 2 \\ -1 & -4 & 1 \\ -1 & -1 & -2 \end{pmatrix} \begin{pmatrix} x \\ 2 \\ 1 \end{pmatrix} = 0$
- The slope of one of the straight lines $ax^2 + 2hxy + 6y^2 = 0$ is twice that of the other, show that $8h^2 = 9ab$.
- If the line joining two points A(2, 0) and B(3, 1) is rotated about A in anticlockwise direction through an angle of 15° , then find the equation of the line in new position.
- Population of a city in the years 2005 and 2010 are 1,35,000 and 1,45,000 respectively. Find the approximate population in the year 2015 (Assuming that the growth of population is constant).
- If a, b, c are in geometric progression and if $a^{\frac{1}{x}} = b^{\frac{1}{y}} = c^{\frac{1}{z}}$, then prove that x, y, z are in arithmetic progression.
- Find the coefficient of x^{15} in $\left(x^2 + \frac{1}{x^3}\right)^{10}$
- Find the value of n if the sum to n terms of the series $\sqrt{3} + \sqrt{75} + \sqrt{243} + \dots$ is $435\sqrt{3}$.
- Answer the following: 3x5=15
- a) Prove that $\sqrt[3]{x^3 + 6} - \sqrt[3]{x^3 + 3}$ is approximately equal to $\frac{1}{x^2}$ when x is sufficiently large. (OR)
 b) The AM of two numbers exceeds their GM by 10 and HM by 16. Find the numbers.
- a) Show that the sum of $(m+n)^{\text{th}}$ and $(m-n)^{\text{th}}$ term of an A.P is equal to twice the mth term. (OR)
 b) A straight rod of length 8 units slides with its ends A and B always on the x and y axes respectively. Find the locus of the midpoint of the line segment AB.
- a) Show that the equation $2x^2 - xy - 3y^2 - 6x + 19y - 20 = 0$ represents a pair of intersecting lines. Show further that the angle between them is $\tan^{-1}(5)$. (OR)
 b) Express the matrix $A = \begin{pmatrix} 1 & 3 & 5 \\ -6 & 8 & 3 \\ -4 & 6 & 5 \end{pmatrix}$ as the sum of a symmetric and a skew-symmetric matrices.