Answer any 6 questions from 1 to 8. Each carries 3 scores.

1. (i) If $A = \{1, 2, 3\}$ and $B = \{1, 4\}$, then the number of subsets of $A \times B$ is (1)

(a) 5^2 (b) 6^2

(c) 2^5 (d) 2^6

(ii) If $\left(\dfrac{x}{3} + 1, y - \dfrac{2}{3}\right) = \left(-\dfrac{2}{3}, \dfrac{2}{3}\right)$, then find x and y. (2)

2. (i) $\cos(x + y) + \cos(x - y) = $ _____. (1)

(ii) Prove that $\cos\left(\dfrac{3\pi}{4} + x\right) + \cos\left(\dfrac{3\pi}{4} - x\right) = -\sqrt{2}\cos x$. (2)

3. (i) Solve the inequality $x + \dfrac{x}{2} + \dfrac{x}{3} \le 10 + \dfrac{x}{6}$. (2)

(ii) Mark the solution in a number line. (1)

4. (i) $^nC_r = $ _____. (1)

(a) $\dfrac{n!}{r!}$ (b) $\dfrac{n!}{(n-r)!}$

(c) $\dfrac{n!}{r!(n-r)!}$ (d) $\dfrac{n(n-1)}{r!}$

(ii) In how many ways a committee consisting of 3 men and 2 women, can be chosen from 7 men and 5 women ? (2)

5. (i) Sum of all coefficients in the Binomial expansion of $(1 + x)^n$ is _____. (1)

(ii) Using Binomial theorem expand $\left(\dfrac{x}{3} + \dfrac{3}{x}\right)^4$. (2)

6. Consider the line $L_1 : 3x - 4y + 12 = 0$ and a point $A(2, -3)$.

(i) Find the equation of the line passing through A and parallel to the given line L_1. (2)

(ii) Find the distance from the origin to the given line L_1. (1)

7. Find the coordinates of focus, equation of directrix and length of latus rectum of the parabola $x^2 = 12y$.

8. (i) $\displaystyle\lim_{x \to a} \frac{x^n - a^n}{x - a} = $ _____. (1)

(ii) If $\displaystyle\lim_{x \to 2} \frac{x^n - 2^n}{x - 2} = 32$, then find the value of n. (2)

Answer any 6 questions from 9 to 16. Each carries 4 scores. (6 × 4 = 24)

9. (i) $A \cap A' = $ _____. (1)

(ii) If $U = \{1, 2, 3, 4, 5, 6\}$, $A = \{2, 3, 4\}$ and $B = \{2, 3, 4, 6\}$, then verify that $(A \cap B)' = A' \cup B'$. (3)

10. (i) Draw the graph of the function, $f : \mathbb{R} - \{0\} \to \mathbb{R}$ defined by $f(x) = \dfrac{1}{x}$. (2)

(ii) Find the domain and range of $f(x) = \sqrt{9 - x^2}$. (2)

11. (i) Express $(1 - i)^6$ in $x + iy$ form. (2)

(ii) Find the coordinates that represent the complex number $\dfrac{1 - i}{1 + i}$ in the argand plane. (2)

12. (i) If $^nP_r = 840$ and $^nC_r = 35$, then find the value of r. (2)

(ii) Find the number of permutations of the letters of the word ATTITTUDE. (2)

13. The vertices of $\triangle PQR$ are P(1, 0), Q(5, 4) and R(–1, 4).

(i) Find the equation of the line representing the side PQ. (2)

(ii) Find the equation of the line through R and perpendicular to the side PQ. (2)

14. An ellipse has its foci on (± 4, 0) and vertices at (± 5, 0)

(i) Find the length of the minor axis. (1)

(ii) Find the length of the latus rectum and eccentricity of the ellipse. (2)

(iii) Also write the equation of the ellipse. (1)

15. (i) Give an example of any one point which lie in second octant. (1)

(ii) Show that the points A(0, 7, 10), B(–1, 6, 6) and C(–4, 9, 6) are the vertices of a right angled triangle. (3)

16. A bag contains 8 red and 5 white balls. Three balls are drawn at random. Find the probability that

    (i)   All the three balls are white **(1)**

    (ii)   All the three balls are red **(1)**

    (iii) One ball is red and two balls are white **(2)**

Answer any 3 questions from 17 to 20. Each carries 6 scores. **(3 × 6 = 18)**

17. (i) $\dfrac{1 - \tan^2 15^\circ}{1 + \tan^2 15^\circ} = $ _____. **(1)**

       (a) $\dfrac{1}{\sqrt{3}}$ (b) $\dfrac{\sqrt{3}}{2}$

       (c) 2   (d) $\sqrt{3}$

    (ii) Prove that $\dfrac{\sin 3x - \sin x}{\cos^2 x - \sin^2 x} = 2 \sin x.$ **(2)**

    (iii) If $\tan \theta = \dfrac{1}{2}$ and $\tan \phi = \dfrac{1}{3}$, then show that $\theta + \phi = \dfrac{\pi}{4}$. **(3)**

18. (i) Which term of the G.P. 2, 8, 32, ... is 32768 ? **(2)**

    (ii) The sum of first three terms of a G.P. is 14 and sum of next three terms is 112. Find the common ratio, first term and the sum to first n terms of the G.P. **(4)**

19. (i) Using first principle find the derivative of $f(x) = \dfrac{1}{x}$. **(3)**

    (ii) Find $\dfrac{d}{dx}\left(\dfrac{x^2 + 1}{x^2 - 1}\right)$. **(3)**

20. (i) Find the mean deviation about mean of the following data :

       4, 7, 8, 9, 10, 12, 13, 17. **(2)**

    (ii) Find the variance of the following frequency data : **(4)**

Class	4 – 8	8 – 12	12 – 16	16 – 20
Frequency	3	6	4	7