



**PART A**

**I. Answer all the multiple-choice questions:**

**1 × 15 = 15**

1. If  $A = (-3, 5)$  and  $B = [-7, 9]$ , then  
(a)  $A = B$                       (b)  $A \subset B$                       (c)  $B \subset A$                       (d)  $A \not\subset B$
2. If  $(x+3, y-1) = (-2, 1)$   
(a)  $x = -5, y = 0$               (b)  $x = -5, y = 2$               (c)  $x = -5, y = -2$               (d)  $x = 5, y = 0$
3. The radian measure of  $25^\circ$  is equal to  
(a)  $\frac{5\pi}{36}$                               (b)  $\frac{4\pi}{18}$                               (c)  $\frac{5\pi}{18}$                               (d)  $\frac{4\pi}{36}$
4. The multiplicative inverse of  $2 - 3i$  is  
(a)  $\frac{2}{13} + \frac{3}{13}i$                       (b)  $\frac{2}{13} - \frac{3}{13}i$                       (c)  $\frac{2}{13} * \frac{3}{13}i$                       (d)  $-\frac{2}{13} - \frac{3}{13}i$
5. Graph of system of inequalities  $x \geq 0, y \leq 0$  is  
(a) First                              (b) Second                              (c) Third                              (d) Forth
6. If  ${}^6P_r = 360, {}^6C_8 = 15$  then the value of r is  
(a) 5                                      (b) 6                                      (c) 4                                      (d) 3
7. If n is a +ve integer, then the number of terms in expansion of  $(a+b)^n$  is  
(a) n                                      (b) n+1                                      (c) n-1                                      (d) 2n
8. The value/s of x such that  $\frac{-2}{7}, x, \frac{-7}{2}$  are in G.P  
(a) 1                                      (b)  $\pm 1$                                       (c) 2                                      (d)  $\pm 2$
9. The slope of the line  $ax + by + c = 0$  is  
(a)  $\frac{a}{b}$                                       (b)  $\frac{-a}{b}$                                       (c)  $\frac{-c}{b}$                                       (d)  $\frac{c}{b}$
10. The equation of parabola with focus  $(0, -3)$  and directrix  $y - 3 = 0$   
(a)  $x^2 = 12y$                       (b)  $x^2 = -12y$                       (c)  $y^2 = 12x$                       (d)  $y^2 = -12x$
11. The center of the circle  $(x+3)^2 + (y-2)^2 = 16$  is  
(a)  $(3, -2)$                               (b)  $(3, 2)$                               (c)  $(-3, 2)$                               (d)  $(-3, -2)$
12. The octant in which the point  $(5, 5, -4)$  lies  
(a) First                                      (b) Sixth                                      (c) Fifth                                      (d) Second
13. The derivative of  $x^{-1}$  with respect to x is  
(a)  $x^2$                                       (b)  $\frac{-1}{x^2}$                                       (c) 1                                      (d) 0
14. The mean of first n natural numbers is  
(a)  $\frac{n}{2}$                                       (b)  $\frac{n+1}{2}$                                       (c)  $\frac{n}{2} + 1$                                       (d)  $\frac{n^2 + n + 1}{2}$
15. The equation of parabola with focus  $(0, -3)$  and directrix  $y - 3 = 0$   
(a)  $x^2 = 12y$                       (b)  $x^2 = -12y$                       (c)  $y^2 = 12x$                       (d)  $y^2 = -12x$

**II. Fill in the blanks by choosing the appropriate answer from those given in the bracket** **1 × 5 = 5**  
 {16, 1, -1, 3, 0, 20}

16. If  $A = \{1, 2\}$  and  $B = \{3, 4\}$ , then the number of relations from A to B is \_\_\_\_\_
17. The value of  $\sin(3\pi)$  is \_\_\_\_\_
18. The value of  $\frac{3!}{2!}$  is \_\_\_\_\_
19. The slope of the line passing through the points (3, -2) and (7, -2) is \_\_\_\_\_
20. The derivative of  $x^2$  at  $x = 10$  is \_\_\_\_\_

**PART B**

**III. Answer any six questions**

**2 × 6 = 12**

21. If  $A = \{3, 6, 9, 12, 15, 18, 21\}$ ,  $B = \{4, 8, 12, 16, 20\}$ ,  $C = \{2, 4, 6, 8, 10, 12, 14, 16\}$ , find  $A - B$  and  $B - A$
22. List all the subsets of  $\{1, 2, 3, 4\}$
23. Prove that  $\sin^2 \frac{\pi}{6} + \cos^2 \frac{\pi}{3} - \tan^2 \frac{\pi}{4} = \frac{-1}{2}$
24. Find the multiplicative inverse of  $-i$
25. If  $a + ib = \frac{(x+i)^2}{2x^2+1}$ , Prove that  $a^2 + b^2 = \frac{(x^2+1)^2}{(2x^2+1)^2}$
26. Solve  $\frac{3x-4}{2} \geq \frac{x+1}{4} - 1$ . Show the graph of the solutions on number line.
27. How many 3 digit even numbers can be formed from the digits 1, 2, 3, 4, 5, 6 if the digits can be repeated.
28. Expand  $(2x-3)^6$  using Binomial theorem
29. Find the equation of the line parallel to the line  $3x-4y+20=0$  and passing through the point (-2, 3)
30. Evaluate  $\lim_{x \rightarrow 0} \left( \frac{\sqrt{1+x}-1}{x} \right)$
31. A die is rolled. Let E be the event "die shows 4", F be the event "die shows even number". Are E and F mutually exclusive.

**PART C**

**IV. Answer any six questions**

**3 × 6 = 18**

32. Let  $U = \{1, 2, 3, 4, 5, 6\}$ ,  $A = \{2, 3\}$ ,  $B = \{3, 4, 5\}$ . Prove that  $(A \cup B)' = A' \cap B'$ .
33. Let  $f(x) = \sqrt{x}$ ,  $g(x) = x$ , be two functions defined over the set of non-negative real numbers. Find  $(f+g)(x)$ ,  $(f-g)(x)$ ,  $(fg)(x)$ ,  $\left(\frac{f}{g}\right)(x)$
34. Prove that  $\sin(3x) = 3\sin x - 4\sin^3 x$
35. If  $\sec x = \frac{13}{5}$ ,  $x$  lies in fourth quadrant. Find the other 5 trigonometric functions
36. Express the following expression in the form of  $(a+ib)$
- $$\frac{(3+i\sqrt{5})(3-i\sqrt{5})}{(\sqrt{3}+i\sqrt{2})-(\sqrt{3}-i\sqrt{2})}$$
37. Find all pairs of consecutive odd positive integers both of which are smaller than 10 such that their sum is more than 11.
38. Find a G.P. whose sum of first two terms is -4 and the fifth term is four times the third term.

39. Derive the equation of a line with x-intercept 'a' and y-intercept 'b' in the form  $\frac{x}{a} + \frac{y}{b} = 1$
40. Find the equation of the ellipse with center at (0, 0), major axis on Y-axis and passes through the points (3, 2) and (1, 6).
41. Show that the points (-1, 2, 1), (1, -2, 5), (4, -7, 8), (2, -3, 4) are vertices of parallelogram.
42. Find the derivative of  $\tan x$  with respect to x from first principle.

**PART D****V. Answer any four questions****4 × 4 = 16**

43. Define Modulus function, draw the graph, write the domain and range.
44. Prove that  $\frac{\sin 5x - 2 \sin 3x + \sin x}{\cos 5x - \cos x} = \tan x$
45. A group consists of 4 girls and 7 boys. In how many ways can a team of 5 members be selected if the team has  
 (a) No girl                      (b) At least one boy and one girl                      (c) At least three girls
46. Prove that for every positive integer n,  
 $(a + b)^n = {}^n C_0 a^n + {}^n C_1 a^{n-1} b + {}^n C_2 a^{n-2} b^2 + \dots + {}^n C_{n-1} a b^{n-1} + {}^n C_n b^n$
47. Derive the formula to find distance of a point  $P(x_1, y_1)$  from the line  $Ax + By + C = 0$
48. Prove geometrically  $\lim_{x \rightarrow 0} \left( \frac{\sin x}{x} \right) = 1$ , x measured in radians.
49. Find the mean deviation about mean for the following data

Marks	10-20	20-30	30-40	40-50	50-60	60-70	70-80
No. of Students	2	3	8	14	8	3	2

50. A letter is chosen at random from the word ASSASSINATION. Find the probability that the letter is  
 (a) Vowel      (b) Consonants      (c) 2 I's comes together      (d) Vowels comes together

**PART E****VI. Answer the following questions****10 × 1 = 10**

51. Prove geometrically that  $\cos(x + y) = \cos x \cos y - \sin x \sin y$

**(6)****OR**

Define hyperbola as a set of points and derive the equation of the hyperbola in the form  $\frac{x^2}{a^2} - \frac{y^2}{b^2} = 1$

52. Find the sum to n terms of the sequence 8, 88, 888, 8888, ....

**(4)****OR**

Find the derivative of  $f(x) = \frac{x + \cos x}{\tan x}$  with respect to x

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