

Part-I

I. Choose the correct answer:

20x1=20

1. The value $\begin{vmatrix} 5 & 5 & 5 \\ 4x & 4y & 4z \\ -3x & -3y & -3z \end{vmatrix}$ is _____.

- a) 5 b) 4 c) 0 d) -3

2. If $\begin{vmatrix} x & 2 \\ 8 & 5 \end{vmatrix} = 0$ then the value of x is _____.

- a) $\frac{-5}{6}$ b) $\frac{5}{6}$ c) $\frac{-16}{5}$ d) $\frac{16}{5}$

3. The middle term in the expansion of $(x + \frac{1}{x})^{10}$ is _____.

- a) $10C_4(\frac{1}{x})$ b) $10C_5$ c) $10C_6$ d) $10C_7x^4$

4. In $nP_r = 720$ (nC_r) then r is equal to _____.

- a) 4 b) 5 c) 6 d) 7

5. The x-intercept of the straight line $3x+2y-1=0$ is _____.

- a) 3 b) 2 c) $\frac{1}{3}$ d) $\frac{1}{2}$

6. The value of $\sin 15^\circ \cos 15^\circ$ is _____.

- a) $\frac{1}{\sqrt{2}}$ b) $\frac{1}{2}$ c) $\frac{\sqrt{3}}{2}$ d) $\frac{1}{4}$

7. The value of $\sin (-420^\circ)$ is _____.

- a) $\frac{\sqrt{3}}{2}$ b) $\frac{-\sqrt{3}}{2}$ c) $\frac{1}{2}$ d) $\frac{-1}{2}$

8. The slope of the line $7x+5y-8=0$ is _____.

- a) $\frac{7}{5}$ b) $\frac{-7}{5}$ c) $\frac{5}{7}$ d) $\frac{-5}{7}$

9. The graph of $y=2x^2$ is passing through

- a) (0, 0) b) (2, 1) c) (2, 0) d) (0, 2)

10. The range of $f(x)=|x|$, for all $x \in \mathbb{R}$ is _____.

- a) (0, ∞) b) [0, ∞) c) $(-\infty, \infty)$ d) [1, ∞)

11. If $y = \log x$, then $y_2 =$ _____

- a) $\frac{1}{x}$ b) $\frac{-1}{x^2}$ c) $\frac{-2}{x^2}$ d) e^2

12. If $f(x)=x^2$ and $g(x)=2x+1$ then $(fg)(0)$ is _____.

- a) 0 b) 2 c) 1 d) 4

13. $\lim_{x \rightarrow 0} \frac{e^x - 1}{x} =$ _____

- a) e b) nx^{n-1} c) 1 d) 0

14. $\frac{d}{dx}(a^x) =$ _____

- a) $\frac{1}{x \log_e a}$ b) a^a c) $x \log_e a$ d) $a^x \log_e a$

15. The equation of directrix of parabola $y^2 = -x$ is _____.

- a) $4x+1=0$ b) $4x-1=0$ c) $x-4=0$ d) $x+4=0$

16. The number of ways selecting 4 players out of 5 is _____.

- a) 4! b) 20 c) 25 d) 5

17. The sum of the binomial coefficient is _____.

- a) 2^n b) n^2 c) $2n$ d) $n+17$

18. If $\begin{vmatrix} 4 & 3 \\ 3 & 1 \end{vmatrix} = -5$ then the value of $\begin{vmatrix} 20 & 15 \\ 15 & 5 \end{vmatrix}$ is _____.

- a) -5 b) -125 c) -15 d) 0

19. The possible outcomes when a coin is tossed five times _____.

- a) 2^5 b) 5^2 c) 10 d) $\frac{5}{2}$

20. Equation of straight line whose x and y intercepts are 'a' and 'b' is _____.

- a) $\frac{y-y_1}{y_2-y_1} = \frac{x-x_1}{x_2-x_1}$ b) 0 c) $\frac{x}{a} + \frac{y}{b} = 1$ d) $y = \frac{m_2 - m_1}{x_2 - x_1}$

II. Answer any 7 of the following, Q.No.30 is compulsory: $7 \times 2 = 14$

21. Solve $\begin{vmatrix} 7 & 4 & 11 \\ -3 & 5 & x \\ -x & 3 & 1 \end{vmatrix} = 0$

22. The technology matrix of an economic systems of two

industries is $\begin{pmatrix} 0.8 & 0.2 \\ 0.9 & 0.7 \end{pmatrix}$. Test whether the system is viable as per Hawkins-Simon condition.

23. If $(n+2)C_n=45$, find n .
24. Find the rank of the word 'MODEL' in dictionary.
25. Find the acute angle between the lines $2x-y+3=0$ and $x+y+2=0$.
26. Find the value of p if the line $3x+4y-p=0$ is the tangent to the circle $x^2+y^2=16$.
27. Convert into the product of trigonometric functions $\cos 8A + \cos 12A$
28. If $f(x)=x+\frac{1}{x}$, then show that $[f(x)]^3=f(x^3)+3f\left(\frac{1}{x}\right)$
29. Evaluate $\lim_{x \rightarrow \infty} \frac{2x+5}{x^2+3x+9}$
30. In any quadrilateral ABCD, prove that $\sin(A+B)+\sin(C+D)=0$
- III. Answer any 7 of the following, Q.No.40 is compulsory: $7 \times 3=21$
31. If $A = \begin{bmatrix} 2 & -2 & 2 \\ 2 & 3 & 0 \\ 9 & 1 & 5 \end{bmatrix}$ then show that $(\text{adj } A)A=0$
32. Solve by using matrix inversion method $2x+5y=1$
 $3x+2y=7$
33. By the principle of mathematical induction prove that n^2+n is an even number for all $n \in \mathbb{N}$.
34. Find the 5th term in the expansion $(x-2y)^{13}$
35. If the lines $x+y=6$ and $x+2y=4$ are diameters of the circle and the circle passes through the point $(2, 6)$ then find the equation.
36. Find the equation of the circle whose centre is $(-3, -2)$ and having circumference 16π .
37. Show that $\sin 20^\circ \sin 40^\circ \sin 60^\circ \sin 80^\circ = \frac{3}{16}$
38. Solve $\tan^{-1} 2x + \tan^{-1} 3x = \frac{\pi}{4}$
39. If $f(x) = \frac{x^7-128}{x^5-32}$, then find $\lim_{x \rightarrow 2} f(x)$

40. Find $\frac{dy}{dx}$ at $(1, 1)$ to the curve $2x^2+3xy+5y^2=10$

IV. Answer any 7 of the following: $7 \times 5=35$

41. Two commodities A and B are produced such that 0.4 tonnes of A and 0.7 tonnes of B are required to produce a tone of A. Similarly 0.1 tonnes of A and 0.7 tonnes of B are needed to produce a tone of B. Write down the technology matrix is 6.8 tonnes of A and 10.2 tonnes of B are required. Find the gross production of both of them.
42. Resolve in to partial fraction $\frac{x^2-3}{(x+2)(x^2+1)}$
43. Show that equation $2x^2+7xy+3y^2+5x+5y+2=0$ represent two straight lines and find their separate equation.
44. If $\sin \alpha + \sin \beta = a$ and $\cos \alpha + \cos \beta = b$, then prove that $\cos(\alpha-\beta) = \frac{a^2+b^2-2}{2}$
45. If $y = (x + \sqrt{1+x^2})^m$ then show that $(1+x^2)y_2 + xy_1 - m^2y = 0$
46. Find the axis, vertex, focus, equation of directrix and length of latus rectum for the parabola $x^2+6x-4y+21=0$
47. In how many ways can a cricket team of 11 players be chosen out of a batch of 15 players?
(i) There is no restriction on the selection (ii) A particular player is always chosen (iii) A particular player is never chosen.
48. Differentiate $\sqrt{\frac{(x-3)(x^2+4)}{3x^2+4x+5}}$
49. If $\sin(y+z-x)$, $\sin(z+x-y)$, $\sin(x+y-z)$ are in A.P, then prove $\tan x$, $\tan y$ and $\tan z$ are in A.P
50. By principle of mathematical induction, prove that $1.2 + 2.3 + 3.4 + \dots + n(n+1) = \frac{n(n+1)(n+2)}{3}$, for all $n \in \mathbb{N}$.