

MATHEMATICS

1. If $\frac{\text{Log } x}{a-b} = \frac{\text{Log } y}{b-c} = \frac{\text{Log } z}{c-a}$ then $xyz =$
- | | |
|-------|------|
| 1) 0 | 2) 1 |
| 3) -1 | 4) 2 |
2. The last digit in 7^{300} is
- | | |
|------|------|
| 1) 7 | 2) 9 |
| 3) 1 | 4) 3 |
3. How many numbers of 6 digits can be formed from the digits of the number 112233 ?
- | | |
|-------|--------|
| 1) 30 | 2) 60 |
| 3) 90 | 4) 120 |
4. The number of solutions for the equation $x^2 - 5|x| + 6 = 0$ is
- | | |
|------|------|
| 1) 4 | 2) 3 |
| 3) 2 | 4) 1 |
5. $0.5737373 \dots =$
- | | |
|----------------------|----------------------|
| 1) $\frac{284}{497}$ | 2) $\frac{284}{495}$ |
| 3) $\frac{568}{999}$ | 4) $\frac{567}{990}$ |
-

(Space for Rough Work)

6. If $ax^2 - y^2 + 4x - y = 0$ represents a pair of lines then $a = \dots\dots\dots$
- | | |
|--------|-------|
| 1) -16 | 2) 16 |
| 3) 4 | 4) -4 |
7. What is the equation of the locus of a point which moves such that 4 times its distance from the x -axis is the square of its distance from the origin?
- | | |
|-------------------------|---------------------------|
| 1) $x^2 + y^2 - 4y = 0$ | 2) $x^2 + y^2 - 4 y = 0$ |
| 3) $x^2 + y^2 - 4x = 0$ | 4) $x^2 + y^2 - 4 x = 0$ |
8. Equation of the straight line making equal intercepts on the axes and passing through the point (2, 4) is $\dots\dots\dots$
- | | |
|---------------------|----------------------|
| 1) $4x - y - 4 = 0$ | 2) $2x + y - 8 = 0$ |
| 3) $x + y - 6 = 0$ | 4) $x + 2y - 10 = 0$ |
9. If the area of the triangle with vertices $(x, 0)$, $(1, 1)$ and $(0, 2)$ is 4 square units then a value of x is $\dots\dots\dots$
- | | |
|-------|-------|
| 1) -2 | 2) -4 |
| 3) -6 | 4) 8 |
10. $\lim_{\theta \rightarrow \frac{\pi}{2}} \frac{\frac{\pi}{2} - \theta}{\cot \theta} =$
- | | |
|------|-------------|
| 1) 0 | 2) -1 |
| 3) 1 | 4) ∞ |

(Space for Rough Work)

16. Which of the following is the inverse of the proposition : "If a number is a prime then it is odd" ?

- 1) If a number is not a prime then it is odd.
- 2) If a number is not a prime then it is not odd.
- 3) If a number is not odd then it is not a prime.
- 4) If a number is odd then it is a prime.

17. $\sim p \wedge q$ is logically equivalent to

- 1) $p \rightarrow q$
- 2) $q \rightarrow p$
- 3) $\sim (p \rightarrow q)$
- 4) $\sim (q \rightarrow p)$

18. What must be the matrix X if $2X + \begin{bmatrix} 1 & 2 \\ 3 & 4 \end{bmatrix} = \begin{bmatrix} 3 & 8 \\ 7 & 2 \end{bmatrix}$?

- 1) $\begin{bmatrix} 1 & 3 \\ 2 & -1 \end{bmatrix}$
- 2) $\begin{bmatrix} 1 & -3 \\ 2 & -1 \end{bmatrix}$
- 3) $\begin{bmatrix} 2 & 6 \\ 4 & -2 \end{bmatrix}$
- 4) $\begin{bmatrix} 2 & -6 \\ 4 & -2 \end{bmatrix}$

19. The value of $\begin{vmatrix} 1 & 1 & 1 \\ bc & ca & ab \\ b+c & c+a & a+b \end{vmatrix}$ is

- 1) 1
- 2) 0
- 3) $(a-b)(b-c)(c-a)$
- 4) $(a+b)(b+c)(c+a)$

20. The value of $\begin{vmatrix} 441 & 442 & 443 \\ 445 & 446 & 447 \\ 449 & 450 & 451 \end{vmatrix}$ is

- 1) $441 \times 446 \times 451$
- 2) 0
- 3) -1
- 4) 1

(Space for Rough Work)

21. Inverse of the matrix $\begin{bmatrix} \cos 2\theta & -\sin 2\theta \\ \sin 2\theta & \cos 2\theta \end{bmatrix}$ is

1) $\begin{bmatrix} \cos 2\theta & -\sin 2\theta \\ \sin 2\theta & \cos 2\theta \end{bmatrix}$

2) $\begin{bmatrix} \cos 2\theta & \sin 2\theta \\ \sin 2\theta & -\cos 2\theta \end{bmatrix}$

3) $\begin{bmatrix} \cos 2\theta & \sin 2\theta \\ \sin 2\theta & \cos 2\theta \end{bmatrix}$

4) $\begin{bmatrix} \cos 2\theta & \sin 2\theta \\ -\sin 2\theta & \cos 2\theta \end{bmatrix}$

22. If $|\vec{a}| = 3$, $|\vec{b}| = 4$ then a value of λ for which $\vec{a} + \lambda\vec{b}$ is perpendicular to $\vec{a} - \lambda\vec{b}$ is

1) $\frac{9}{16}$

2) $\frac{3}{4}$

3) $\frac{3}{2}$

4) $\frac{4}{3}$

23. $(\vec{a} \cdot \hat{i})\hat{i} + (\vec{a} \cdot \hat{j})\hat{j} + (\vec{a} \cdot \hat{k})\hat{k} =$

1) \vec{a}

2) $2\vec{a}$

3) $3\vec{a}$

4) $\vec{0}$

24. The projection of $\vec{a} = 2\hat{i} + 3\hat{j} - 2\hat{k}$ on $\vec{b} = \hat{i} + 2\hat{j} + 3\hat{k}$ is

1) $\frac{1}{\sqrt{14}}$

2) $\frac{2}{\sqrt{14}}$

3) $\sqrt{14}$

4) $\frac{-2}{\sqrt{14}}$

25. In the group $\{1, 2, 3, 4, 5, 6\}$ under multiplication modulo 7, $2^{-1} \times 4 =$

1) 1

2) 4

3) 2

4) 3

(Space for Rough Work)

26. If Q_1 is the set of all rationals other than 1 with the binary operation $*$ defined by $a * b = a + b - ab$ for all a, b in Q_1 then the identity in Q_1 w.r.t. $*$ is
- 1) 1
 - 2) 0
 - 3) -1
 - 4) 2
27. Which of the following is true ?
- 1) The set of all fourth roots of unity is a multiplicative group.
 - 2) The set of all cube roots of unity is an additive group.
 - 3) $(ab)^{-1} = a^{-1}b^{-1}$ for all a, b in any group G .
 - 4) If $(ab)^2 = a^2b^2$ for all a, b in any group G , then the group G is nonabelian.
28. The set of all integral multiples of 5 is a subgroup of
- 1) The set of all rational numbers under multiplication.
 - 2) The set of all integers under multiplication.
 - 3) The set of all nonzero rational numbers under multiplication.
 - 4) The set of all integers under addition.
29. The circle $x^2 + y^2 - 8x + 4y + 4 = 0$ touches
- 1) x - axis
 - 2) y - axis
 - 3) both axes
 - 4) neither x - axis nor y - axis
30. The value of k so that $x^2 + y^2 + kx + 4y + 2 = 0$ and $2(x^2 + y^2) - 4x - 3y + k = 0$ cut orthogonally is
- 1) $\frac{10}{3}$
 - 2) $\frac{-8}{3}$
 - 3) $\frac{-10}{3}$
 - 4) $\frac{8}{3}$

(Space for Rough Work)

31. The coaxal system of circles given by $x^2 + y^2 + 2gx + c = 0$ for $c < 0$ represents.
- 1) intersecting circles
 - 2) non intersecting circles
 - 3) touching circles
 - 4) touching or non intersecting circles
32. The radius of the circle passing through the point (6, 2) and two of whose diameters are $x + y = 6$ and $x + 2y = 4$ is.
- 1) 4
 - 2) 6
 - 3) 20
 - 4) $\sqrt{20}$
33. If (0, 6) and (0, 3) are respectively the vertex and focus of a parabola then its equation is
- 1) $x^2 + 12y = 72$
 - 2) $x^2 - 12y = 72$
 - 3) $y^2 - 12x = 72$
 - 4) $y^2 + 12x = 72$
34. For the ellipse $25x^2 + 9y^2 - 150x - 90y + 225 = 0$ the eccentricity, $e =$
- 1) $\frac{2}{5}$
 - 2) $\frac{3}{5}$
 - 3) $\frac{4}{5}$
 - 4) $\frac{1}{5}$
35. If the foci of the ellipse $\frac{x^2}{16} + \frac{y^2}{b^2} = 1$ and the hyperbola $\frac{x^2}{144} - \frac{y^2}{81} = \frac{1}{25}$ coincide then the value of b^2 is
- 1) 1
 - 2) 7
 - 3) 5
 - 4) 9

(Space for Rough Work)

36. The equation of the director circle of the hyperbola $\frac{x^2}{16} - \frac{y^2}{4} = 1$ is given by

1) $x^2 + y^2 = 16$

2) $x^2 + y^2 = 4$

3) $x^2 + y^2 = 20$

4) $x^2 + y^2 = 12$

37. If $0 \leq x \leq \pi$ and $81^{\sin^2 x} + 81^{\cos^2 x} = 30$ then $x =$

1) $\frac{\pi}{6}$

2) $\frac{\pi}{2}$

3) $\frac{\pi}{4}$

4) $\frac{3\pi}{4}$

38. If $\sin^{-1} \frac{x}{5} + \operatorname{Cosec}^{-1} \frac{5}{4} = \frac{\pi}{2}$ then $x =$

1) 1

2) 4

3) 3

4) 5

39. If $\cos^{-1} p + \cos^{-1} q + \cos^{-1} r = \pi$ then $p^2 + q^2 + r^2 + 2pqr =$

1) 3

2) 1

3) 2

4) -1

40. The smallest positive integer n for which $(1+i)^{2n} = (1-i)^{2n}$ is

1) 1

2) 2

3) 3

4) 4

(Space for Rough Work)

41. If $x + \frac{1}{x} = 2 \cos \alpha$ then $x^n + \frac{1}{x^n} =$
- 1) $2^n \cos \alpha$ 2) $2^n \cos n\alpha$
 3) $2i \sin n\alpha$ 4) $2 \cos n\alpha$
42. If $w = \frac{-1 + \sqrt{3}i}{2}$ then $(3 + w + 3w^2)^4 =$
- 1) 16 2) -16
 3) $16w$ 4) $16w^2$
43. If $f(x) = \begin{cases} \frac{1 - \cos x}{x}, & x \neq 0 \\ k, & x = 0 \end{cases}$ is continuous at $x = 0$, then $k =$
- 1) 0 2) $\frac{1}{2}$
 3) $\frac{1}{4}$ 4) $-\frac{1}{2}$
44. If $y = \tan^{-1}(\sec x - \tan x)$ then $\frac{dy}{dx} =$
- 1) 2 2) -2
 3) $\frac{1}{2}$ 4) $-\frac{1}{2}$
45. The differential coefficient of $f(\sin x)$ w.r.t. x where $f(x) = \log x$ is
- 1) $\tan x$ 2) $\cot x$
 3) $f(\cos x)$ 4) $\frac{1}{x}$

(Space for Rough Work)

46. If $x = a \left(t - \frac{1}{t} \right)$, $y = a \left(t + \frac{1}{t} \right)$ then $\frac{dy}{dx} =$

1) $\frac{y}{x}$

2) $\frac{-y}{x}$

3) $\frac{x}{y}$

4) $\frac{-x}{y}$

47. If $x = A \cos 4t + B \sin 4t$ then $\frac{d^2x}{dt^2} =$

1) $-16x$

2) $16x$

3) x

4) $-x$

48. For the curve $y^n = a^{n-1}x$ if the subnormal at any point is a constant then $n =$

1) 1

2) 2

3) -2

4) -1

49. If the distance 's' metres traversed by a particle in 't' seconds is given by $s = t^3 - 3t^2$, then the velocity of the particle when the acceleration is zero, in metres/sec is

1) 3

2) -2

3) -3

4) 2

50. The maximum of the function $3 \cos x - 4 \sin x$ is

1) 2

2) 3

3) 4

4) 5

(Space for Rough Work)

51. If a tangent to the curve $y = 6x - x^2$ is parallel to the line $4x - 2y - 1 = 0$, then the point of tangency on the curve is

1) (2, 8)

2) (8, 2)

3) (6, -1)

4) (4, 2)

52. $\int \frac{dx}{x^2 + 2x + 2} =$

1) $\text{Sin}^{-1}(x+1) + c$

2) $\text{Sinh}^{-1}(x+1) + c$

3) $\text{Tanh}^{-1}(x+1) + c$

4) $\text{Tan}^{-1}(x+1) + c$

53. $\int \sqrt{x} e^{\sqrt{x}} dx =$

1) $2\sqrt{x} - e^{\sqrt{x}} - 4\sqrt{x} e^{\sqrt{x}} + c$

2) $(2x - 4\sqrt{x} + 4)e^{\sqrt{x}} + c$

3) $(2x + 4\sqrt{x} + 4)e^{\sqrt{x}} + c$

4) $(1 - 4\sqrt{x})e^{\sqrt{x}} + c$

54. $\int \frac{dx}{x(x^7+1)} =$

1) $\text{Log} \left(\frac{x^7}{x^7+1} \right) + c$

2) $\frac{1}{7} \text{Log} \left(\frac{x^7}{x^7+1} \right) + c$

3) $\text{Log} \left(\frac{x^7+1}{x^7} \right) + c$

4) $\frac{1}{7} \text{Log} \left(\frac{x^7+1}{x^7} \right) + c$

55. $\int_{-1}^1 |1-x| dx =$

1) -2

2) 0

3) 2

4) 4

(Space for Rough Work)

56. $\int_0^{\pi/2} \frac{\cos x - \sin x}{1 + \cos x \sin x} dx =$

1) 0

2) $\frac{\pi}{2}$

3) $\frac{\pi}{4}$

4) $\frac{\pi}{6}$

57. $\int_0^{\pi/8} \cos^3 4\theta d\theta =$

1) $\frac{2}{3}$

2) $\frac{1}{4}$

3) $\frac{1}{3}$

4) $\frac{1}{6}$

58. The area enclosed between the curves $y = x^3$ and $y = \sqrt{x}$ is, in square units

1) $\frac{5}{3}$

2) $\frac{5}{4}$

3) $\frac{5}{12}$

4) $\frac{12}{5}$

59. The degree of the differential equation $\left(1 + \left(\frac{dy}{dx}\right)^2\right)^{3/4} = \left(\frac{d^2y}{dx^2}\right)^{1/3}$ is

1) $\frac{1}{3}$

2) 4

3) 9

4) $\frac{3}{4}$

60. The general solution of the differential equation $\frac{dy}{dx} + \frac{1 + \cos 2y}{1 - \cos 2x} = 0$ is given by

1) $\tan y + \cot x = c$

2) $\tan y - \cot x = c$

3) $\tan x - \cot y = c$

4) $\tan x + \cot y = c$

(Space for Rough Work)