

MATHEMATICS

1. ${}_7 2 \text{Log}_7^5$ is equal to
- 1) 5
2) $\text{Log}_7 35$
3) $\text{Log}_7 25$
4) 25
2. In the group $(G \otimes_{15})$, where $G = \{3, 6, 9, 12\}$, \otimes_{15} is multiplication modulo 15, the identity element is
- 1) 6
2) 3
3) 9
4) 12
3. A group $(G *)$ has 10 elements. The minimum number of elements of G , which are their own inverses is
- 1) 1
2) 2
3) 0
4) 9
4. If \vec{a} and \vec{b} are vectors such that $|\vec{a} + \vec{b}| = |\vec{a} - \vec{b}|$, then the angle between \vec{a} and \vec{b} is
- 1) 60°
2) 120°
3) 30°
4) 90°
5. $\frac{3x^2 + 1}{x^2 - 6x + 8}$ is equal to
- 1) $\frac{49}{2(x-4)} - \frac{13}{2(x-2)}$
2) $3 + \frac{49}{2(x-4)} - \frac{13}{2(x-2)}$
3) $\frac{49}{2(x-4)} + \frac{13}{2(x-2)}$
4) $\frac{-49}{2(x-4)} + \frac{13}{2(x-2)}$

(Space for Rough Work)

6. If $\vec{a} = 2\hat{i} + 3\hat{j} - \hat{k}$, $\vec{b} = \hat{i} + 2\hat{j} - 5\hat{k}$, $\vec{c} = 3\hat{i} + 5\hat{j} - \hat{k}$, then a vector perpendicular to \vec{a} and in the plane containing \vec{b} and \vec{c} is

1) $17\hat{i} + 21\hat{j} - 123\hat{k}$

2) $-17\hat{i} + 21\hat{j} - 97\hat{k}$

3) $-17\hat{i} - 21\hat{j} - 97\hat{k}$

4) $-17\hat{i} - 21\hat{j} + 97\hat{k}$

7. \vec{OA} and \vec{OB} are two vectors of magnitudes 5 and 6 respectively. If $\angle BOA = 60^\circ$, then $\vec{OA} \cdot \vec{OB}$ is equal to

1) 15

2) 0

3) $15\sqrt{3}$

4) -15

8. A vector perpendicular to the plane containing the points $A(1, -1, 2)$, $B(2, 0, -1)$, $C(0, 2, 1)$ is

1) $8\hat{i} + 4\hat{j} + 4\hat{k}$

2) $4\hat{i} + 8\hat{j} - 4\hat{k}$

3) $\hat{i} + \hat{j} - \hat{k}$

4) $3\hat{i} + \hat{j} + 2\hat{k}$

9. $\frac{1}{2.5} + \frac{1}{5.8} + \frac{1}{8.11} + \dots + \frac{1}{(3n-1)(3n+2)} =$

1) $\frac{n}{6n+3}$

2) $\frac{n}{6n-4}$

3) $\frac{n+1}{6n+4}$

4) $\frac{n}{6n+4}$

10. The ninth term of the expansion $\left(3x - \frac{1}{2x}\right)^8$ is

1) $\frac{-1}{512x^9}$

2) $\frac{1}{512x^9}$

3) $\frac{1}{256 \cdot x^8}$

4) $\frac{-1}{256 \cdot x^8}$

(Space for Rough Work)

11. If $A = \begin{bmatrix} 1 & -1 & 1 \\ 2 & 1 & -3 \\ 1 & 1 & 1 \end{bmatrix}$, $10B = \begin{bmatrix} 4 & 2 & 2 \\ -5 & 0 & \alpha \\ 1 & -2 & 3 \end{bmatrix}$ and B is the inverse of A , then the value of α is

- 1) 0
2) 2
3) 4
4) 5

12. If $A = \begin{bmatrix} 0 & x & 16 \\ x & 5 & 7 \\ 0 & 9 & x \end{bmatrix}$ is singular, then the possible values of x are

- 1) 0, 1, -1
2) 0, +12, -12
3) 0, 5, -5
4) 0, 4, -4

13. If $A = \begin{bmatrix} 1 & -2 & 2 \\ 0 & 2 & -3 \\ 3 & -2 & 4 \end{bmatrix}$, then $A \cdot \text{adj}(A)$ is equal to

- 1) $\begin{bmatrix} 5 & 0 & 0 \\ 0 & 5 & 0 \\ 0 & 0 & 5 \end{bmatrix}$
2) $\begin{bmatrix} 5 & 1 & 1 \\ 1 & 5 & 1 \\ 1 & 1 & 5 \end{bmatrix}$
3) $\begin{bmatrix} 0 & 0 & 0 \\ 0 & 0 & 0 \\ 0 & 0 & 0 \end{bmatrix}$
4) $\begin{bmatrix} 8 & 0 & 0 \\ 0 & 8 & 0 \\ 0 & 0 & 8 \end{bmatrix}$

14. If $f: R \rightarrow R$ is defined by $f(x) = |x|$, then,

- 1) $f^{-1}(x) = \frac{1}{|x|}$
2) $f^{-1}(x) = -x$
3) $f^{-1}(x) = \frac{1}{x}$
4) The function $f^{-1}(x)$ does not exist.

15. The value of $\begin{vmatrix} x & p & q \\ p & x & q \\ p & q & x \end{vmatrix}$ is

- 1) $(x-p)(x-q)(x+p+q)$
2) $x(x-p)(x-q)$
3) $pq(x-p)(x-q)$
4) $(p-q)(x+q)(x-p)$

(Space for Rough Work)

26. A graph G has ' m ' vertices of odd degree and ' n ' vertices of even degree. Then which of the following statements is necessarily true ?

- 1) $m + n$ is an even number 2) $m + n$ is an odd number
 3) $m + 1$ is an odd number 4) $n + 1$ is an even number

27. If p is any point on the ellipse $\frac{x^2}{36} + \frac{y^2}{16} = 1$, and S and S' are the foci, then $PS + PS' =$

- 1) 8 2) 4
 3) 12 4) 10

28. The value of $\sin \left[2\cos^{-1} \frac{\sqrt{5}}{3} \right]$ is

- 1) $\frac{2\sqrt{5}}{3}$ 2) $\frac{\sqrt{5}}{3}$
 3) $\frac{2\sqrt{5}}{9}$ 4) $\frac{4\sqrt{5}}{9}$

29. If $\frac{x^2}{36} - \frac{y^2}{k^2} = 1$ is a hyperbola, then which of the following statements can be true ?

- 1) (3, 1) lies on the hyperbola 2) (-3, 1) lies on the hyperbola
 3) (5, 2) lies on the hyperbola 4) (10, 4) lies on the hyperbola

30. The focus of the parabola is

- 1) $\left(\frac{1}{3}, \frac{-3}{2} \right)$ 2) $\left(\frac{-1}{3}, \frac{3}{2} \right)$
 3) $\left(\frac{1}{3}, \frac{-1}{2} \right)$ 4) $\left(\frac{1}{3}, \frac{3}{2} \right)$

(Space for Rough Work)

31. The solution of $\tan^{-1}x + 2\cot^{-1}x = \frac{2\pi}{3}$ is

- | | |
|-------------------------|--------------------------|
| 1) $\frac{1}{\sqrt{3}}$ | 2) $-\frac{1}{\sqrt{3}}$ |
| 3) $\sqrt{3}$ | 4) $-\sqrt{3}$ |

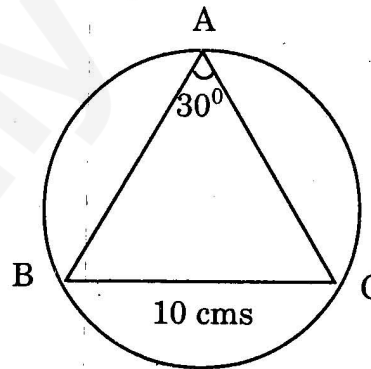
32. $\sin^2 17.5^\circ + \sin^2 72.5^\circ$ is equal to

- | | |
|----------------------|----------------------|
| 1) $\tan^2 45^\circ$ | 2) $\cos^2 90^\circ$ |
| 3) $\sin^2 45^\circ$ | 4) $\cos^2 30^\circ$ |

33. The conjugate of the complex number $\frac{(1+i)^2}{1-i}$ is

- | | |
|-----------|-----------|
| 1) $1+i$ | 2) $1-i$ |
| 3) $-1-i$ | 4) $-1+i$ |

34. ABC is a triangle with $\angle A = 30^\circ$ $BC = 10$ cms
The area of the circum-circle of the triangle is



- | | |
|--------------------------------|----------------------|
| 1) 5 sq. cms. | 2) 100π sq. cms. |
| 3) $\frac{100\pi}{3}$ sq. cms. | 4) 25 sq. cms. |

35. If $\sin 3\theta = \sin \theta$, how many solutions exist such that $-2\pi < \theta < 2\pi$?

- | | |
|------|------|
| 1) 9 | 2) 8 |
| 3) 7 | 4) 5 |

(Space for Rough Work)

41. If $\text{Sec}^{-1}\left(\frac{1+x}{1-y}\right) = a$, then $\frac{dy}{dx}$ is

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

2) $\frac{y-1}{x+1}$

3) $\frac{x-1}{y+1}$

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

42. If $y = \text{Cos}^2 \frac{3x}{2} - \text{Sin}^2 \frac{3x}{2}$, then $\frac{d^2y}{dx^2}$ is

1) $9y$

2) $-3\sqrt{1-y^2}$

3) $3\sqrt{1-y^2}$

4) $-9y$

43. If the function $f(x) = \begin{cases} \frac{1-\text{Cos} x}{x^2} & \text{for } x \neq 0 \\ k & \text{for } x = 0 \end{cases}$ is continuous at $x = 0$, then the value of k is

1) 0

2) 1

3) -1

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

44. If $1, w, w^2$ are the cube roots of unity then $(1+w)(1+w^2)(1+w^4)(1+w^8)$ is equal to

1) 0

2) 1

3) w

4) w^2

45. If $x^x = y^y$ then $\frac{dy}{dx}$ is

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

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

3) $\frac{1+\text{Log } x}{1+\text{Log } y}$

4) $1+\text{Log}\left(\frac{x}{y}\right)$

(Space for Rough Work)

46. The point on the curve $y^2 = x$, the tangent at which makes an angle 45° with X-axis is

- | | |
|---------------------------------|----------------------------------|
| 1) $(\frac{1}{2}, \frac{1}{4})$ | 2) $(\frac{1}{4}, \frac{1}{2})$ |
| 3) $(\frac{1}{2}, \frac{1}{2})$ | 4) $(\frac{1}{2}, -\frac{1}{2})$ |

47. The length of the subtangent to the curve $x^2y^2 = a^4$ at $(-a, a)$ is

- | | |
|------------------|------------------|
| 1) $2a$ | 2) $\frac{a}{2}$ |
| 3) $\frac{a}{3}$ | 4) a |

48. The number of positive divisors of 252 is

- | | |
|-------|-------|
| 1) 5 | 2) 9 |
| 3) 10 | 4) 18 |

49. The remainder obtained when 5^{124} is divided by 124 is

- | | |
|------|------|
| 1) 0 | 2) 5 |
| 3) 1 | 4) 2 |

50. Which of the following is not a group with respect to the given operation ?

- 1) The set of odd integers under addition.
- 2) The set of even integers under addition.
- 3) $\{1, -1\}$ under multiplication.
- 4) $\{0\}$ under addition.

(Space for Rough Work)

56. The value of $\int e^x (x^5 + 5x^4 + 1) \cdot dx$ is

- 1) $e^x \cdot x^5 + e^x + C$ 2) $e^x \cdot x^5$
 3) $5x^4 \cdot e^x$ 4) $e^{x+1} \cdot x^5 + C$

57. The value of $\int \frac{x^2+1}{x^2-1} dx$ is

- 1) $\text{Log}\left(\frac{x+1}{x-1}\right) + C$ 2) $\text{Log}\left(\frac{x-1}{x+1}\right) + C$
 3) $\text{Log}(x^2-1) + C$ 4) $x + \text{Log}\left(\frac{x-1}{x+1}\right) + C$

58. The area bounded by the curve $x = 4 - y^2$ and the Y-axis is

- 1) 32 sq. units 2) 16 sq. units
 3) $\frac{16}{3}$ sq. units 4) $\frac{32}{3}$ sq. units

59. The differential equation of the family of straight lines whose slope is equal to y-intercept is

- 1) $(x+1)\frac{dy}{dx} + y = 0$ 2) $(x+1)\frac{dy}{dx} - y = 0$
 3) $\frac{dy}{dx} = \frac{x+1}{y+1}$ 4) $\frac{dy}{dx} = \frac{x-1}{y-1}$

60. The order and degree of the differential equation $\left[1 + \left(\frac{dy}{dx}\right)^5\right]^{\frac{1}{3}} = \frac{d^2y}{dx^2}$ are respectively

- 1) 2, 1 2) 1, 5
 3) 2, 3 4) 2, 5

(Space for Rough Work)