MATHEMATICS

1. $7^{2Log_7^5}$ is equal to

   1) 5
   2) $Log_7 35$
   3) $Log_7 25$
   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) 60^0
   2) 120^0
   3) 30^0
   4) 90^0

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. $\overrightarrow{OA}$ and $\overrightarrow{BO}$ are two vectors of magnitudes 5 and 6 respectively. If $\angle BOA = 60^0$, then $\overrightarrow{OA}\cdot\overrightarrow{OB}$ 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. $\frac{1}{2.5}+\frac{1}{5.8}+\frac{1}{8.11}+\ldots\ldots\ldots\frac{1}{(3n-1)(3n+2)}=$

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 $f:R\to R$ 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)

16. The number of common tangents to the circles $x^2 + y^2 = 4$ and $x^2 + y^2 - 6x - 8y - 24 = 0$ is,

1) 4 2) 3
3) 1 4) 2

17. If $3x + y + k = 0$ is a tangent to the circle $x^2 + y^2 = 10$, the values of k are,

1) ± 5 2) ± 7
3) ± 9 4) ± 10

18. The negation of the proposition "If 2 is prime, then 3 is odd" is

1) 2 is prime and 3 is not odd 2) If 2 is not prime then 3 is not odd
3) If 2 is not prime then 3 is odd 4) 2 is not prime and 3 is odd.

19. The equation to two circles which touch the Y-axis at $(0, 3)$ and make an intercept of 8 units on X-axis are

1) $x^2 + y^2 \pm 6x - 10y + 9 = 0$ 2) $x^2 + y^2 \pm 10x - 6y + 9 = 0$
3) $x^2 + y^2 + 10x \pm 6y + 9 = 0$ 4) $x^2 + y^2 - 8x \pm 10y + 9 = 0$

20. The orthocentre of the triangle with vertices $A(0, 0), B\left(0, \frac{3}{2}\right), C(-5, 0)$ is

1) $\left(-\frac{5}{2}, \frac{3}{4}\right)$ 2) $\left(\frac{5}{2}, \frac{3}{4}\right)$
3) $(0, 0)$ 4) $\left(-5, \frac{3}{2}\right)$

(Space for Rough Work)

21. $x^2+y^2-6x-6y+4=0$, $x^2+y^2-2x-4y+3=0$, $x^2+y^2+2kx+2y+1=0$ If the Radical centre of the above three circles exists, then which of the following cannot be the value of k ?

1) 1 2) 2

3) 4 4) 5

22. If the circles $x^2+y^2-2x-2y-7=0$ and $x^2+y^2+4x+2y+k=0$ cut orthogenally, then the length of the common chord of the circles is

1) 2 2) $12/\sqrt{13}$

3) 8 4) 5

23. The co-ordinates of the foot of the perpendicular drawn from the point (3, 4) on the line $2x+y-7=0$ is

1) (1, 5) 2) $\left(\frac{9}{5}, \frac{17}{5}\right)$

3) (1, −5) 4) (−5, 1)

24. The area enclosed by the pair of lines $xy=0$, the line $x-4=0$ and $y+5=0$ is

1) 10 sq. units. 2) 20 sq. units

3) 0 sq. units. 4) $\frac{5}{4}$ sq. units.

25. If the area of the auxillary circle of the ellipse $\frac{x^2}{a^2}+\frac{y^2}{b^2}=1$ $(a>b)$ is twice the area of the ellipse, then the eccentricity of the ellipse is

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

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

(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 $Sin\left[2Cos^{-1}\frac{\sqrt{5}}{3}\right]$ 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 $Tan^{-1}x + 2Cot^{-1}x = \frac{2\pi}{3}$ is

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

3) $\sqrt{3}$ 4) $-\sqrt{3}$

32. $Sin^2 17.5^0 + Sin^2 72.5^0$ is equal to

1) $Tan^2 45^0$ 2) $Cos^2 90^0$

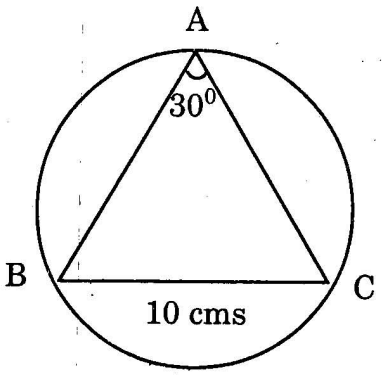
3) $Sin^2 45^0$ 4) $Cos^2 30^0$

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 $\angle A = 30^0$ $BC = 10$ 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)

36. The imaginary part of i^i is

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

37. The amplitude of $(1+i)^5$ is

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

38. ABC is a tringle. G is the centroid. D is the mid point of BC. If $A=(2,\ 3)$ and $G=(7,\ 5)$, then the point D is

1) $\left(\frac{19}{2},\ 6\right)$ 2) $\left(\frac{9}{2},\ 4\right)$
3) $\left(8,\ \frac{13}{2}\right)$ 4) $\left(\frac{11}{2},\ \frac{11}{2}\right)$

39. $\underset{x\to 1}{Lim}\ \frac{Tan\left(x^2-1\right)}{x-1}$ is equal to

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

40. If $y=2^{Log\,x}$, then $\frac{dy}{dx}$ is

1) $2^{Log\,x}\cdot Log\,2$ 2) $\frac{2^{Log\,x}}{Log\,2}$
3) $\frac{2^{Log\,x}\cdot Log\,2}{x}$ 4) $\frac{2^{Log\,x}}{x}$

(Space for Rough Work)

41. If $Sec^{-1}\left(\frac{1+x}{1-y}\right)=a$, 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 $y=Cos^2\frac{3x}{2}-Sin^2\frac{3x}{2}$, 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 $f(x)=\begin{cases}\frac{1-Cos\,x}{x^2} & for\ x\neq 0\\ k & for\ x=0\end{cases}$ 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 $(1+w)\left(1+w^2\right)\left(1+w^4\right)\left(1+w^8\right)$ 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) $\frac{1+Log\,x}{1+Log\,y}$ 4) $1+Log\left(\frac{x}{y}\right)$

(Space for Rough Work)

46. The point on the curve $y^2 = x$, the tangent at which makes an angle 45^0 with X-axis is

1) $(1/2, 1/4)$ 2) $(1/4, 1/2)$

3) $(1/2, 1/2)$ 4) $(1/2, -1/2)$

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

1) $2a$ 2) $a/2$

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

(Space for Rough Work)

51. The range in which $y = -x^2 + 6x - 3$ is increasing is

1) $x > 3$ 2) $x < 3$

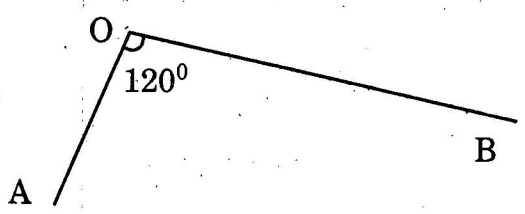
3) $5 < x < 6$ 4) $7 < x < 8$

52. The value of the integral $\int_0^{\pi/2} \left(Sin^{100}x - Cos^{100}x\right) dx$ is

1) $\frac{100\,!}{(100)^{100}}$ 2) $\frac{1}{100}$

3) 0 4) $\frac{\pi}{100}$

53. OA and OB are two roads enclosing an angle of 120^0. X and Y start from 'O' at the same time. X travels along OA with a speed of 4 km/hour and Y travels along OB with a speed of 3 km/hour. The rate at which the shortest distance between X and Y is increasing after 1 hour is



1) 37 km/hour 2) $\sqrt{37}$ km/hour

3) $\sqrt{13}$ km/hour 4) 13 km/hour

54. If $k\int_0^1 x \cdot f(3x)dx = \int_0^3 t \cdot f(t)dt$, then the value of k is

1) 3 2) 9

3) $\frac{1}{3}$ 4) $\frac{1}{9}$

55. The value of $\int \frac{1}{1+Cos\,8x}\,dx$ is

1) $\frac{Tan\,8x}{8} + C$ 2) $\frac{Tan\,2x}{8} + C$

3) $\frac{Tan\,4x}{8} + C$ 4) $\frac{Tan\,4x}{4} + C$

(Space for Rough Work)

56. The value of $\int e^x \left(x^5 + 5x^4 + 1\right) \cdot dx$ 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) $Log\left(\frac{x+1}{x-1}\right)+C$
2) $Log\left(\frac{x-1}{x+1}\right)+C$
3) $Log\left(x^2-1\right)+C$
4) $x + Log\left(\frac{x-1}{x+1}\right)+C$

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)