JEE MAIN 2020 SHIFT-01

1. If the system of linear equations

2x + 2ay + az = 0

2x + 3by + bz = 0

2x + 4cy + cz = 0,

where a, b, c $\in$ R are non-zero and distinct; has a non-zero solution, then

(a) a, b, c are in A.P.

(b)1/a, 1/b,1/c are in A.P.

(c) a + b + c = 0

(d) a, b, c are in G.P.

2. If $y(\alpha)=\sqrt{2\left(\frac{\tan\alpha+\cot\alpha}{1+\tan^2\alpha}\right)+\frac{1}{\sin^2\alpha}}, \alpha\in\left(\frac{3\pi}{4},\pi\right)$

Then $\frac{dy}{d\alpha}$ at $\alpha=\frac{5\pi}{6}$ is

(a) 4 (b) $\frac{4}{3}$ (c) $-\frac{1}{4}$ (d) – 4

3. If y = mx + 4 is a tangent to both the parabolas. y^2 = 4x and x^2 = 2by, then b is equal to :

(a) –64 (b) –32

(c) –128 (d) 128

4. Let P be a plane passing through the points (2, 1, 0), (4, 1, 1) and (5, 0, 1) and R be any point (2, 1, 6). Then the image of R in the plane P is:

(a) (6, 5, –2) (b) (4, 3, 2)

(c) (6, 5, 2) (d) (3, 4, –2)

5. A vector $\vec{a}=\alpha i+2j+\beta k(\alpha,\beta\in R)$ lies in the plane of the vectors $\vec{b}=\hat{i}+\hat{j}$ and $\vec{c}=\hat{i}-\hat{j}+4\hat{k}$. If $\vec{a}$ bisects the angle between b and c , then:

(a) $\vec{a}\cdot\hat{k}+4=0$ (b) $\vec{a}\cdot\hat{k}+2=0$

(c) $\vec{a}\cdot\hat{i}+1=0$ (d) $\vec{a}\cdot\hat{i}+3=0$

6. If the distance between the foci of an ellipse is 6 and the distance between its directrices is 12, then the length of its latus rectum is:

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

7. The greatest positive integer k, for which 49^k + 1 is a factor of the sum $49^{125} + 49^{124} + \ldots + 49^2 + 49 + 1$,is

(a) 32 (b) 63

(c) 65 (d) 60

8. If g(x) = x^2 + x –1 and (gof)(x) = $4x^2$ – 10x + 5, then f $\left(\frac{5}{4}\right)$ is equal to :

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

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

9. Let α be a root of equation $x^2+x+1=0$ and the matrix $A=\frac{1}{\sqrt{3}}\begin{bmatrix}1&1&1\\1&\alpha&\alpha^2\\1&\alpha^2&\alpha^4\end{bmatrix}$, then the matrix A^{31} is equal to

(a) A^3 (b) A^2

(c) I3 (d) A

10. The logical statement

$(p\Leftrightarrow q)\wedge(q\Leftrightarrow\sim p)$ is equivalent to

(a) p (b) q

(c ~p (d) ~ q

11. If $\text{Re}\left(\frac{z-1}{2z+i}\right)=1$, where $z=x+iy$, then the point (x, y) lies on a :

(a) Straight line whose slope is $-\frac{2}{3}$

(b) Straight line whose slope is $\frac{3}{2}$

(c) circle whose diameter is $\frac{\sqrt{5}}{2}$

(d) circle whose centre is at $\left(-\frac{1}{2},-\frac{3}{2}\right)$

12. Let y = f(x) is the solution of the differential equation $e^y\left(\frac{dy}{dx}-1\right)=e^x$ such that y(0) = 0, then y(1) is equal to:

(a) 2e (b) 1+$\log_e$2

(c) $\log_e$ 2 (d) 2+$\log_e$ 2

13. Let α and β be two real roots of the $(k+1)\tan^2 x-\sqrt{2}\cdot\lambda\tan x=(1-k)$, where $k(\neq -1)$ and λ are real numbers. If $\tan^2(\alpha+\beta)=50$, then a value of λ is:

(a) $10\sqrt{2}$ (b) $5\sqrt{2}$

(c) 10 (d) 5

14. Five numbers are in A.P., whose sum is 25 and product is 2520. If one of these five numbers is $-\frac{1}{2}$, then the greatest number amongst them is :

(a) $\frac{21}{2}$ (b) 16

(c) 27 (d) 7

15. If f(a + b + 1 – x) = f(x), for all x, where a and b are fixed positive real numbers, then $\frac{1}{(a+b)}\int_a^b x(f(x)+f(x+1))$dx is equal to

(a) $\int_{a+1}^{b+1} f(x+1)\,dx$ (b) $\int_{a-1}^{b-1} f(x+1)\,dx$

(c) $\int_{a+1}^{b+1} f(x)\,dx$ (d) $\int_{a-1}^{b-1} f(x)\,dx$

16. Let the function, f : [–7, 0] → R be continuous on [–7, 0] and differentiable on (–7, 0). If f(–7) = –3 and f′(x) ≤ 2 for all x ∈ (– 7, 0), then for all such functions f, f(–1) + f(0) lies in the interval :

(a) [– 6, 20] (b) (–∞, 20]

(c) (– ∞, 11] (d) [–3, 11]

17. Total number of 6-digit numbers in which only and all the five digits 1, 3, 5, 7 and 9 appear, is

(a) 5^6 (b) $\frac{1}{2}(6!)$

(c) 6 ! (d) $\frac{5}{2}(6!)$

18. An unbiased coin is tossed 5 times. Suppose that a variable X is assigned the value k when k consecutive heads are obtained for k = 3, 4, 5 otherwise X takes the value –1. Then the expected value of X, is :

(a) $\frac{3}{16}$ (b) $-\frac{1}{8}$

(c) $-\frac{3}{16}$ (d) $\frac{1}{8}$

19. Let $x^k + y^k = a^k, (a, k > 0)$ and $\frac{dy}{dx} + \left(\frac{y}{x}\right)^{\frac{1}{3}} = 0$, then k is

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

20. The area of the region, enclosed by the circle $x^2 + y^2 = 2$ which is not common to the region bounded by the parabola $y^2 = x$ and the straight line y = x, is :

(a) $\frac{1}{3}(6\pi - 1)$ (b) $\frac{1}{3}(12\pi - 1)$

(c) $\frac{1}{6}(12\pi - 1)$ (d) $\frac{1}{6}(24\pi - 1)$

21. If the variance of the first n natural numbers is 10 and the variance of the first m even natural numbers is 16, then m + n is equal to______

(a)14 (b)17

(c)16 (d) 18

22. If the sum of the coefficients of all even powers of x in the product $(1 + x + x^2 + ….. +x^{2n})(1– x + x^2 – x^3 + …. + x^{2n})$ is 61, then n is equal to _____

(a)28 (b) 27

(c)30 (d) 29

23. $\lim_{x\to 2} \frac{3^x + 3^{3-x} - 12}{3^{-x/2} - 3^{1-x}}$ is equal to

(a)36 (b)35

(c)37 (d)32

24. Let S be the set of points where the function, f(x) = |2 – |x – 3||, x∈R, is not differentiable. Then $\sum_{x\in s} f(f(x))$ is equal to ______

(a)2 (b) 3

(c)1 (d) 4

25. Let A(1, 0), B(6, 2) and $C\left(\frac{3}{2}, 6\right)$ be the vertices of a triangle ABC. If P is a point inside the triangle ABC such that the triangles APC, APB and BPC have equal areas, then the length of the line segment PQ, where Q is the point $\left(-\frac{7}{6}, -\frac{1}{3}\right)$, is _________

(a) 2 (b) 1

(c 5 (d) 3

ANSWER KEY

1. (b)	**2.** (a)	**3.** (c)	**4.** (a)	**5.** (b)	**6.** (b)	**7.** (b)	**8.** (c)	**9.** (a)	**10.** (c)
11. (c)	**12.** (b)	**13.** (c)	**14.** (b)	**15.** (b)	**16.** (b)	**17.** (d)	**18.** (d)	**19.** (b)	**20.** (c)
21. (d)	**22.** (c)	**23.** (a)	**24.** (b)	**25.** (c)					