JEE Main Part Test 1

Subject: Mathematics   Class: Standard XII

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1. Let a_n denote the n^{th} term of a geometric progression with common ratio less than 1. If $a_1 + a_2 + a_3 = 13$ and $a_1^2 + a_2^2 + a_3^2 = 91$, then the value of a_{10} is

   A. 3^{10}

   B. 3^{11}

   C. $\frac{1}{3^{10}}$

   D. $\frac{1}{3^{7}}$

2. The complete set of values of x for which the inequality $\log_x\left(\frac{4x+5}{6-5x}\right) < -1$ holds good, is

   A. $\left(1, \frac{6}{5}\right)$

   B. $(0, 1)$

   C. $\left(\frac{1}{2}, 1\right)$

   D. $(0, 1) \cup \left(1, \frac{6}{5}\right)$

3. A survey conducted in a city reveals that 48% children like cricket while 77% children like football. Then the percentage of children who like both cricket and football can be

   A. 23

   B. 31

   C. 51

   D. 65

4. Given that α, β, a, b are in A.P. ; α, β, c, d are in G.P. and α, β, e, f are in H.P. If b, d, f are in G.P., then the value of $\dfrac{\beta^6 - \alpha^6}{\alpha\beta(\beta^4 - \alpha^4)}$ is

A. $\frac{2}{3}$

B. $\frac{3}{2}$

C. $\frac{4}{3}$

D. $\frac{3}{4}$

5. If there are 12 points in a plane out of which only 5 are collinear, then the number of quadrilaterals that can be formed using these points is

A. 210

B. 280

C. 350

D. 420

6. If the function $f(x) = \lambda\,|\sin x| + \lambda^2\,|\cos x| + g(\lambda),\ \lambda \in \mathbb{R}$ is periodic with fundamental period $\frac{\pi}{2}$, then

A. $\lambda = 0, 1$

B. $\lambda = 1$

C. $\lambda = 0$

D. $\lambda = -1$

7. If t lies between real roots of the equation $2x^2-2(2t+1)x+t(t+1)=0$, then t cannot be

A. 1

B. -2

C. $-\frac{1}{2}$

D. $\frac{1}{2}$

8. Set of all real values of x satisfying the inequation $\frac{\log_2(x^2-5x+4)}{\log_2(x^2+1)} > 1$ is

A. $\left(-\infty, \frac{3}{5}\right) - \{0\}$

B. $(-\infty, 1) - \{0\}$

C. $\left(\frac{3}{5}, \infty\right)$

D. $\left(-\infty, \frac{3}{5}\right)$

9. If $A = \{\theta : 2\cos^2\theta + \sin\theta \le 2\}$ and $B = \left\{\theta : \frac{\pi}{2} \le \theta \le \frac{3\pi}{2}\right\}$, then $A \cap B$ is equal to

A. $\left\{\theta : \frac{\pi}{2} \le \theta \le \frac{5\pi}{6}\right\}$

B. $\left\{\theta : \pi \le \theta \le \frac{3\pi}{2}\right\}$

C. $\left\{\theta : \frac{\pi}{2} \le \theta \le \frac{5\pi}{6}\right\} \cup \left\{\theta : \pi \le \theta \le \frac{3\pi}{2}\right\}$

D. $\left\{\theta : \frac{\pi}{2} \le \theta \le \frac{5\pi}{6}\right\} \cap \left\{\theta : \pi \le \theta \le \frac{3\pi}{2}\right\}$

10. An aeroplane flying with uniform speed horizontally 1 km above the ground is observed at an elevation of 60° from a point on the ground. After 10 seconds, if the elevation is observed to be 30°, then the speed of the plane (in km/hr) is

A. $\frac{240}{\sqrt{3}}$

B. $200\sqrt{3}$

C. $240\sqrt{3}$

D. $\frac{120}{\sqrt{3}}$

11. The number of ways in which 20 letters $a_1, a_2, a_3, \ldots, a_{10}, b_1, b_2, b_3, \ldots, b_{10}$ can be arranged in a line so that suffixes of the letters a and also those of b are respectively in ascending order of magnitude is

A. $\frac{20!}{10!}$

B. $\frac{20!}{(10!)^2}$

C. 2^{20}

D. $20! - 10! \cdot 10!$

12. If $\operatorname{sgn}(y)$ denotes the signum function of y, then the number of solution(s) of the equation $||x+2|-3| = \operatorname{sgn}\left(1 - \left|\frac{(x-2)\left(x^2+10x+24\right)}{\left(x^2+1\right)(x+4)\left(x^2+4x-12\right)}\right|\right)$ is

A. 0

B. 1

C. 3

D. 4

JEE Main Part Test 1

13. The equation $\left(x^2-5x+1\right)\left(x^2+x+1\right)+8x^2=0$ has

A. four real and distinct roots

B. three real and distinct roots

C. two real and distinct roots

D. only one real root

14. If 5^{40} is divided by 11, then remainder is α and if 2^{2003} is divided by 17, then remainder is β. Then the value of $(\beta-\alpha)$ is

A. 3

B. 5

C. 7

D. 8

15. The number of solution(s) of the equation $3\tan\left(x-\frac{\pi}{12}\right)=\tan\left(x+\frac{\pi}{12}\right)$ in $A=\left\{x\in\mathbb{R}:x^2-6x\leq 0\right\}$ is

A. 2

B. 3

C. 1

D. 4

16. The value of $2^{\frac{1}{4}}\cdot 4^{\frac{1}{8}}\cdot 8^{\frac{1}{16}}\cdot 16^{\frac{1}{32}}\ldots\ldots$ is

A. 2

B. $\frac{3}{2}$

C. 1

D. $\frac{2}{3}$

17. If $\log_{10}\sin x + \log_{10}\cos x = -1;\ x \in \left(0, \frac{\pi}{2}\right)$ and $\log_{10}(\sin x + \cos x) = \frac{(\log_{10} n) - 1}{2}$, then the value of n is

A. 7

B. 15

C. 10

D. 12

18. Let $\alpha = 3^{\log_4 5} - 5^{\log_4 3} + 2$. If p and q are the roots of the equation $\log_\alpha x + \log_x \alpha = \frac{10}{3}$, then the value of $p^3 + q^3$ is

A. 10

B. 514

C. 66

D. 564

19. If $A_1, A_2; G_1, G_2$ and H_1, H_2 are arithmetic mean, geometric mean and harmonic mean between two numbers, then the value of $\frac{G_1G_2}{H_1H_2} \times \frac{H_1 + H_2}{A_1 + A_2}$ is

A. 1

B. 0

C. 2

D. 3

20. The number of value(s) of $\theta \in [0, 2\pi]$ satisfying the equation $\left(\log_{\sqrt{5}} \tan\theta\right)\sqrt{\log_{\tan\theta} 5\sqrt{5} + \log_{\sqrt{5}} 5\sqrt{5}} = -\sqrt{6}$ is

A. 0

B. 4

C. 2

D. 5

21. The number of integral terms in the expansion of $\left(\sqrt{3} + \sqrt[8]{5}\right)^{256}$ is

22. If the sum of the solutions of the equation $\cos\left(\frac{\pi}{3} - \theta\right)\cos\left(\frac{\pi}{3} + \theta\right) - \frac{\sec\theta}{4} = 0$ in $[0, 10\pi]$ is $k\pi$, then the value of k is

23. If $\left(1 + x + x^2\right)^8 = a_0 + a_1 x + a_2 x^2 + \cdots + a_{16} x^{16}$ for all real x, then a_5 is equal to

24. If $f : [-2, 2] \to \mathbb{R}$ defined by $f(x) = x^3 + \tan x + \left[\frac{x^2 + 1}{p}\right]$ is an odd function, then the least value of $[p]$ is
($[.]$ represents the greatest integer function)

25. If α, β are the roots of $\lambda\left(x^2 + x\right) + x + 5 = 0$ and λ_1, λ_2 are two values of λ for which α, β are connected by the relation $\frac{\alpha}{\beta} + \frac{\beta}{\alpha} = 4$, then the value of $\frac{\lambda_1}{\lambda_2} + \frac{\lambda_2}{\lambda_1}$ is equal to

26. If the number of ways in which four distinct balls can be put into two identical boxes so that no box remains empty is equal to k, then k is

27. Let f be a real function defined as $f(x)=\frac{2^x+1}{2^x-1}$. The number of integer(s) which are not in the range of f is

28. Let A, B, C be finite sets. Suppose that $n(A)=10, n(B)=15, n(C)=20, n(A\cap B)=8$ and $n(B\cap C)=9$. Then the maximum possible value of $n(A\cup B\cup C)$ is

29. The number of integral values of x satisfying $||x-\pi|-|\pi x-1||=(x-1)(1+\pi)$, is

30. Number of integer values of x satisfying the inequality $|x-3|+|2x+4|+|x|\leq 11$ is