MATHS

BOOKS - NTA MOCK TESTS

NTA TPC JEE MAIN TEST 47

Mathematics Single Choice

1. The number of distinct terms in the expansion of $\left(x^4+\frac{1}{x^4}+1\right)^{100}$ is

A. 101

B. 201

C. 401

D. 801

Answer: B

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2. If the points z_1, z_2 lie on the curves [z] = 2 and [z] = 3 respectively and the angle between the vectors representing z_1, z_2 is 60°, then $\left|\frac{z_1 + z_2}{z_1 - z_2}\right|$ is equal to

A. $\sqrt{\frac{19}{7}}$

B. $\sqrt{19}$

C. $\sqrt{7}$

D. $\sqrt{133}$

Answer: A

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3. If the system of equations

$\lambda x + 2y + 3z = x$

$\lambda y - 2z = y$

$y + \lambda z = 4z$

have a non zero solution, then sum of all possible values of λ is

A. 2

B. -5

C. 6

D. 8

Answer: C

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4. A determinant of second order is made with elements 0 and 1. The probability that the determinant made is non-negative is equal to

A. $\frac{11}{16}$

B. $\frac{13}{16}$

C. $\frac{9}{16}$

D. $\frac{7}{16}$

Answer: B

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5. If all the equations

$x^2 + (2a + 3b)x + 60 = 0, x^2 + ax + 10 = 0$ and $x^2 + bx + 8 = 0$

where $a, b \in R$, have a common root, then value of $|a - b|$ is

A. 0

B. 1

C. 2

D. None of these

Answer: B

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6. If $S_1, S_2, S_3, \ldots\ldots . S_n$ are the sum of infinite geometric series whose first terms are $1, 3, 5, \ldots\ldots, (2n-1)$ and whose common ratios are $\frac{2}{3}, \frac{2}{5}, \ldots\ldots . , \frac{2}{2n+1}$ respectively, then $\left\{\frac{1}{S_1 S_2 S_3}+\frac{1}{S_2 S_3 S_4}+\frac{1}{S_3 S_4 S_5}+\ldots\ldots . \text{upto infinite terms}\right\}$

A. $\frac{1}{15}$

B. $\frac{1}{60}$

C. $\frac{1}{12}$

D. none of these

Answer: B

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7. If R and S are two symmetric relations (not disjoint) on a set A, then the relation $R \cap S$ is

A. reflexive

B. symmetric

C. transitive

D. None of these

Answer: B

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8. The equation of a circle with origin as centre and passing through the vertices of an equilateral triangle whose median is of length 3a is

A. $x^2 + y^2 = 9a^2$

B. $x^2 + y^2 = 16a^2$

C. $x^2 + y^2 = 4a^2$

D. $x^2 + y^2 = a^2$

Answer: C

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9. If equation of hyperbola touching x-axis and lines $x-2y=0, x+y+1=0$ as its asymptotes is $\alpha(x-2y)(x+y+1)+\beta=0(\alpha,\beta\in N$ and their HCF is 1), then value of $\alpha-\beta$ is

A. 1

B. 2

C. 3

D. 4

Answer: C

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10. Consider a parabola $y^2=4ax$, if the normal to the parabola at the point $\left(at^2,2at\right)$ cuts the parabola again at $\left(aT^2,2aT\right)$, then

A. $T^2\geq 8$

B. $T^2 \leq 6$

C. $T \in (-\infty, -8) \cup (8, \infty)$

D. None of these

Answer: A

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11. A point O is inside an equilateral triangle, if the distance of O from the sides are $\sqrt{12}, \sqrt{27}$ and $\sqrt{48}$, then the length of the side of the triangle, is

A. $10\sqrt{3}$

B. $15\sqrt{3}$

C. 18

D. 20

Answer: C

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12. The equation of the plane passing through the line of intersection of the planes $x + y + z = 5$ and $2x + 3y + 4z + 5 = 0$ and perpendicular to the plane $x + y + z = 5$ is

A. $x - z = 10$

B. $x - z = 20$

C. $x + y - 2z = 10$

D. $x + y - 2z = 20$

Answer: B

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13. If $\vec{a}, \vec{b}$, and $\vec{c}$ are unit vectors such that $\vec{a} + 2\vec{b} + 2\vec{c} = \vec{0}$, then $\left|\vec{a} \times \vec{c}\right|$ is equal to :

A. $\frac{1}{4}$

B. $\frac{\sqrt{15}}{16}$

C. $\frac{15}{16}$

D. $\frac{\sqrt{15}}{4}$

Answer: D

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14. Let $g(x) = \begin{cases} \frac{ax^2+bx+c(\cot x)^n}{4+(\cot x)^n} & , \ x \in \left(0, \frac{\pi}{4}\right) \\ 1 & , \text{at } x = \frac{\pi}{4} \\ \frac{\sin x+\cos x+(\tan x)^n}{1+c(\tan x)^n} & , \ x \in \left(\frac{\pi}{4}, \frac{\pi}{2}\right) \end{cases}$

where a, b, care real constants and $f(x) = \lim_{n \to \infty} g(x)$ If $\lim_{x \to \frac{\pi}{4}}$ f(x) exist

then c may be equal to

A. 2

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

C. 3

D. -1

Answer: D

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15. Given $f(x) = \begin{cases} \sqrt{10 - x^2} & \text{if } -3 < x < 3 \\ 2 - e^{x-3} & \text{if } x \geq 3 \end{cases}$ The graph of f(x) is -

A. continuous and differentiable at x = 3

B. continuous but not differentiable at x = 3

C. differentiable but not continuous at x = 3

D. neither differentiable nor continuous at x = 3

Answer: B

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16. Solution of differential equation $\frac{dy}{dx} = \sin x + 2x$, is

A. $y = x^2 - \cos x + c$

B. $y = \cos x + x^2 + c$

C. $y = \cos x + 2$

D. $y = \cos x + 2 + c$

Answer: A

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17. If $\int \frac{1}{1+\sin x} dx = \tan\left(\frac{x}{2} + a\right) + b$ then

A. $a = -\frac{\pi}{4}, b \in R$

B. $a = \frac{\pi}{4}, b \in R$

C. $a = \frac{5\pi}{4}, b \in R$

D. None of these

Answer: A

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18. Each side of an equilateral triangle subtends an angle of 60° at the top a tower h meter high located at the centre of the triangle. If a is the length of each side of the triangle, then

A. $3a^2 = 2h^2$

B. $2a^2 = 3h^2$

C. $a^2 = 3h^2$

D. $3a^2 = h^2$

Answer: B

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19. If $\frac{x^2}{f(4a)} + \frac{y^2}{f(a^2-5)}$ represents an ellipse with major axis as y-axis and f is a decreasing function, then:

A. $a \in (-\infty, 1)$

B. $a \in (5, \infty)$

C. $a \in (1, 4)$

D. $a \in (-1, 5)$

Answer: D

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20. $\sum_{m=1}^{n} \tan^{-1}\left(\frac{2m}{m^4 + m^2 + 2}\right)$ is equal to

A. $\tan^{-1}\left(\frac{n^2 + n}{n^2 + n + 2}\right)$

B. $\tan^{-1}\left(\frac{n^2 - n}{n^2 - n + 2}\right)$

C. $\tan^{-1}\left(\frac{n^2 + n + 2}{n^2 + n}\right)$

D. None of these

Answer: A

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Mathematics Subjective Numerical

1. Let $D_1 = \begin{vmatrix} x & a & b \\ -1 & 0 & x \\ x & 2 & 1 \end{vmatrix}$ and $D_2 = \begin{vmatrix} cx^2 & 2a & -b \\ x & 2 & 1 \\ -1 & 0 & x \end{vmatrix}$. If all the roots of the equation $(x^2 - 4x - 10)(x^2 - 5x + 3) = 0$ also satisfy the equaiton $D_1 + D_2 = 0$, then $(a + 8b + 64c) =$

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2. The value of n, if $y - b = 45e^x + c$ represent the equation of tangent to the curve $y = e^x + e^{x^2} + e^{x^3} + \ldots + e^{x^n}$, $n \in N$ at $x = 1$, is

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3. If $\frac{1}{2}f(x + y) = f(x)f(y)$, $f'(5) = 1024 \log 2$, $f(2) = 8$ and $f'(3) = \log 2^n$, then the value of a = _____

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4. Let F be a positive function and let

$$A = \int_{\frac{\pi}{2}-a^2-a-1}^{a^2+a+1} \sin^2 x F\left(\sin^2 x \cos^2 x\right) dx, B = \int_{\frac{\pi}{2}-a^2-a-1}^{a^2+a+1} F\left(\sin^2 x \cos^2 x\right)$$

where $a \in R$, then $\frac{B}{A} =$

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5. Given that $4\cos x \cos y = 1$ and $\sin^2 x + \sin^2 y \geq \frac{3}{2}$. Evaluate $\tan^2 x + \tan^2 y$

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6. At an election, a voter may vote for any number of candidates, not more than the number to be elected. There are 10 candidates and 4 are to be elected. If a voter can vote for at least one candidate, then the number of ways in which he can vote is _____

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7. If $fx\sqrt{\frac{2\sin(x^2+1)-\sin 2(x^2+1)}{2\sin(x^2+1)+\sin 2(x^2+1)}}dx = \log f\left(m\left(x^2+1\right)\right)+c$ then evaluate $\left[f\left(\frac{m\pi}{2}\right)\right]$, where [ ] represents the greatest integer function.

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8. If the coefficient of first three terms in the binomial expansion of $\left(x^{\frac{1}{2}}+\frac{1}{2x^{\frac{1}{4}}}\right)^n$ arrange in descending power of u are in arithmetic progression, then the number of terms in the expansion, having integral powers of x are

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9. A cricket player played $n(n>1)$ matches during his career and made a total of $\frac{(n+1)\left(2^{n+1}-n-2\right)}{4}$ runs. If the player made $k.\ 2^{n-k+1}$ runs in the k^{th} match, then the value of n is $(1 \le k \le n)$

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10. If the angle between the tangents at (1,0) and (6,0) to the curve $y = x^2 - 7x + 6$ is $\tan^{-1}\left(\frac{m}{n}\right)$, then ||n| - |m|| =.

(Given that G.C.D.of (m, n) = 1)

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