



## MATHS

### BOOKS - NTA MOCK TESTS

#### NTA JEE MOCK TEST 83

#### Mathematics

1. The last two digits of the number  $(23)^{14}$  are 01 b. 03 c. 09 d. none of these

A. 01

B. 03

C. 09

D. 17

**Answer: C**



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2. Let  $\vec{a}$  and  $\vec{b}$  are unit vectors such that  $|\vec{a} + \vec{b}| = \frac{3}{2}$ , then the value of  $(2\vec{a} + 7\vec{b}) \cdot (4\vec{a} + 3\vec{b} + 2020\vec{a} \times \vec{b})$  is equal to

A.  $\frac{133}{4}$

B. 133

C. 30

D. 120

Answer: A



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3. Set of all the vectors of  $x$  satisfying the inequality

$$\sqrt{x^2 - 7x + 6} > x + 2$$
 is

A.  $x \in \left(-\infty, \frac{2}{11}\right)$

B.  $x \in \left(\frac{2}{11}, \infty\right)$

C.  $x \in (-\infty, 1] \cup [6, \infty)$

D.  $x \in [6, \infty)$

**Answer: A**



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4. If the value of the integral  $I = \int_0^{2\pi} \text{sgn}(e^x) dx$  is equal to  $k\pi$ , then the smallest prime number greater than  $2k$  is (where,  $\text{sgn}(x)$  represents the signum function of  $x$ )

A. 3

B. 5

C. 7

D. 11

**Answer: B**



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5. Let A lies on  $3x - 4y + 1 = 0$ , B lies on  $4x + 3y - 7 = 0$  and C is  $(-2, 5)$ . If ABCD is a rhombus, then the locus of D is a conic whose length of the latus rectum is equal to

A. 10 units

B. 15 units

C. 5 units

D. 20 units

**Answer: A**



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6. If  $f(x) = \frac{x}{x-1}$ , then the points of discontinuity of the function  $f^{15}(x)$ , where  $f^n = f \circ f \dots \circ f$  (n times), are

A.  $x = 2, 1$

B.  $x = 0, 1$

C.  $x = 1, 2, 0$

D. continuous everywhere except  $x = 1$

**Answer: D**



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7. All the students of a class performed poorly in physics. The teacher decided to give grace marks of 15 to the entire class. Which of the following statistical measures will not change even after the grace marks were given?

A. median

B. mode

C. variance

D. mean

**Answer: C**



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8. Two vertical poles AL and BM of height 4 m and 16 m respectively stand apart on a horizontal plane. If A, B be the feet of the poles and AM and BL intersect at P, then the height of P from the horizontal plane is equal to

A. 3.2 m

B. 2.5 m

C. 4 m

D. 8 m

**Answer: A**



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9. Let  $A = \begin{bmatrix} 2 & 3 \\ 5 & 7 \end{bmatrix}$  and  $B = \begin{bmatrix} a & 0 \\ 0 & b \end{bmatrix}$  where  $a, b \in \mathbb{N}$ . The number of matrices B such that  $AB = BA$ , is equal to

- A. 0
- B. 1
- C. 2
- D. infinite

**Answer: D**



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10. A line makes an angle  $\theta$  with the x-axis and the y-axis. If it makes an angle  $\alpha$  with the z - axis such that  $\sin^2 \alpha = 3 \sin^2 \theta$ , then  $\cos^2 \theta$  is equal to

- A.  $\frac{\sqrt{3}}{2}$
- B.  $\frac{3}{4}$

C.  $\frac{3}{5}$

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

**Answer: C**



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**11.** The number of ways in which the letters of the word 'ARRANGE' can be arranged so that two A's are together is

A. 160

B. 200

C. 360

D. 900

**Answer: C**



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12. When two dice are thrown n number of times, the probability of getting a doublet atleast once is greater than 80 % and the least value of n is  $\lambda$ , then the value of  $\lambda$  is equal to

A. 62

B. 71

C. 80

D. 91

**Answer: D**



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13. Consider the integrals  $I_1 = \int e^{x^2} \cos x dx$  and  $I_2 = \int x e^{x^2} \sin x dx$ .

Then  $I_1 + 2I_2$  simplifies to (Where, c is the constant of integration)

A.  $e^x \sin x + c$

B.  $e^{x^2} \cos x + c$

C.  $2e^{x^2} \sin x + c$

D.  $e^{x^2} \sin x + c$

**Answer: D**



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14.

if

$$\frac{\sin^3 \theta - \cos^3 \theta}{\sin \theta - \cos \theta} - \frac{\cos \theta}{\sqrt{1 + \cot^2 \theta}} - 2 \tan \theta \cot \theta = -1 (\forall \theta \in [0, 2\pi]),$$

then

A.  $\theta \in \left(0, \frac{\pi}{2}\right) - \left\{\frac{\pi}{4}\right\}$

B.  $\theta \in \left(\frac{\pi}{2}, \pi\right) - \left\{\frac{3\pi}{4}\right\}$

C.  $\theta \in \left(\pi, \frac{3\pi}{2}\right) - \left\{\frac{5\pi}{4}\right\}$

D.  $\theta \in (0, \pi) - \left\{\frac{\pi}{4}, \frac{\pi}{2}\right\}$

**Answer: D**



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15. The area bounded by  $y + x^2 \leq 4x$  and  $y \geq 3$  is  $k$  sq. units, then  $3k$  is equal to

A. 2

B. 4

C. 6

D. 8

**Answer: B**



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16. The solution of the differential equation

$2\sqrt{x}e^{\sqrt{x}}dy + e^{\sqrt{x}}ydx = \sqrt{x}\sin xdx$  is (where,  $c$  is arbitrary constant)

A.  $2ye^{\sqrt{x}} + \sin x = c$

B.  $y\sin x = e^{\sqrt{x}} + c$

C.  $ye^{\sqrt{x}} + \sin x = c$

D.  $2ye^{\sqrt{x}} + \cos x = c$

**Answer: D**



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17. The sum of all the values of  $\lambda$  for which the set  $\{(x, y) : x^2 + y^2 - 6x + 4y = 12\} \cap \{(x, y) : 4x + 3y\lambda\}$  contains exactly one element is

A. 31

B. -31

C. 12

D. -19

**Answer: C**



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18. The range of the function  $f(x) = \frac{\tan(\pi[x + 1])}{x^4 + 1}$  (where,  $[.]$  is the greatest integer function) is

- A.  $[0, 1]$
- B.  $[-1, 1]$
- C.  $\{0\}$
- D.  $(-\infty, \infty)$

**Answer: C**



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19. From a point on the line  $x - y + 2 = 0$  tangents are drawn to the hyperbola  $\frac{x^2}{6} - \frac{y^2}{2} = 1$  such that the chord of contact passes through a fixed point  $(\lambda, \mu)$ . Then,  $\mu - \lambda$  is equal to

- A. 2

B. 3

C. 4

D. 5

**Answer: A**



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20. Let  $\omega (\omega \neq 1)$  is a cube root of unity, such that  $(1 + \omega^2)^8 = a + b\omega$  where  $a, b$  in  $\mathbb{R}$ , then  $|a + b|$  is equal to

A. 1

B. 3

C. 0

D. 2

**Answer: D**



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21. For the series

$$S = 1 + \frac{1}{(1+3)}(1+2)^2 + \frac{1}{(1+3+5)}(1+2+3)^2 + \frac{1}{(1+3+5+7)}(1+2+3+4)^2 + \dots$$

if the 7<sup>th</sup> term is K, then  $\frac{K}{4}$  is equal to

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22. The value of  $\lim_{x \rightarrow 2} \sum_{r=1}^7 \frac{x^r - 2^r}{2r(x-2)}$  is equal to

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23. If  $f(\theta) = \begin{vmatrix} \cos^2 \theta & \cos \theta \sin \theta & -\sin \theta \\ \cos \theta \sin \theta & \sin^2 \theta & \cos \theta \\ \sin \theta & -\cos \theta & 0 \end{vmatrix}$  then,

$$f\left(\frac{\pi}{6}\right) + f\left(\frac{\pi}{3}\right) + f\left(\frac{\pi}{2}\right) + f\left(\frac{2\pi}{3}\right) + f\left(\frac{5\pi}{6}\right) + f(\pi) + \dots + f\left(\frac{53\pi}{6}\right)$$

is equal to

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24. The minimum possible distance between the points  $A(a, a - 1)$  and  $B(b, b^2 + b + 1) \forall a, b \in \mathbb{R}$  is  $D$  units, then the value of  $D^2$  is



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25. Let  $2a + 2b + c = 0$ ,  $l_1$  and  $l_2$  are straight lines of the family  $ax + by + c = 0$  which are at 1 unit distance from the point  $(1, 1)$ , then the area (in sq. units) bounded by  $l_1$ ,  $l_2$  and coordinate axes is



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