



## MATHS

### BOOKS - NTA MOCK TESTS

#### NTA JEE MOCK TEST 107

#### Mathematics

1. The coefficient of  $x^{48}$  in the expansion of  $(1 + x^4)(1 + x^{24})(1 + x^{48})$  is

A.  ${}^{12}C_6 + 3$

B.  ${}^{12}C_6$

C. 1

D.  ${}^{12}C_6 + 2$

**Answer: C**



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2. If  $i^2 = -1$  and  $\sum_{r=1}^n (i)^r \forall n \in \mathbb{N}$ , is a non - zero real number, then n can be

A. 100

B. 201

C. 302

D. 403

**Answer: D**

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3. If  $P = \begin{bmatrix} \lambda & 0 \\ 7 & 1 \end{bmatrix}$  and  $Q = \begin{bmatrix} 4 & 0 \\ -7 & 1 \end{bmatrix}$  such that  $P^2 = Q$ , then  $P^3$  is equal to

A.  $\begin{bmatrix} -8 & 0 \\ 21 & 1 \end{bmatrix}$

B.  $\begin{bmatrix} 10 & 1 \\ 8 & 0 \end{bmatrix}$

C.  $\begin{bmatrix} 7 & 0 \\ 8 & 1 \end{bmatrix}$

D.  $\begin{bmatrix} 6 & 0 \\ 4 & 1 \end{bmatrix}$

**Answer: A**

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4. The system of equations  $x + py = 0$ ,  $y + pz = 0$  and  $z + px = 0$  has infinitely many solutions for

A.  $p = 1$

B.  $p = 0$

C.  $p = -1$

D. no real value of  $p$

**Answer: C**



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5. The value of the integral

$$\int_0^1 \left\{ 4t^3(1+t)^8 + 8t^4(1+t)^7 \right\} dt \text{ is}$$

- A. 128
- B. 512
- C. 256
- D. 1024

**Answer: C**



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6. The focal chords of the parabola  $y^2 = 16x$  which are tangent to the circle of radius  $r$  and centre  $(6, 0)$  are

perpendicular, then the radius  $r$  of the circle is

A. units

B.  $\sqrt{2}$  units

C. 1 units

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

**Answer: B**



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7. The equation of the circumcircle of the  $x^2 - 8x + 12 = 0$  and  $y^2 - 14y + 45 = 0$  is

A.  $x^2 + y^2 - 4x - 7y + 57 = 0$

$$\text{B. } x^2 + y^2 - 8x - 14y + 57 = 0$$

$$\text{C. } x^2 + y^2 - 8x - |14y + 5| = 0$$

$$\text{D. } 2x^2 + y^2 - 8x - 14y + 57 = 0$$

**Answer: B**

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8. Let  $A, B, C$  be three events and  $\bar{A}, \bar{B}, \bar{C}$  be their corresponding complementary event. If the probabilities of events  $B, A \cap B \cap \bar{C}$  and  $\bar{A} \cap B \cap \bar{C}$  are  $\frac{5}{6}, \frac{1}{2}$  and  $\frac{1}{4}$  respectively, then the probability of the event  $B \cap C$  is

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

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

C.  $\frac{1}{6}$

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

**Answer: A**



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**9.** The area (in sq. units) of the region in the first quadrant bounded by  $y = x^2$ ,  $y = 2x + 3$  and the y - axis is

A.  $2\sqrt{3}$

B. 6

C. 9



D.  $\frac{44}{3}$

**Answer: C**

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10. If the line  $\frac{x - 4}{1} = \frac{y - 2}{1} = \frac{z - q}{p}$  lies completely in the plane  $2x - 4y + z = 7$ , then the ordered pair  $(p, q)$  is

A.  $(2, 7)$

B.  $(7, 2)$

C.  $(2, 4)$

D.  $(1, 1)$

**Answer: A**



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11. Which of the following statement is converse of the statement "if it rains then we will party"?

- A. We will party or it rains
- B. It rains or we will party
- C. We will not party or it rains
- D. We will not party or it does not rain

**Answer: C**



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12. Let  $y(x)$  is the solution of the differential equation  $(x + 2)\frac{dy}{dx} - (x + 1)y = 2$ . If  $y(0) = -1$ , then the value of  $y(2)$  is equal to

A.  $e^2 + \frac{1}{2}$

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

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

D.  $e^2$

**Answer: B**



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13. For a differentiable function  $f(x)$ , if  $f'(2) = 2$  and  $f'(3) = 1$ , then the value of

$$\lim_{x \rightarrow 0} \frac{f(x^2 + x + 2) - f(2)}{f(x^2 - x + 3) - f(3)}$$
 is equal to

A. 2

B. 1

C.  $-2$

D.  $-1$

**Answer: C**



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14. For  $p > 2$  and  $x \in \mathbb{R}$ , if the number of natural numbers in the range of  $f(x) = \frac{x^2 + 2x + p}{x^2 + 2x + 2}$  is 3, then the value of  $p$  is equal to

A. 3

B. 4

C. 5

D. 6

**Answer: C**



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15. Let  $\vec{V}_1 = \hat{i} + a\hat{j} + \hat{k}$ ,  $\vec{V}_2 = \hat{j} + a\hat{k}$  and  $\vec{V}_3 = a\hat{i} + \hat{k}$ ,  $\forall a > 0$ . If  $\left[ \vec{V}_1 \ \vec{V}_2 \ \vec{V}_3 \right]$  is minimum, then the value of  $a$  is

A.  $\sqrt{3}$

B. 3

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

D.  $\frac{1}{\sqrt{3}}$

**Answer: D**



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16. The orthocentre of the triangle whose vertices are  $(1, 1)$ ,  $(5, 1)$  and  $(4, 5)$  is

A.  $\left(\frac{9}{4}, -\frac{1}{3}\right)$

B.  $(4, 13)$

C.  $\left(4, \frac{9}{4}\right)$

D.  $\left(4, \frac{7}{4}\right)$

**Answer: D**



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17. Let  $a \in \left(0, \frac{\pi}{2}\right)$  and

$f(x) = \sqrt{x^2 + x} + \frac{\tan^2 \alpha}{\sqrt{x^2 + x}}, x > 0$ . If the least value of

$f(x)$  is  $2\sqrt{3}$ , then  $\alpha$  is equal to

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

B.  $\frac{\pi}{8}$

C.  $\frac{\pi}{6}$

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

**Answer: A**



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**18.** A normal is drawn to the ellipse  $\frac{x^2}{9} + y^2 = 1$  at the point  $(3 \cos \theta, \sin \theta)$  where  $0 < \theta < \frac{\pi}{2}$ . If N is the foot of the perpendicular from the origin O to the normal such that  $ON = 2$ , then  $\theta$  is equal to



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

B.  $\frac{\pi}{12}$

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

D.  $\frac{\pi}{6}$

**Answer: D**



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**19.** The natural domain of the function

$$f(x) = \sqrt{\sin^{-1}(2x) + \frac{\pi}{3}}$$
 is

A.  $\left[-\frac{1}{2}, \frac{1}{2}\right]$

B.  $\left[-\frac{\sqrt{3}}{4}, \frac{1}{2}\right]$

C.  $\left[ \frac{13}{4}, \frac{1}{2} \right]$

D.  $\left[ -\frac{\sqrt{3}}{2}, 1 \right]$

**Answer: B**



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**20.** In the interval  $[0, 2]$ , on which of the following function Lagrange's mean value theorem is not applicable ?

A.  $f(x) = \begin{cases} \frac{\sin x}{x} & x \neq 0 \\ 1 & x = 0 \end{cases}$

B.  $f(x) = \begin{cases} 1 - x & x < 1 \\ (1 - x)^2 & x \geq 1 \end{cases}$

C.  $f(x) = x^2|x|$

D.  $f(x) = |e^x - 1|$

**Answer: B**

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**21.** The number of ways three different natural numbers can be drawn from the set  $\{1, 2, 3, 4, \dots, 10\}$ , if minimum of the chosen numbers is smaller than 4, is

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**22.** Let

$$f(x) = x^2 + 2px + 2q^2 \text{ and } g(x) = -x^2 - 2px + p^2$$

(where  $q \neq 0$ ). If  $x \in R$  and the minimum value of  $f(x)$  is

equal to the maximum value of  $g(x)$ , then the value of  $\frac{p^2}{q^2}$  is equal to

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23. If

$$\int \frac{dx}{(x+1)^2(x^2+2x+2)} = \frac{A}{x+1} + B \tan^{-1}(x+1) + C,$$

where A and B are constants and C is the constant of integration, then  $|A - B|$  is equal to

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24. The number of solutions of the equation  $\sin x \cdot \sin 2x \cdot \sin 3x \cdot \sin 4x \cdot \sin 5x = 0$  in  $[0, \pi]$  is equal to



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**25.** A balloon is rising vertically upwards. At an instant, an observation on the ground, whose distance from the balloon is 100 meters, sees the balloon at an angle of elevation of  $30^\circ$ . If the balloon rises further vertically to a point where the angle of elevation as seen by the observer is  $45^\circ$ , then its height (in meters) from the ground is  
(Take  $\sqrt{3} = 1.73$ )

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