



## MATHS

### BOOKS - NTA MOCK TESTS

### NTA JEE MOCK TEST 108

#### Mathematics

1. For  $f(x) = x^3 + bx^2 + cx + d$ , if  $b^2 > 4c > 0$  and

$b, c, d \in R$ , then  $f(x)$

A. is strictly increasing

B. is strictly decreasing

C. has a local maxima

D. is bounded

**Answer: C**



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2. Let  $f(x)$  be a differentiable function such that

$$\int_t^{t^2} x f(x) dx = \frac{4}{3}t^3 - \frac{4t}{3} \quad \forall t \geq 0, \text{ then } f(1) \text{ is equal to}$$

A. 4

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

C. 3

D.  $\frac{8}{3}$

**Answer: D**



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3. If the area bounded by  $y^2 = 4ax$  and  $x^2 = 4ay$  is  $\frac{64}{3}$  square units, then the positive value of  $a$  is

A. 1

B. 2

C. 3

D. 4

**Answer: B**



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4. If  $\left(\frac{2 + \cos x}{3 + y}\right) \frac{dy}{dx} + \sin x = 0$  and  $y(0) = 1$ , then  $y\left(\frac{\pi}{3}\right)$  is equal to

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

B.  $\frac{7}{3}$

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

D. 1

**Answer: C**



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5. The area (in square units) of the triangle bounded by  $x = 4$  and the lines  $y^2 - x^2 + 2x = 1$  is equal to

A. 3

B. 6

C. 12

D. 9

**Answer: D**



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6. The angle between the tangents drawn from the point (2, 6) to the parabola  $y^2 - 4y - 4x + 8 = 0$  is

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

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

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

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

**Answer: C**

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7. If  $f(x) = \cos x + \sin x$  and  $g(x) = x^2 - 1$ , then  $g(f(x))$  is injective in the interval

A.  $\left[0, \frac{\pi}{2}\right]$

B.  $\left[-\frac{\pi}{4}, \frac{\pi}{4}\right]$

C.  $\left[-\frac{\pi}{2}, \frac{\pi}{2}\right]$

D.  $[0, \pi]$

**Answer: B**

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8. The value of  $\lim_{x \rightarrow 0} \frac{(1 + 6x)^{\frac{1}{3}} - (1 + 4x)^{\frac{1}{2}}}{x^2}$  is equal to

A. 1

B. 2

C. -1

D. -2

**Answer: D**



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9. If  $\int \frac{x}{x + 1 + e^x} dx = px + q \ln|x + 1 + e^x| + c$ , where  $c$  is the constant of integration, then  $p + q$  is equal to

A. 0

B. 1

C. 2

D. 3

**Answer: A**



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**10.** Let  $X_n$  denote the mean of first  $n$  natural numbers, then the mean of  $X_1, X_2, \dots, X_{100}$  is

A. 25

B. 50

C. 25.5



D. 25.75

**Answer: D**



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11. Let  $f(x) = \frac{\sin x + 3 \sin 3x + 5 \sin 5x + 3 \sin 7x}{\sin 2x + 2 \sin 4x + 3 \sin 6x}$ ,  
wherever defined. If  $x_1 + x_2 = \frac{\pi}{2}$ , where  $f(x)$  is defined at  
 $x_1$  and  $x_2$ , then  $f^2(x_1) + f^2(x_2)$  is

A.  $\cos^2 x$

B.  $\sin^2 x$

C. 4

D. 1

**Answer: C**



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12. If two points A and B lie on the curve  $y = x^2$  such that  $\vec{OA} \cdot \hat{i} = 1$  and  $\vec{OB} \cdot \hat{j} = 4$ , where O is origin and A and B lie in the 1<sup>st</sup> and 2<sup>nd</sup> quadrant respectively, then  $\vec{OA} \cdot \vec{OB}$  is equal to

A. 0

B. 2

C. 4

D. 5

**Answer: B**



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13. A man alternately tosses a coin and throw a dice, beginning with the coin. The probability that he gets a head in coin before he gets a 5 or 6 in dice, is

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

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

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

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

**Answer: A**



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14. A plane P passes through the point  $(1, 1, 1)$  and is parallel to the vectors  $\vec{a} = -\hat{i} + \hat{j}$  and  $\vec{b} = \hat{i} - \hat{k}$ . The

distance of the point  $\left(\frac{3\sqrt{3}}{2}, 3\sqrt{3}, 3\right)$  from the plane is equal to

- A.  $\sqrt{3}$  units
- B.  $\frac{9}{2}$  units
- C.  $3\sqrt{3}$  units
- D. 3 units

**Answer: B**

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15. Let A and B two non singular matrices of same order such that  $(AB)^k = B^k A^k$  for consecutive positive integral values of k, then  $AB^2 A^{-1}$  is equal to

A.  $A^2$

B. B

C. A

D.  $B^2$

**Answer: D**



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16. The value of  $\sum_{r=1}^n (-1)^{r+1} \frac{{}^n C_r}{r+1}$  is equal to

A.  $-\frac{1}{n+1}$

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

C.  $\frac{1}{n+1}$

D.  $\frac{n}{n+1}$

**Answer: D**



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17. If  $\alpha$  and  $\beta$  are the roots of the equation  $x^2 + \alpha x + \beta = 0$  such that  $\alpha \neq \beta$ , then the number of integral values of  $x$  satisfying  $||x - \beta| - \alpha| < 1$  is

A. 0

B. 1

C. 2

D. more than 2

**Answer: C**



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18. Given  $\alpha$  and  $\beta$  are the roots of the quadratic equation  $x^2 - 4x + k = 0 (k \neq 0)$ . If  $\alpha\beta, \alpha\beta^2 + \alpha^2\beta$  and  $\alpha^3 + \beta^3$  are in geometric progression, then the value of  $k$  is equal to

A. 4

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

C.  $\frac{3}{7}$

D. 12

**Answer: B**



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19. The equation  $\cos^4 x - \sin^4 x + \cos 2x + \alpha^2 + \alpha = 0$  will have at least one solution, if

A.  $-2 \leq \alpha \leq 2$

B.  $-3 \leq \alpha \leq 1$

C.  $-2 \leq \alpha \leq 1$

D.  $-1 \leq \alpha \leq 2$

**Answer: C**



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20. The radius of the circle with centre at  $(3, 2)$  and whose common chord with the circle



$C: x^2 + y^2 - 4x - 8y + 16 = 0$  is also a diameter of the circle C, is

- A. 3 units
- B. 2 units
- C. 1 units
- D.  $\sqrt{3}$  units

**Answer: A**

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**21.** Let

$$f(x) = [x]\{x^2\} + [x][x^2] + \{x\}[x^2] + \{x\}\{x^2\}, \forall x \in [0, 10]$$

[.] and {.} the greatest integer and fractional part

functions respectively). The number of points of discontinuity of  $f(x)$  is

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22. If the line  $2x + \sqrt{6}y = 2$  touches the hyperbola  $x^2 - 2y^2 = a^2$ , then  $a^2$  is equal to

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23. If  $i^2 = -1$  and  $\left(\frac{1+i}{\sqrt{2}}\right)^n = \left(\frac{1-i}{\sqrt{2}}\right)^m = 1, \forall n, m \in N$ , then the minimum value of  $n + m$  is equal to

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24. If  $a$ ,  $b$  and  $c$  are non - zero real numbers and if system of equations

$(a - 1)x = y + z$ ,  $(b - 1)y = z + x$  and  $(c - 1)z = x + y$  have a non - trivial solutin, then  $\frac{3}{2a} + \frac{3}{2b} + \frac{3}{2c}$  is equal to

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25. The number of quadratic polynomials  $ax^2 + 2bx + c$  which satisfy the following conditions is  $k$

(i)  $a, b, c$  are distinct

(ii)  $a, b, c \in \{1, 2, 3, 4, \dots, 2001, 2002\}$

(iii)  $x + 1$  divides  $ax + 2bx + c$  Then  $\frac{k}{10^5}$  is equal to

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