

**FINAL JEE–MAIN EXAMINATION – SEPTEMBER, 2020**

**(Held On Saturday 05<sup>th</sup> SEPTEMBER, 2020) TIME : 9 AM to 12 PM**

**MATHEMATICS**

1. If  $3^{2 \sin 2\alpha - 1}$ , 14 and  $3^{4 - 2 \sin 2\alpha}$  are the first three terms of an A.P. for some  $\alpha$ , then the sixth term of this A.P. is :

- (1) 66 (2) 65  
(3) 81 (4) 78

**Official Ans. by NTA (1)**

2. If the function  $f(x) = \begin{cases} k_1(x - \pi)^2 - 1, & x \leq \pi \\ k_2 \cos x, & x > \pi \end{cases}$

is twice differentiable, then the ordered pair  $(k_1, k_2)$  is equal to :

- (1)  $\left(\frac{1}{2}, 1\right)$  (2) (1, 1)  
(3)  $\left(\frac{1}{2}, -1\right)$  (4) (1, 0)

**Official Ans. by NTA (1)**

3. If the common tangent to the parabolas,  $y^2 = 4x$  and  $x^2 = 4y$  also touches the circle,  $x^2 + y^2 = c^2$ , then  $c$  is equal to :

- (1)  $\frac{1}{2}$  (2)  $\frac{1}{2\sqrt{2}}$   
(3)  $\frac{1}{\sqrt{2}}$  (4)  $\frac{1}{4}$

**Official Ans. by NTA (3)**

4. The negation of the Boolean expression  $x \leftrightarrow \sim y$  is equivalent to :

- (1)  $(\sim x \wedge y) \vee (\sim x \wedge \sim y)$   
(2)  $(x \wedge \sim y) \vee (\sim x \wedge y)$   
(3)  $(x \wedge y) \vee (\sim x \wedge \sim y)$   
(4)  $(x \wedge y) \wedge (\sim x \vee \sim y)$

**Official Ans. by NTA (3)**

**TEST PAPER WITH ANSWER**

5. If the volume of a parallelepiped, whose coterminus edges are given by the vectors  $\vec{a} = \hat{i} + \hat{j} + n\hat{k}$ ,  $\vec{b} = 2\hat{i} + 4\hat{j} - n\hat{k}$  and

$\vec{c} = \hat{i} + n\hat{j} + 3\hat{k}$  ( $n \geq 0$ ), is 158 cu. units, then :

- (1)  $\vec{a} \cdot \vec{c} = 17$  (2)  $\vec{b} \cdot \vec{c} = 10$   
(3)  $n = 7$  (4)  $n = 9$

**Official Ans. by NTA (2)**

6. If  $y = y(x)$  is the solution of the differential

equation  $\frac{5 + e^x}{2 + y} \cdot \frac{dy}{dx} + e^x = 0$  satisfying

$y(0) = 1$ , then a value of  $y(\log_e 13)$  is :

- (1) 1 (2) -1  
(3) 2 (4) 0

**Official Ans. by NTA (2)**

7. A survey shows that 73% of the persons working in an office like coffee, whereas 65% like tea. If  $x$  denotes the percentage of them, who like both coffee and tea, then  $x$  cannot be:

- (1) 63 (2) 38  
(3) 54 (4) 36

**Official Ans. by NTA (4)**

8. The product of the roots of the equation  $9x^2 - 18|x| + 5 = 0$ , is

- (1)  $\frac{25}{9}$  (2)  $\frac{25}{81}$   
(3)  $\frac{5}{27}$  (4)  $\frac{5}{9}$

**Official Ans. by NTA (2)**

9. If  $\int (e^{2x} + 2e^x - e^{-x} - 1)e^{(e^x+e^{-x})} dx$   
 =  $g(x)e^{(e^x+e^{-x})} + c$ , where  $c$  is a constant of  
 integration, then  $g(0)$  is equal to :
- (1) 2 (2)  $e^2$   
 (3)  $e$  (4) 1

**Official Ans. by NTA (1)**

10. If the minimum and the maximum values of the  
 function  $f : \left[ \frac{\pi}{4}, \frac{\pi}{2} \right] \rightarrow \mathbb{R}$ , defined by :

$$f(\theta) = \begin{vmatrix} -\sin^2 \theta & -1 - \sin^2 \theta & 1 \\ -\cos^2 \theta & -1 - \cos^2 \theta & 1 \\ 12 & 10 & -2 \end{vmatrix}$$

are  $m$  and  $M$  respectively, then the ordered pair  
 ( $m, M$ ) is equal to :

- (1) (0, 4) (2) (-4, 4)  
 (3) (0,  $2\sqrt{2}$ ) (4) (-4, 0)

**Official Ans. by NTA (4)**

11. Let  $\lambda \in \mathbb{R}$ . The system of linear equations

$$2x_1 - 4x_2 + \lambda x_3 = 1$$

$$x_1 - 6x_2 + x_3 = 2$$

$$\lambda x_1 - 10x_2 + 4x_3 = 3$$

is inconsistent for :

- (1) exactly one negative value of  $\lambda$ .  
 (2) exactly one positive value of  $\lambda$ .  
 (3) every value of  $\lambda$ .  
 (4) exactly two values of  $\lambda$ .

**Official Ans. by NTA (1)**

12. If  $S$  is the sum of the first 10 terms of the series

$$\tan^{-1}\left(\frac{1}{3}\right) + \tan^{-1}\left(\frac{1}{7}\right) + \tan^{-1}\left(\frac{1}{13}\right) + \tan^{-1}\left(\frac{1}{21}\right) + \dots,$$

then  $\tan(S)$  is equal to :

- (1)  $\frac{5}{11}$  (2)  $-\frac{6}{5}$   
 (3)  $\frac{10}{11}$  (4)  $\frac{5}{6}$

**Official Ans. by NTA (4)**

13. If the four complex numbers  $z, \bar{z}, \bar{z} - 2\text{Re}(\bar{z})$   
 and  $z - 2\text{Re}(z)$  represent the vertices of a square  
 of side 4 units in the Argand plane, then  $|z|$  is  
 equal to :

- (1) 4 (2) 2  
 (3)  $4\sqrt{2}$  (4)  $2\sqrt{2}$

**Official Ans. by NTA (4)**

14. If the point  $P$  on the curve,  $4x^2 + 5y^2 = 20$  is  
 farthest from the point  $Q(0, -4)$ , then  $PQ^2$  is  
 equal to :

- (1) 21 (2) 36  
 (3) 48 (4) 29

**Official Ans. by NTA (2)**

15. The mean and variance of 7 observations are  
 8 and 16, respectively. If five observations are  
 2, 4, 10, 12, 14, then the absolute difference  
 of the remaining two observations is :

- (1) 2 (2) 4  
 (3) 3 (4) 1

**Official Ans. by NTA (1)**

16. If  $(a, b, c)$  is the image of the point  $(1, 2, -3)$   
 in the line,  $\frac{x+1}{2} = \frac{y-3}{-2} = \frac{z}{-1}$ , then  
 $a + b + c$  is equal to

- (1) -1 (2) 2  
 (3) 3 (4) 1

**Official Ans. by NTA (2)**

17. The value of  $\int_{-\pi/2}^{\pi/2} \frac{1}{1+e^{\sin x}} dx$  is

- (1)  $\pi$  (2)  $\frac{3\pi}{2}$   
 (3)  $\frac{\pi}{4}$  (4)  $\frac{\pi}{2}$

**Official Ans. by NTA (4)**

18. If  $2^{10} + 2^9 \cdot 3^1 + 2^8 \cdot 3^2 + \dots + 2 \cdot 3^9 + 3^{10} = S - 2^{11}$ , then S is equal to :

- (1)  $\frac{3^{11}}{2} + 2^{10}$  (2)  $3^{11} - 2^{12}$   
 (3)  $3^{11}$  (4)  $2 \cdot 3^{11}$

**Official Ans. by NTA (3)**

19. If the co-ordinates of two points A and B are  $(\sqrt{7}, 0)$  and  $(-\sqrt{7}, 0)$  respectively and P is any point on the conic,  $9x^2 + 16y^2 = 144$ , then PA + PB is equal to :

- (1) 8 (2) 6  
 (3) 16 (4) 9

**Official Ans. by NTA (1)**

20. If  $\alpha$  is the positive root of the equation,

$$p(x) = x^2 - x - 2 = 0, \text{ then } \lim_{x \rightarrow \alpha^+} \frac{\sqrt{1 - \cos(p(x))}}{x + \alpha - 4}$$

is equal to

- (1)  $\frac{3}{\sqrt{2}}$  (2)  $\frac{3}{2}$   
 (3)  $\frac{1}{\sqrt{2}}$  (4)  $\frac{1}{2}$

**Official Ans. by NTA (1)**

21. Four fair dice are thrown independently 27 times. Then the expected number of times, at least two dice show up a three or a five, is \_\_\_\_\_.

**Official Ans. by NTA (11)**

22. If the line,  $2x - y + 3 = 0$  is at a distance  $\frac{1}{\sqrt{5}}$

and  $\frac{2}{\sqrt{5}}$  from the lines  $4x - 2y + \alpha = 0$  and

$6x - 3y + \beta = 0$ , respectively, then the sum of all possible values of  $\alpha$  and  $\beta$  is \_\_\_\_\_

**Official Ans. by NTA (30)**

23. The natural number m, for which the coefficient

of x in the binomial expansion of  $\left(x^m + \frac{1}{x^2}\right)^{22}$

is 1540, is \_\_\_\_\_.

**Official Ans. by NTA (13)**

24. The number of words, with or without meaning, that can be formed by taking 4 letters at a time from the letters of the word 'SYLLABUS' such that two letters are distinct and two letters are alike, is \_\_\_\_\_.

**Official Ans. by NTA (240)**

25. Let  $f(x) = x \cdot \left[\frac{x}{2}\right]$ , for  $-10 < x < 10$ , where [t]

denotes the greatest integer function. Then the number of points of discontinuity of f is equal to \_\_\_\_\_.

**Official Ans. by NTA (8)**