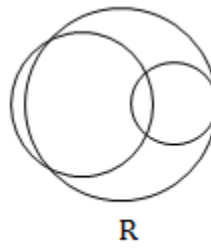
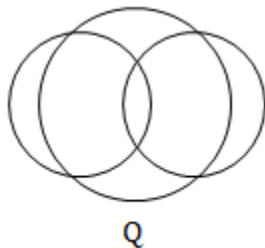
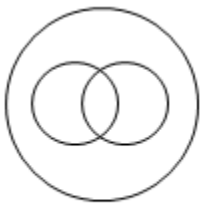


## JEE-Main Mathematics Questions Paper 17.3.2021 Shift-1

1. The inverse of  $y = 5^{\log x}$  is :
- (a)  $x = 5^{\log y}$                       (b)  $x = y^{\log 5}$                       (c)  $x = y^{\frac{1}{\log 5}}$                       (d)  $x = 5^{\frac{1}{\log y}}$
2. Let  $\vec{a} = 2\hat{i} - 3\hat{j} + 4\hat{k}$  and  $\vec{b} = 7\hat{i} + \hat{j} - 6\hat{k}$ .  
If  $\vec{r} \times \vec{a} = \vec{r} \times \vec{b}$ ,  $\vec{r} \cdot (\hat{i} + 2\hat{j} + \hat{k}) = -3$ , then  $\vec{r} \cdot (2\hat{i} - 3\hat{j} + \hat{k})$  is equal to:
- (a) 12                                      (b) 8                                      (c) 13                                      (d) 10
3. In a triangle PQR, the co-ordinates of the points P and Q are  $(-2, 4)$  and  $(4, -2)$  respectively. If the equation of the perpendicular bisector of PR is  $2x - y + 2 = 0$ , then the centre of the circumcircle of the  $\Delta PQR$  is:
- (a)  $(-1, 0)$                               (b)  $(-2, -2)$                               (c)  $(0, 2)$                               (d)  $(1, 4)$
4. The system of equations  $kx + y + z = 1$ ,  $x + ky + z = k$  and  $x + y + zk = k^2$  has no solution if  $k$  is equal to:
- (a) 0                                      (b) 1                                      (c) -1                                      (d) -2
5. If  $\cot^{-1}(\alpha) = \cot^{-1} 2 + \cot^{-1} 8 + \cot^{-1} 18 + \cot^{-1} 32 + \dots$  upto 100 terms, then  $\alpha$  is:
- (a) 1.01                                      (b) 1.00                                      (c) 1.02                                      (d) 1.03
6. The equation of the plane contains the y-axis and passes through the point  $(1, 2, 3)$  is:
- (a)  $x + 3z = 10$                               (b)  $x + 3z = 0$                               (c)  $3x + z = 6$                               (d)  $3x - z = 0$
7. If  $A = \begin{pmatrix} 0 & \sin \alpha \\ \sin \alpha & 0 \end{pmatrix}$  and  $\det\left(A^2 - \frac{1}{2}I\right) = 0$ , then a possible value of  $\alpha$  is
- (a)  $\frac{\pi}{2}$                                       (b)  $\frac{\pi}{3}$                                       (c)  $\frac{\pi}{4}$                                       (d)  $\frac{\pi}{6}$
8. If the Boolean expression  $(p \Rightarrow q) \Leftrightarrow (q * (\sim p))$  is a tautology, then the Boolean expression  $p * (\sim q)$  is equivalent to:
- (a)  $q \Rightarrow p$                               (b)  $\sim q \Rightarrow p$                               (c)  $p \Rightarrow \sim q$                               (d)  $p \Rightarrow q$
9. Two dices are rolled. If both dices have six faces numbered 1, 2, 3, 5, 7 and 11, then the probability that the sum of the numbers on the top faces is less than or equal to 8 is:
- (a)  $\frac{4}{9}$                                       (b)  $\frac{17}{36}$                                       (c)  $\frac{5}{12}$                                       (d)  $\frac{1}{2}$
10. If the fourth term in the expansion of  $(x + x^{\log_2 x})^7$  is 4480, then the value of  $x$  where  $x \in \mathbb{N}$  is equal to:
- (a) 2                                      (b) 4                                      (c) 3                                      (d) 1
11. In a school, there are three types of games to be played. Some of the students play two types of games, but none play all the three games. Which Venn diagrams can justify the above statement?



(a) P and Q

(b) P and R

(c) None of these

(d) Q and R

12. The sum of possible values of  $x$  for  $\tan^{-1}(x+1) + \cot^{-1}\left(\frac{1}{x-1}\right) = \tan^{-1}\left(\frac{8}{31}\right)$  is:
- (a)  $-\frac{32}{4}$                       (b)  $-\frac{31}{4}$                       (c)  $-\frac{30}{4}$                       (d)  $-\frac{33}{4}$
13. The area of the triangle with vertices  $A(z)$ ,  $B(iz)$  and  $C(z+iz)$  is:
- (a) 1                      (b)  $\frac{1}{2}|z|^2$                       (c)  $\frac{1}{2}$                       (d)  $\frac{1}{2}|z+iz|^2$
14. The line  $2x - y + 1 = 0$  is a tangent to the circle at the point  $(2, 5)$  and the centre of the circle lies on  $x - 2y = 4$ . Then, the radius of the circle is:
- (a)  $3\sqrt{5}$                       (b)  $5\sqrt{3}$                       (c)  $5\sqrt{4}$                       (d)  $4\sqrt{5}$
15. Team 'A' consists of 7 boys and  $n$  girls and Team 'B' has 4 boys and 6 girls. If a total of 52 single matches can be arranged between these two teams when a boy plays against a boy and a girl plays against a girl, then  $n$  is equal to:
- (a) 5                      (b) 2                      (c) 4                      (d) 6
16. The value of  $4 + \frac{1}{5 + \frac{1}{4 + \frac{1}{5 + \frac{1}{4 + \dots \infty}}}}$  is:
- (a)  $2 + \frac{2}{5}\sqrt{30}$                       (b)  $2 + \frac{4}{5}\sqrt{30}$                       (c)  $4 + \frac{4}{5}\sqrt{30}$                       (d)  $5 + \frac{2}{5}\sqrt{30}$
17. Choose the incorrect statement about the two circles whose equations are given below:  
 $x^2 + y^2 - 10x - 10y + 41 = 0$  and  
 $x^2 + y^2 - 16x - 10y + 80 = 0$
- (a) Distance between two centres is the average of radii of both the circles.  
 (b) Both circles' centres lie inside region of one another.  
 (c) Both circles pass through the centre of each other.  
 (d) Circles have two intersection points.
18. Which of the following statements is incorrect for the function  $g(\alpha)$  for  $\alpha \in \mathbb{R}$  such that
- $$g(\alpha) = \int_{\frac{\pi}{6}}^{\frac{\pi}{3}} \frac{\sin^\alpha x}{\cos^\alpha x + \sin^\alpha x} dx$$
- (a)  $g(\alpha)$  is a strictly increasing function  
 (b)  $g(\alpha)$  has an inflection point at  $\alpha = -\frac{1}{2}$   
 (c)  $g(\alpha)$  is a strictly decreasing function  
 (d)  $g(\alpha)$  is an even function

19. Which of the following is true for  $y(x)$  that satisfies the differential equation

$$\frac{dy}{dx} = xy - 1 + x - y; y(0) = 0:$$

(a)  $y(1) = e^{\frac{1}{2}} - 1$

(b)  $y(1) = e^{\frac{1}{2}} - e^{-\frac{1}{2}}$

(c)  $y(1) = 1$

(d)  $y(1) = e^{\frac{1}{2}} - 1$

20. The value of  $\lim_{x \rightarrow 0^+} \frac{\cos^{-1}(x - [x]^2) \cdot \sin^{-1}(x - [x]^2)}{x - x^3}$ , where  $[x]$  denotes the greatest integer  $\leq x$  is:

(a)  $\pi$

(b) 0

(c)  $\frac{\pi}{4}$

(d)  $\frac{\pi}{2}$

### Integer Type

- The maximum value of  $z$  in the following equation  $z = 6xy + y^2$ , where  $3x + 4y \leq 100$  and  $4x + 3y \leq 75$  for  $x \geq 0$  and  $y \geq 0$  is \_\_\_\_.
- If the function  $f(x) = \frac{\cos(\sin x) - \cos x}{x^4}$  is continuous at each point in its domain and  $f(0) = \frac{1}{k}$ , then  $k$  is \_\_\_\_.
- If  $f(x) = \sin\left(\cos^{-1}\left(\frac{1-2^{2x}}{1+2^{2x}}\right)\right)$  and its first derivative with respect to  $x$  is  $-\frac{b}{a} \log_e 2$  when  $x = 1$ , where  $a$  and  $b$  are integers, then the minimum value of  $|a^2 - b^2|$  is \_\_\_\_.
- Let three be three independent events  $E_1, E_2$  and  $E_3$ . The probability that only  $E_1$  occurs is  $\alpha$ , only  $E_2$  occurs is  $\beta$  and only  $E_3$  occurs is  $\gamma$ . Let 'p' denotes the probability of none of events occurs that satisfies the equations  $(\alpha - 2\beta)p = \alpha\beta$  and  $(\beta - 3\gamma)p = 2\beta\gamma$ . All the given probabilities are assumed to lie in the interval  $(0, 1)$ .  
Then,  $\frac{\text{Probability of occurrence of } E_1}{\text{Probability of occurrence of } E_3}$  is equal to \_\_\_\_.
- If  $\vec{a} = \alpha\hat{i} + \beta\hat{j} + 3\hat{k}$ ,  
 $\vec{b} = -\beta\hat{i} - \alpha\hat{j} - \hat{k}$  and  
 $\vec{c} = \hat{i} - 2\hat{j} - \hat{k}$   
such that  
 $\vec{a} \cdot \vec{b} = 1$  and  $\vec{b} \cdot \vec{c} = -3$ , then  $\frac{1}{3}((\vec{a} \times \vec{b}) \cdot \vec{c})$  is equal to \_\_\_\_.
- If  $A = \begin{bmatrix} 2 & 3 \\ 0 & -1 \end{bmatrix}$ , then the value of  $\det(A^4) + \det(A^{10} - (\text{Adj}(2A))^{10})$  is equal to \_\_\_\_.

7. If  $[.]$  represents the greatest integer function, then the value of

$$\left| \int_0^{\sqrt{\frac{\pi}{2}}} \left[ [x^3] - \cos x \right] dx \right| \text{ is } \underline{\hspace{2cm}} .$$

8. The minimum distance between any two points  $P_1$  and  $P_2$  while considering point  $P_1$  on one circle and point  $P_2$  on the other circle for the given circles' equations

$$x^2 + y^2 - 10x - 10y + 41 = 0$$

$$x^2 + y^2 - 24x - 10y + 160 = 0 \text{ is } \underline{\hspace{2cm}} .$$

9. If the equation of the plane passing through the line of intersection of the planes

$$2x - 7y + 4z - 3 = 0, 3x - 5y + 4z + 11 = 0 \text{ and the point } (-2, 1, 3) \text{ is } ax + by + cz - 7 = 0, \text{ then the value of } 2a + b + c - 7 \text{ is } \underline{\hspace{2cm}} .$$

10. If  $(2021)^{3762}$  is divided by 17, then the remainder is  $\underline{\hspace{2cm}}$ .

### ANSWER KEYS

#### Single Correct Type

1.	c	2.	a	3.	b	4.	d	5.	a
6.	d	7.	c	8.	a	9.	b	10.	a
11.	c	12.	a	13.	b	14.	a	15.	c
16.	a	17.	b	18.	d	19.	a	20.	d

#### Integer Type

1. 904

2. 6

3. 481

4. 6

5. 2

6. 16

7. 1

8. 1

9. 4

10. 4