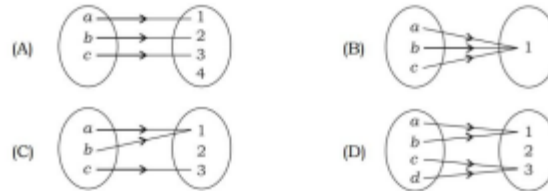


**PREVIOUS QUESTIONS AND ANSWERS**

**MATHS(311)**



1. Which one of the following mappings represents an onto function? (2024)

**Ans) Option B. Every element has a pre image.**

2. The direction cosines of y-axis are (2024)

- a) 1,1,0      b) 1,0,1      c) 0,1,0      d) 0,1,1

**Ans) Option c**

3. Two statements p and q are given (2023)

p : If a number is divisible by 3, then it is divisible by 9 also.

q : If a number is not divisible by 9, then it is not divisible by 3 also.

- a) q is negation of p      c) q is converse of p  
b) q is contrapositive of p      d) None of the above

**Ans) Option b**

4. The value of  $\cot(\tan^{-1}\alpha + \cot^{-1}\alpha)$  is (2023)

- a) 0      b) 1      c)  $\pi/4$       d)  $\pi/2$

$$\tan^{-1}\alpha + \cot^{-1}\alpha = \frac{\pi}{2}, \cot\frac{\pi}{2} = 0$$

**Ans) Option a.**

5. Find the area of a triangle whose vertices are (-2,-3),(3,2) and (-1,-8) (2022)

$$\frac{1}{2} \begin{vmatrix} x_1 & y_1 & 1 \\ x_2 & y_2 & 1 \\ x_3 & y_3 & 1 \end{vmatrix} - \frac{1}{2} \text{ mark}$$

**Ans) Area =**

$$\text{Area} = \frac{1}{2} \begin{vmatrix} -2 & -3 & 1 \\ 3 & 2 & 1 \\ -1 & -8 & 1 \end{vmatrix} - \frac{1}{2} \text{ mark}$$

$$\text{Area} = \frac{1}{2} [-2(2+8) + 3(3+1) + 1(-24+2)] = -15 = 15 \text{ sq units} - 1 \text{ mark}$$

6. If A is a skew-symmetric matrix, then all its diagonal elements are \_\_\_\_\_ (2024)

**Ans) Zero**

7. Show that the points A(2,3,4), B(5,8,7) and C(-1,-2,1) are collinear (2022)

$$\text{Ans) Distance of } |AB| = \sqrt{[(5-2)^2 + (8-3)^2 + (7-4)^2]} = \sqrt{43} - \frac{1}{2} \text{ mark}$$

$$\text{Distance of } |BC| = \sqrt{[(-1-5)^2 + (-2-8)^2 + (1-7)^2]} = \sqrt{172} = 2\sqrt{43} - \frac{1}{2} \text{ mark}$$

$$\text{Distance of } |AC| = \sqrt{[(-1-2)^2 + (-2-3)^2 + (1-4)^2]} = \sqrt{43} - \frac{1}{2} \text{ mark}$$

**AB + AC = BC ; Collinear - 1/2 mark**

8. For A =  $\begin{bmatrix} 1 & 2 \\ 3 & 2 \end{bmatrix}$ ,  $|A^2| = (|A|)^2$  (2021)

$$\text{Ans) } A^2 = \begin{bmatrix} 1 & 2 \\ 3 & 2 \end{bmatrix} \begin{bmatrix} 1 & 2 \\ 3 & 2 \end{bmatrix} = \begin{bmatrix} 7 & 6 \\ 9 & 10 \end{bmatrix} - \frac{1}{2} \text{ mark}$$

$$|A^2| = 70 - 54 = 16 - \frac{1}{2} \text{ mark}$$

$$|A| = 2 - 6 = -4 - \frac{1}{2} \text{ mark}$$

$$(|A|)^2 = -4^2 = 16 - \frac{1}{2} \text{ mark}$$

9. Find the area of the parallelogram whose diagonals are  $2\hat{i} - 3\hat{j} + 4\hat{k}$  and  $2\hat{i} - 3\hat{k}$  (2021)

$$\vec{a} \times \vec{b} = \begin{vmatrix} \hat{i} & \hat{j} & \hat{k} \\ 2 & -3 & 4 \\ 2 & 0 & -3 \end{vmatrix} - \frac{1}{2} \text{ mark}$$

Ans)

$$\hat{i}(9 - 0) - \hat{j}(-6 - 8) + \hat{k}(0 + 6) = 9\hat{i} + 14\hat{j} + 6\hat{k} - \frac{1}{2} \text{ mark}$$

$$|\vec{a} \times \vec{b}| = \sqrt{81 + 196 + 36} = \sqrt{313} \text{ unit}^2 - 1 \text{ mark}$$

10. A binary operation \* on a set A is a function from \_\_\_\_\_ to A (2024)

Ans) A x A

11. If  $x = \cos \alpha - \cos 2\alpha$  and  $y = \sin \alpha - \sin 2\alpha$ , find  $\frac{dy}{dx}$  (2016)

Ans)  $\frac{dx}{d\alpha} = 2 \sin 2\alpha - \sin \alpha - 1 \text{ mark}$

$$\frac{dy}{d\alpha} = \cos \alpha - 2 \cos 2\alpha - 1 \text{ mark}$$

$$\frac{dy}{dx} = \frac{\cos \alpha - 2 \cos 2\alpha}{2 \sin 2\alpha - \sin \alpha} - 2 \text{ mark}$$

12. Show that a closed right circular cylinder of given surface has maximum volume if it's height equals the diameter of its base. (2023)

Ans)  $S = 2\pi rh + 2\pi r^2 - \frac{1}{2} \text{ mark}$

$$V = \pi r^2 h = \pi r^2 \left[ \frac{S - 2\pi r^2}{2\pi r} \right] = \frac{Sr}{2} - \pi r^3 - \frac{1}{2} \text{ mark}$$

$$\frac{dV}{dr} = \frac{S}{2} - \pi(3r^2) - 1 \text{ mark}$$

For maximum or minimum,  $dV/dr = 0$  ;  $S = 6\pi r^2 - 1 \text{ mark}$

$$6\pi r^2 = 2\pi rh + 2\pi r^2 ; 2r = h - 1 \text{ mark}$$

$$\frac{d^2V}{dr^2} = -6\pi r = \text{a negative quantity} - 1 \text{ mark}$$

Hence the volume of the right circular cylinder is maximum when its height is equal to twice its radius ; when  $h = 2r$  – 1 mark

13. The three coordinate planes divide the whole space into eight parts called \_\_\_\_\_ (2024)

**Ans) Octants**

14. Let  $AX = B$  be a system of linear equations having unique solution, then the solution is given by  $X =$  \_\_\_\_\_ (2024)

**Ans)  $X = A^{-1}B$**

15. Write the contrapositive and converse of the following statement.  
If you live in Kashmir, then you have winter clothes. (2017)

**Ans) Converse : If you have winter clothes, then you live in Kanpur. – 1 mark**

**Contrapositive: if you do not have winter clothes then you do not live in Kanpur. – 1 mark**