

General instructions:-

1. This question paper contains Five sections A,B,C,D and E. Each question is compulsory.
2. Section A has 18 MCQ's and 02 Assertion –Reason based questions of 01 mark each
3. Section B has 5 very short answer questions of 2 marks each.
4. Section C has 6 short answer questions of 3 marks each.
5. Section D has 4 Long answer questions of 5marks each.
6. Section E has 3 source based/case study questions of 4 marks each with sub parts.

Section A (MCQ)

1. If a matrix has 8 elements, then which of the following will not be a possible order of the matrix a) 1×8 b) 2×4 c) 4×2 d) 4×4
2. For what value of k, the matrix $\begin{pmatrix} 2-k & 4 \\ -5 & 1 \end{pmatrix}$ is invertible a) 8 b) 17 c) 22 d) 25
3. If the area of the triangle with vertices $(-3,0)$, $(3,0)$ and $(0,k)$ is 9 units, then value of k = a) ± 4 b) ± 2 c) ± 3 d) ± 4
4. The direction ratios of the line $\frac{x+2}{2} = \frac{2y-5}{-3}$, $z=2$, a) 1,1,5 b) 2,1,3 c) 4,3,0 d) 4,-3,0
5. The projection of $i-j$ on the vector $i+j$ is a) 1 b) 0 c) 2 d) 5
6. For what value of a, the vectors $2i-3j+4k$ and $ai+6j-8k$ are collinear? a) 4 b) -4 c) -2 d) 2
7. Let $\begin{vmatrix} 3 & y \\ x & 1 \end{vmatrix} = \begin{vmatrix} 3 & 2 \\ 4 & 1 \end{vmatrix}$ Then the no of all possible pair of values of x and y, if $x,y \in \mathbb{N}$ are a) 1 b) 2 c) 3 d) 4
8. If two events A and B are mutually exclusive, then $P(A/B) = ?$ a) 0 b) 1 c) 0.5 d) 0.25
9. The order and degree of the differential equation $d^2y/dx^2 + (dy/dx)^{1/4} + x^{1/5} = 0$ respectively are a) 2 and 4 b) 2 and 2 c) 2 and 3 d) 3 and 3
10. Solve $x^3ydx = dy$, Given that $y = 1$ when $x = 1$
a) $y = e^{\frac{x^4-1}{3}}$ b) $y = e^{\frac{x^4-1}{4}}$ c) $y = e^x$ d) $y = e^{\frac{-x^4}{4}}$
11. If $y = \log_5 x$, then $dy/dx =$ a) $\frac{1}{x \log 5}$ b) $\frac{1}{\log 5}$ c) $\frac{5}{x \log 5}$ d) $\frac{5}{x}$
12. If a leap year is selected at random, then what is the chance that it will contain 53 Tuesday? a) $1/7$ b) $2/7$ c) $3/7$ d) $5/7$
13. The value of $\int x^2 e^{x^3} dx =$ a) $(1/3) e^{x^3} + c$ b) $(1/3) e^{x^4} + c$ c) $(1/2) e^{x^3} + c$ d) $(1/2) e^{x^2} + c$
14. The function f is given by $f(x) = 3x+17$ is a) strictly increasing on \mathbb{R} b) strictly decreasing on \mathbb{R} c) decreasing on \mathbb{R} d) both (b) and (c) are correct.
15. The graph of the inequality $2x+3y>6$ is a) half plane that contains the origin. b) half plane that neither contains the origin nor the points of the line $2x+3y = 6$ c) Whole XOY plane excluding the points on the line $2x+3y = 6$ d) Entire XOY plane
16. The function $f : \mathbb{N} \rightarrow \mathbb{N}$ \mathbb{N} being the set of natural numbers, defined by $f(x) = 2x+3$ is a) injective and surjective b) injective but not surjective c) not injective but surjective d) neither injective nor surjective.
17. $\sin^{-1}(\cos 3\pi/5) =$ a) $\pi/10$ b) $3\pi/5$ c) $-\pi/10$ d) $-3\pi/5$
18. The minimum value of the function $f(x) = |x-4|$ exists at $x =$ a) 0 b) 2 c) 4 d) -4

19. In the following questions, a statement of Assertion (A) is followed by a statement of reason (R). Choose the correct answer out of the following choices.
- Both (A) and (R) are true and (R) is the correct explanation of A.
 - Both (A) and (R) are true, but (R) is not the correct explanation of (A)
 - (A) is true (R) is false
 - (A) is false but (R) is true.

Assertion (A) : If $A = \begin{pmatrix} 3 & 1 \\ -5 & x \end{pmatrix}$, then $(-A)$ is given by $\begin{pmatrix} -3 & -1 \\ 5 & -x \end{pmatrix}$

Reason (R) : The negative of a matrix is given by $-A$ and is defined as $-A = (-1) A$

20. Assertion (A) : Let $A = \{2,4,6\}$ and $B = \{3,5,7,9\}$ and defined a function $f = \{(2,3), (4,5), (6,7)\}$ from A to B, f is not onto .

Reason(R) : A function $f : A \rightarrow B$ is said to be onto, if the range of f is subset of B

Section B (VSA) :-

- Show that the area of a parallelogram havin diagonals $3i+j-2k$ and $i-3j+4k$ is $5\sqrt{3}$ units
- If two vectors a and b are such that $|a| = 2$, $|b| = 3$ and $a \cdot b = 4$, the find $|a-b|$
- Evaluate $\int e^x(\cos x - \sin x) dx$ (or) Evaluate $\int xe^x dx$
- Find $[P(B/A) + P(A/B)]$, if $P(A) = 3/10$, $P(B) = 2/5$ and $P(A \cup B) = 3/5$
- Solve $dy/dx = \frac{3e^{2x} + 3e^{4x}}{e^x + e^{-x}}$

Section C (SA) :-

- If $y = (x)^x + (\sin x)^x$, then find dy/dx
- If $A = \{1,2,3,\dots,9\}$ and R be the relation defined by $(a,b) R (c,d)$ if $a+d = b+c$ for $(a,b), (c,d)$ in $A \times A$. Prove that R is an equivalence relation. (or) Show that the function $f : R \rightarrow R$ defined by $f(x) = 2x^3 - 5$ is a bijective function
- Evaluate $\int \frac{\sqrt{1+\cos x}}{(1-\cos x)^{5/2}} dx$ (Or) Evaluate $\int_0^1 \log((1/x) - 1) dx$
- Three rotten apples are mixed with seven fresh apples. Find the probability distribution of the number of rotten apples, if three apples are drawn one by one with replacement. Find the mean of the number of rotten apples.
- Solve $(x+1)dy/dx = 2e^{-y} + 1$; $y = 0$ when $x = 0$ (or) Solve $x \sin(y/x) dy/dx + x y \sin(y/x) = 0$; $y = \pi/2$, when $x = 1$
- Find the shortest distance between the lines $\frac{x-3}{1} = \frac{y-5}{-2} = \frac{z-7}{1}$ and $\frac{x+1}{7} = \frac{y+1}{-6} = \frac{z+1}{1}$

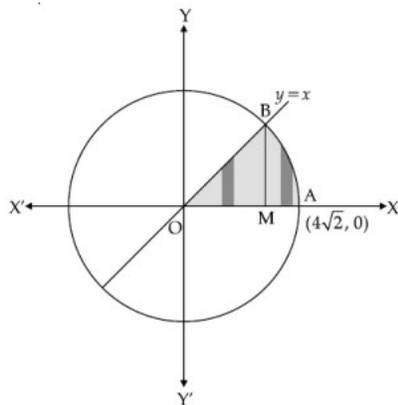
Section D : (LA)

- Determine the product of $\begin{pmatrix} -4 & 4 & 4 \\ -7 & 1 & 3 \\ 5 & -3 & -1 \end{pmatrix}$ and $\begin{pmatrix} 1 & -1 & 1 \\ 1 & -2 & -2 \\ 2 & 1 & 3 \end{pmatrix}$ then use to solve the system of equations $x-y+z=4$, $x-2y-2z=9$ and $2x+y+3z=1$
- Evaluate $\int_0^{\pi/4} \frac{\sin x + \cos x}{9+16\sin 2x} dx$ (or) Evaluate $\int_0^{\pi} \frac{xdx}{a^2 \cos^2 x + b^2 \sin^2 x}$
- Determine graphically the minimum value of the objective function $Z = -50x + 20y$ subject to constraints are $2x-y \geq -5$, $3x+y \geq 3$, $2x-3y \leq 12$ and $x, y \geq 0$

35. Find the value of b so that the lines $\frac{x-1}{2} = \frac{y-b}{3} = \frac{z-3}{4}$ and $\frac{x-4}{5} = \frac{y-1}{2} = z$ are intersecting lines. Also find the point of intersection.

Section E (Case study)

36. Let $P(x) = -6x^2 + 120x + 25000$ (in ₹), is the total profit function of a company, where x denotes the production of the company. Based on the information , Answer the following questions.
- Find the profit of the company, when the production is 3 units.
 - Find $P'(5)$
 - Find the interval in which the profit is strictly increasing
 - Find the production when the profit is maximum.
37. In an office three employees Vinay, Sonia and Iqbal process incoming copies of a certain form. Vinay processes 50% of the forms, Sonia processes 20% and Iqbal processes 30% of the forms. Vinay has an error rate of 0.06, Sonia has an error rate of 0.04 and Iqbal has an error rate of 0.03 . Based on the above information answer the following questions.
- The total probability of committing an error in processing the form.
 - The manager of the company wants to do a quality check. During inspection, he selects a form at random from the days output of processed forms. If the form selected at random has an error, Find the probability that the form is not processed by Vinay.
38. In the figure $O(0, 0)$ is the centre of the circle. The line $y = x$ meets the circle in the first quadrant at the point B .



- Write the equation of the circle
- Find the Area of $\triangle OBM$ (or) Find the area of $BAMB$
- Find the area of the shaded region.

"Learning is the only thing the mind never exhausts, never fears, and never regrets."