## Central Kerala Sahodaya
## Class XII Session 2022-23
## Mathematics (Code-041)

**Time Allowed: 3 Hours** **Maximum Marks: 80**

## General Instructions :

**1. This Question paper contains - five sections A, B, C, D and E. Each section is compulsory. However, there are internal choices in some questions.**
**2. Section A has 18 MCQ's and 02 Assertion-Reason based questions of 1 mark each.**
**3. Section B has 5 Very Short Answer (VSA)-type questions of 2 marks each.**
**4. Section C has 6 Short Answer (SA)-type questions of 3 marks each.**
**5. Section D has 4 Long Answer (LA)-type questions of 5 marks each.**
**6. Section E has 3 source based/case based/passage based/integrated units of assessment (4 marks each) with sub parts.**

**SECTION A**

1. The order of the single matrix obtained from

$$\begin{bmatrix} 5 & 4 & 3 \\ -1 & 2 & 7 \end{bmatrix}\begin{bmatrix} 1 & 4 \\ -2 & 3 \\ 7 & 0 \end{bmatrix}\begin{bmatrix} 1 & -3 & 4 \\ 9 & 2 & 5 \end{bmatrix}$$

(a) 2 × 3 (b) 2 × 2 (c) 3 × 2 (d) 3 × 3

2. If a matrix A is both symmetric and skew-symmetric, then
(a) A is a diagonal matrix (b) A is zero matrix
(c) A is a scalar matrix (d) A is square matrix

3. In triangle ABC, which of the following is not true?
(a) $\overrightarrow{AB} + \overrightarrow{BC} + \overrightarrow{CA} = \vec{0}$ (b) $\overrightarrow{AB} + \overrightarrow{BC} - \overrightarrow{AC} = \vec{0}$
(c) $\overrightarrow{AB} + \overrightarrow{BC} - \overrightarrow{CA} = \vec{0}$ (d) $\overrightarrow{AB} - \overrightarrow{CB} + \overrightarrow{CA} = \vec{0}$

4. Find k , if

$$\mathbf{f}(x) = \begin{cases} 2x+1\ ,\ x < 2 \\ k,\ x = 2 \\ 3x-1\ , x > 2 \end{cases}$$ is continuous at $at\ x = 2$

a) 0 b) 2 c) 5 d) 3

5. f(x) = $|x-1| + |x-2|$ is not differentiable
**a)** at x = 1 b) x ∈ [1,2] c) x ∈ {1,2} d) None

6. If $y = x + e^x$ , then $\frac{d^2x}{dy^2}$ = ----------
$a)\ \frac{1}{(1+e^x)^2}$ b) $\frac{-e^x}{(1+e^x)^2}$ c) $\frac{-e^x}{(1+e^x)^3}$ d) $e^x$

7. If m and n, respectively, are the order and the degree of the differential equation $\frac{d}{dx}\left[\left(\frac{dy}{dx}\right)\right]^4 = 0$, then m + n =
(a) 1 (b) 2 (c) 3 (d) 4

8. The solution set of the inequality 3x + 5y > 4 is

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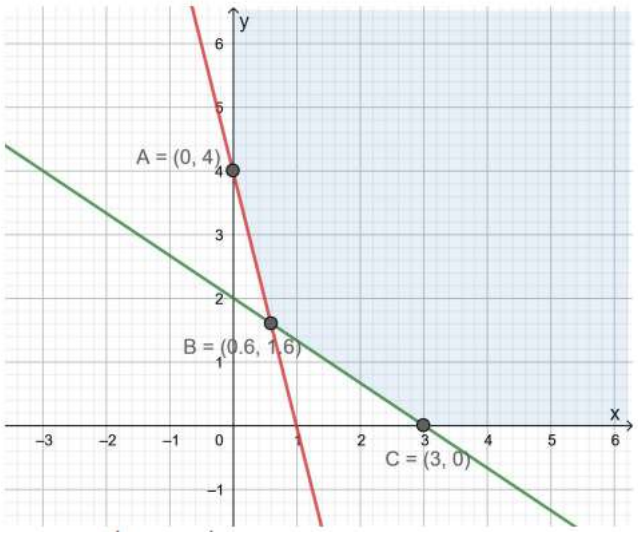
| | (a) an open half-plane not containing the origin.<br>(b) an open half-plane containing the origin.<br>(c) the whole XY-plane not containing the line 3x + 5y = 4.<br>(d) a closed half plane containing the origin. | |
| 9 | Evaluate: $\int_{-1}^{1} [x]dx$<br><br>a) 0 b) -1 c) 1 d) 2 | |
| 10. | If A = $\begin{bmatrix} 2 & -1 \\ 3 & 4 \end{bmatrix}$, Find $\lvert(A^{-1})^{-1}\rvert$<br>a) 5 b) $\frac{1}{5}$ c) $\frac{1}{11}$ d) 11 | |
| 11. | The corner points of the shaded unbounded feasible region of an LPP are ( 0,4) , ( 0.6, 1.6) and (3,0) as shown in the figure The minimum value of the objective function Z = 4x + 6y occurs at<br>  <br><br>a) (0.6, 1.6) only b) (3,0) only c) (0.6, 1.6) and (3,0) only<br>d) at every point of the line segment joining the points (0.6, 1.6) and (3,0) | |
| 12. | If $\lvert\vec{a}\rvert$ = 3, $\lvert\vec{b}\rvert$ = 4 , $\lvert\vec{c}\rvert$ = 5, each vector is perpendicular to sum of the other two. Find $\lvert\vec{a} + \vec{b} + \vec{c}\rvert$<br>a) 10 b) 5 c) 12 d)$5\sqrt{2}$ | |
| 13. | If A = $\begin{bmatrix} a & 2 \\ 2 & a \end{bmatrix}$ and $\lvert A\rvert^3 = 125$ ,then find the value of a<br>a)(a) ± 1 (b) ± 2 (c) ± 3 (d) ± 5 | |
| 14. | Let f : R→ R be defined as f(x) = $x^4$.Choose the correct answer.<br>a)f is one- one onto b) f is many-one onto<br>c) f is one-one but not onto d) f is neither one-one nor onto. | |
| 15. | Choose the correct principal value branch of the range of $y = \tan^{-1} x$.<br>$a)\left[-\frac{\pi}{2}, \frac{\pi}{2}\right]$ b) $\left(-\frac{\pi}{2}, \frac{\pi}{2}\right)$ c) $[0, \pi]$ d) $(0, \pi)$ | |
| 16. | Given that events A and B are such that P(A) = $\frac{1}{2}$, P(B) = p, | |

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| | P(A∪ B) $= \frac{3}{5}$. Find p if they are independent<br>a) $\frac{1}{10}$ b) $\frac{1}{5}$ c) 1 d) $\frac{2}{5}$ | |
| 17. | P is a point on the line joining the points $A(0,5,-2)$ and $B(3,-1,2)$. If the x-coordinate of P is 6, then its z-coordinate is<br>(a) 10 (b) 6 (c) -6 (d) -10 | |
| 18. | If $y = \sin^{-1} x$, then $(1-x^2)y_2$ = ------<br>a) $xy_2$ b) $xy_1$ c) xy d) $x^2$ | |
| | ASSERTION-REASON BASED QUESTIONS (19 & 20)<br>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.<br>(a) Both A and R are true and R is the correct explanation of A.<br>(b) Both A and R are true but R is not the correct explanation of A.<br>(c) A is true but R is false.<br>(d) A is false but R is true. | |
| 19. | **Assertion**: The function f(x) = sin x does not possess inverse if x ∈ R.<br>**Reason**: The function f(x) = sin x is not one-one & onto if x ∈ R. | |
| 20. | **Assertion** : In ΔABC , $\overrightarrow{AB} + \overrightarrow{BC} + \overrightarrow{CA} = \vec{0}$.<br>**Reason** : If $\overrightarrow{OA} = \vec{a}$ , $\overrightarrow{OB} = \vec{b}$ , then $\overrightarrow{AB} = \vec{a} + \vec{b}$ (triangle law of addition) | |
| | **SECTION B** | |
| 21. | Evaluate: $sin\left(\frac{1}{2}\cos^{-1}\frac{4}{5}\right)$<br>OR<br>$f$ : **N** →**N** be defined by<br>f(x) = $\begin{cases} x+1, if\ x\ is\ odd \\ x-1, if\ x\ is\ even \end{cases}$ for all$x$ ϵ N, show that f is bijective | |
| 22. | The total cost c(x) associated with the production of x units of an item is given by<br>$C(x) = 0.007x^3 - 0.003x^2 + 15x + 4000$.Find the marginal cost when 17units are produced. | |
| 23. | Find a vector perpendicular to $\vec{a} + \vec{b}$ and $\vec{a} - \vec{b}$<br>where $\vec{a}$ =3 $\hat{\imath}$ +2 $\hat{\jmath}$ + 2$\hat{k}$ and $\vec{b}$ = $\hat{\imath}$ +2 $\hat{\jmath}$ - 2$\hat{k}$.<br>OR<br>Find the values of p so that the line<br>$\frac{1-x}{3} = \frac{7y-14}{2p} = \frac{z-3}{2} and\ \frac{7-7x}{3p} = \frac{y-5}{1} = \frac{6-z}{5}\ are\ right\ angles$ | |
| 24. | Find $\frac{dy}{dx}\ if,$ y = $x^{sinx}$ | |
| 25. | $\vec{a}$ = $\hat{\imath}$ +4 $\hat{\jmath}$ + 2$\hat{k}$ , $\vec{b}$ = 3$\hat{\imath}$ - 2$\hat{\jmath}$ + 7$\hat{k}$ and $\vec{c}$ = 2$\hat{\imath}$ - $\hat{\jmath}$ + 4$\hat{k}$ .Find a vector $\vec{p}$ which is ⊥ to $\vec{a}$ and $\vec{b}$ and $\vec{p}$ . $\vec{c}$ = 18 | |

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| | SECTION C | |
| 26. | Evaluate: $\int \frac{1}{\sqrt{2+2x+x^2}}\,dx$ | |
| 27. | Evaluate: $\int_1^2 \frac{\sqrt{x}}{\sqrt{x}+\sqrt{3-x}}\,dx$<br><br>OR<br>Evaluate: $\int_{-1}^{1} \lvert 2x-1 \rvert\,dx$ | |
| 28. | Find the differential equation $\frac{dy}{dx} = (1+x^2)(1+y^2)$<br><br>OR<br>Find the differential equation $x\frac{dy}{dx} + 2y = x^2\ (x \neq 0)$ | |
| 29. | Solve the following Linear Programming Problem graphically:<br>Maximize Z = 400x + 300y<br>subject to $x + y \leq 200$<br>$x \leq 40, x \geq 20, y \geq 0$ | |
| 30. | Evaluate: $\int \frac{5x-2}{3x^2+2x+1}$ dx | |
| 31. | From a lot of 30 bulbs which includes 6 defective, a sample of 4 bulbs is drawn at a random with replacement . Find the mean of the number of the defective bulbs.<br>OR<br>The probability of A, B and C solving a problem are 1/3,2/7, and 3/8 respectively. If all the three try to solve the problem simultaneously, find the probability that exactly one of them can solve it. | |
| | SECTION D | |
| 32. | Show that the relation R in the set N of Natural numbers given by<br>R = $\{(a,b): \lvert a-b \rvert \ is\ a\ multiple\ of\ 4\}$ is an equivalence relation. | |
| 33. | Make a rough sketch of the region $\{(x, y): 0 \leq y \leq x^2, 0 \leq y \leq x, 0 \leq x \leq 2\}$ and find the area of the region using integration.<br>OR<br>Using integration find the area of region bounded by the triangle whose vertices are (1,0),(2,2) and (3,1). | |
| 34. | $\begin{bmatrix} 4 & 2 & 3 \\ 1 & 1 & 1 \\ 3 & 1 & -2 \end{bmatrix}$ find $A^{-1}$ and hence solve: 4x + 2y + 3z = 2 , x + y + z = 1,<br><br>3x + y - 2z = 5 | |
| 35. | Suppose we have 2 particles moving in space.<br>Particle A's position after t seconds is given by: x(t) = 5-2t , y(t) = 4-3t , z(t) = 4+4t | |

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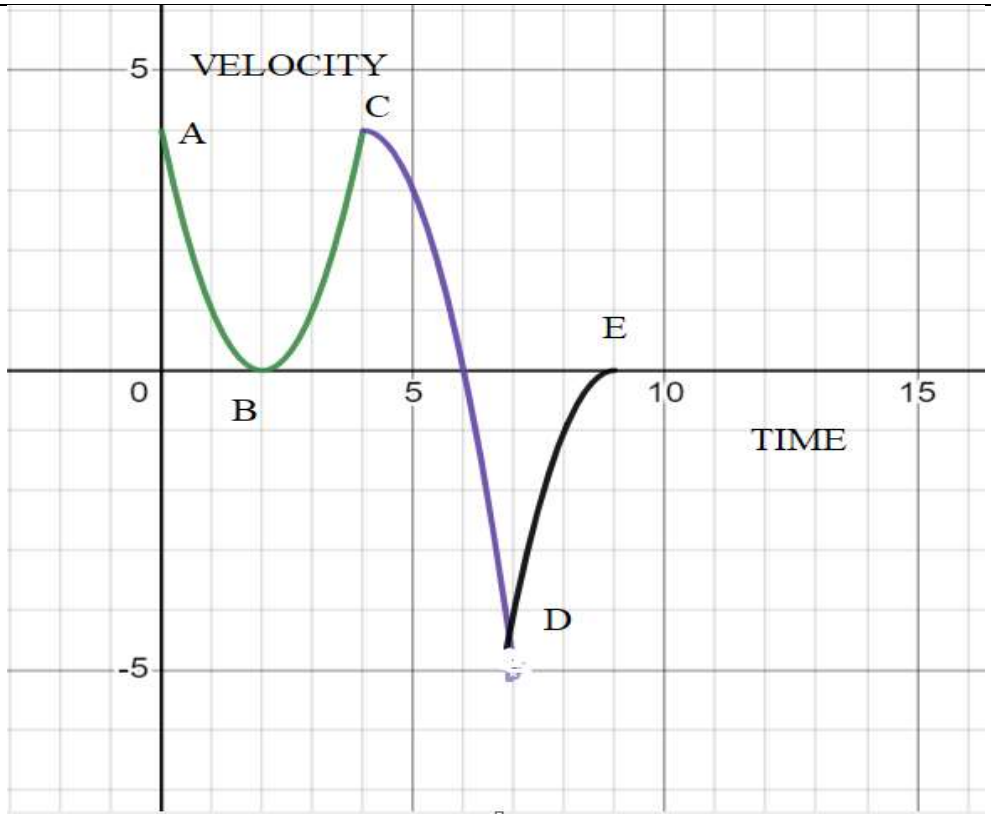
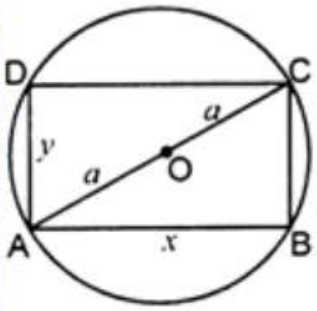
| | Particle B's position after t seconds is given by: x(t) = 1 , y(t) = -4-2t , cz(t) = 14+2t<br>All distances are in metres<br>i) What are the position vectors of each particle initially?<br>ii) What are the Cartesian equations of both the Particles path?<br>iii) What is the shortest distance between their path? | |
| | SECTION E | |
| 36. |  <br>The above graph is the velocity – time graph of a moving particle.<br>i) At which point the velocity is minimum?<br>a) A b) E c) D d) B<br>ii) In which interval the velocity is decreasing?<br>a) (2,4) b) (4,7) c) (7,9) d) None<br>iii) In which interval the velocity is Increasing?<br>a) (0,2) b) (4,7) c) (7,9) d) None<br>iv) Which of the point is not a critical point?<br>a) (2,0) b) (6,0) c) (4,4) d) None<br>v) At which points the velocity is maximum?<br>b) A, C b) B,E c) B,D d) None | |
| 37. | A gardener wants to construct a rectangular bed of garden in a circular patch of land. He takes the maximum perimeter of the rectangular region as possible. (Refer to the images given below for calculations) | |




i. The perimeter of rectangle P is:
   a) $4x + 4\sqrt{a^2 - x^2}$
   b) $2x + 2\sqrt{4a^2 - x^2}$
   c) $4x + 2\sqrt{a^2 - x^2}$
   d) $x + 4\sqrt{a^2 - x^2}$

ii. To find critical points put
   a) $\frac{dp}{dx} > 0$
   b) $\frac{dp}{dx} < 0$
   c) $\frac{dp}{dx} = 0$
   d) None

iii. The value of y when perimeter is maximum
   a) $\frac{a}{2}$
   b) $\frac{a}{\sqrt{2}}$
   c) 2a
   d) $\sqrt{2}$ a

iv. P is maximum when the rectangle is
   a) Square
   b) Parallelogram
   c) Rectangle
   d) Trapezium

v. If a rectangle of the maximum perimeter which can be inscribed in a circle of radius 10 cm is square then the sides of the region.
   a) $10\sqrt{2}$ cm
   b) $2\sqrt{10}$ cm
   c) $20\sqrt{2}$ cm
   d) $10/\sqrt{2}$ cm

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| 38. | A shopkeeper sells three types of flower seeds A1, A2, and A3. They are sold as a mixture where the proportions are 4:4:2 respectively. The germination rates of the three types of seeds are 45%, 60% and 35%. | |

Based on the above information answer the following questions:

i. The probability of a randomly chosen seed to germinate:

a. 0.69 b. 0.39 c. 0.49 d. 0.59

ii. The probability that the seed will not germinate given that the seed is of type A3:

a. $\frac{15}{100}$ b. $\frac{65}{100}$ c. $\frac{75}{100}$ d. $\frac{55}{100}$

iii. The probability that the seed is of the type A2 given that a randomly chosen seed does not germinate.

a. $\frac{22}{51}$ b. $\frac{55}{51}$ c. $\frac{51}{16}$ d. $\frac{16}{51}$

iv. Calculate the probability that it is of the type A1 given that a randomly chosen seed does not germinate.

a. $\frac{51}{22}$ b. $\frac{22}{51}$ c. $\frac{16}{51}$ d. $\frac{7}{51}$

v. The probability that it will not germinate given that the seed is of type A1:

a. $\frac{55}{100}$ b. $\frac{65}{100}$ c. $\frac{35}{100}$ d. $\frac{45}{100}$