# CHENNAI SAHODAYA SCHOOLS COMPLEX

*(General Instructions)*

- Please check that this question paper contains ___6___ printed pages.
- Please check that this question paper contains __38___ questions.
- Please write down the serial number of the question before attempting it.
- Reading time of 15 minutes is given to read the question paper alone. No writing during this time.
- **This Question paper contains - five sections A, B, C, D and E. Each section is compulsory. However, there are internal choices in some questions.**
- **Section A has 18 MCQ's and 02 Assertion-Reason based questions of 1 mark each.**
- **Section B has 5 Very Short Answer (VSA)-type questions of 2 marks each.**
- **Section C has 6 Short Answer (SA)-type questions of 3 marks each.**
- **Section D has 4 Long Answer (LA)-type questions of 5 marks each.**
- **Section E has 3 source based/case based/passage based/integrated units of assessment of 4 marks each with sub-parts.**

## COMMON EXAMINATION
## Class-12
## (MATHEMATICS – 041)

*Roll No.:* *set - 2* *Maximum Marks:80*

*Date: DD/MM/YYYY* *Time allowed: 3 hours*

**Section –A**

(Each question carries 1 mark)

**(Multiple Choice Questions)**

**1.** If $\begin{bmatrix} 2x+y & 4x \\ 5x-7 & 4x \end{bmatrix} = \begin{bmatrix} 7 & 7y-13 \\ y & x+6 \end{bmatrix}$, then the value of x + y is:

(a) 7 (b) 4 (c) 5 (d) 2

**2.** The sum of cofactors of 7 and 10 in the determinant $\begin{vmatrix} 1 & 2 & 4 \\ 5 & 7 & 8 \\ 9 & 10 & 12 \end{vmatrix}$ is:

(a) -27 (b) -12 (c) -18 (d) 0

**3.** If A = $\begin{bmatrix} 1 & k & 3 \\ 3 & k & -2 \\ 2 & 3 & -4 \end{bmatrix}$ is singular matrix, then k = ?

(a) 16/3 (b) 34/5 (c) 33/2 (d) 33/3

**4.** If A is a square matrix of order 3 and $|A| = 15$, then $|adj\ A|$ = ?

(a) 5 (b) 25 (c) 125 (d) 225

**5.** If $|A| = 3$ and $A^{-1} = \begin{bmatrix} 3 & -1 \\ -5/3 & 2/3 \end{bmatrix}$, then adj A = ?

(a) $\begin{bmatrix} 9 & 3 \\ -5 & -2 \end{bmatrix}$ (b) $\begin{bmatrix} 9 & -3 \\ -5 & 2 \end{bmatrix}$ (c) $\begin{bmatrix} -9 & -3 \\ 5 & 2 \end{bmatrix}$ (d) $\begin{bmatrix} 9 & -3 \\ 5 & -2 \end{bmatrix}$

**6.** If $\sqrt{x} + \sqrt{y} = \sqrt{a}$, then $\frac{dy}{dx}$ is:

(a) $-\sqrt{\frac{x}{y}}$ (b) $-\frac{1}{2}\sqrt{\frac{x}{y}}$ (c) $-\sqrt{\frac{y}{x}}$ (d) $-2\sqrt{\frac{x}{y}}$

7. The function $f(x) = \begin{cases} 1+x\ , when\ x \leq 2 \\ 5-x\ ,\ when\ x > 2 \end{cases}$ is :

(a) continuous as well as differentiable at x = 2
(b) continuous but not differentiable at x = 2
(c) differentiable but not continuous at x = 2
(d) neither continuous nor differentiable at x = 2

8. The minimum value of ( $x^2 + \frac{250}{x}$ ) is:

(a) 5 (b) 25 (c) 50 (d) 75

9. If m and n are the order and degree of the differential equation $3x \left(\frac{dy}{dx}\right)^3 - \frac{d^2y}{dx^2} - 8y = \sin y$ respectively then, write the value of m + n.

(a) 1 (b) 2 (c) 3 (d) 4

10. The general solution of the differential equation $x\frac{dy}{dx} = y + x\tan\left(\frac{y}{x}\right)$ is:

(a) $C\,x = \sin\left(\frac{y}{x}\right)$ (b) $\sin\left(\frac{y}{x}\right) = C$ (c) $\sin\left(\frac{y}{x}\right) = Cy$ (d) $\sin\left(\frac{x}{y}\right) = C$

11. The projection of the vector $2\hat{\imath} + 3\hat{\jmath} + 2\hat{k}$ *on the vector* $\hat{\imath} + 2\hat{\jmath} + \hat{k}$ is:

(a) $10/\sqrt{6}$ (b) 10/3 ( c) $5/\sqrt{6}$ (d) $10/\sqrt{3}$

12. If $\vec{a}$, $\vec{b}$ and $\vec{c}$ are the unit vectors and $\vec{a} + \vec{b} + \vec{c} = \vec{0}$ . Evaluate the quantity $\mu = \vec{a}.\vec{b} + \vec{b}.\vec{c} + \vec{a}.\vec{c}$ = ?

(a) ½ (b) - ½ (c) 3/2 (d) -3/2

13. Two adjacent sides of a parallelogram are represented by the vectors $\vec{a} = 3\hat{\imath} + \hat{\jmath} + 4\hat{k}$ *and* $\vec{b} = \hat{\imath} - \hat{\jmath} + \hat{k}$ , then the area of parallelogram is :

(a) $\sqrt{42}$ sq. units (b) 6 sq. units
(c) $\sqrt{35}$ sq. units (d) $\sqrt{52}$ sq. units

14. The cartesian equation of the line joining the points (3, -2, - 5) and ( 3, -2, 6 ) is :

(a) $\frac{x+3}{0} = \frac{y-2}{0} = \frac{z+5}{11}$ (b) $\frac{x-3}{0} = \frac{y+2}{0} = \frac{z+5}{11}$
(c) $\frac{x+3}{0} = \frac{y+2}{0} = \frac{z-5}{11}$ (d) $\frac{x-3}{0} = \frac{y+2}{0} = \frac{z+5}{-11}$

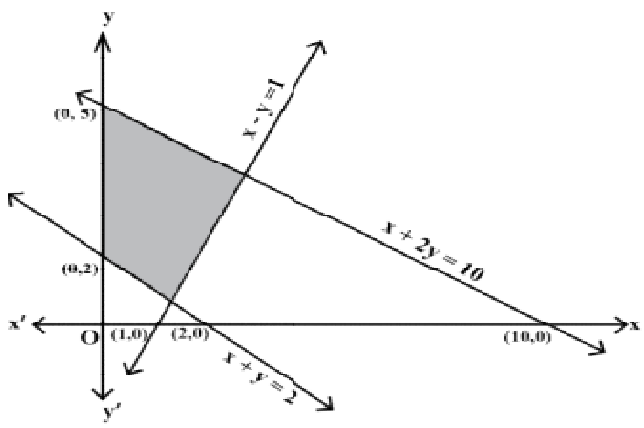
15. If ( $\hat{\imath} + 3\hat{\jmath} + 8\hat{k}$ ) $X$ ( $3\hat{\imath} - k\hat{\jmath} + m\hat{k}$ ) = $\vec{0}$ , then k and m are :

(a) m=24, k= -9 (b) m = -24, k= -9 (c) m= -9, k= 18 (d)m= 27, n = -9

16. The optimal value of the objective function is attained at the points:

(a) on X- axis (b) corner points of the feasible region
(c) on Y - axis (d) in the first quadrant

**17. The feasible region corresponding to the linear constraints of a linear programming problem is given below:**




Which of the following is not a constraint to the given Linear Programming Problem?

(a) $x+y\geq 2$ (b) $x+2y\leq 10$ (c) $x-y\geq 1$ (d) $x-y\leq 1$

**18. If A and B are two independent events with P(A) = 3/5 and P(B) = 4/9, then find $P(\bar{A}\cap\bar{B})$**

**(a) 1/9 (b) 2/9 (c) 1/3 (d) 4/9**

**ASSERTION-REASON BASED QUESTIONS**

**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.**

**19. Assertion (A): $\sin^{-1}(\sin(2\pi/3)) = 2\pi/3$.**

**Reasoning(R): $\sin^{-1}(\sin\theta) = \theta$, if $\theta \in [-\pi/2, \pi/2]$**

**(a) Both (A) and (R) are true and (R) is the correct explanation of (A).**
**(b) Both (A) and (R) are true but (R) is not the correct explanation of (A).**
**(c) (A) is true but (R) is false.**
**(d) (A) is false but (R) is true.**

**20. Assertion(A): If $\int_0^1 (3x^2+2x+k)\,dx = 0$ , then the value if k is – 2**

**Reasoning(R): $\int_a^b x^n\,dx = \left[\frac{x^{n+1}}{n+1}\right]$ + c**

**(a) Both (A) and (R) are true and (R) is the correct explanation of (A).**
**(b) Both (A) and (R) are true but (R) is not the correct explanation of (A).**
**(c) (A) is true but (R) is false.**
**(d) (A) is false but (R) is true.**

## Section –B

(This section comprises of very short answer type questions (VSA) of 2 marks each)

**21. Let set A = { 1, 2, 3, 4}and relation R = {(1,1), (2,2), (3,3),(4,4), (1,2), (1,3), ( 3,2)}. Show that R is reflexive and transitive.**

22. The volume of cube is increasing at the rate of 7 $cm^3$/sec. How fast is its surface area increasing at the instant when the length of an edge of the cube is 12 cm?

OR

Water is leaking from a conical funnel at the rate of 5 $cm^3$/sec. If the radius of the base of the funnel is 5 cm and its altitude is 10 cm. Find the rate at which the water level is dropping when it is 2.5 cm from the top.

23. Find the maximum profit that a company can make, if the profit function is given by $P(x) = 41 + 24x - 18x^2$.

24. Evaluate: $\int_0^{\frac{\pi}{2}} \sqrt{1 + \cos 2x}\, dx$.

OR

Evaluate : $\int_1^{\sqrt{2}} \frac{dx}{x\sqrt{x^2-1}}$ .

25. Using integration, find the area of the region bounded by the line $2y + x = 8$, the x-axis and the lines $x = 2$ and $x = 4$.

## Section – C

(This section comprises of short answer type questions (SA) of 3 marks each)

26. If $y = (x)^{\cos x} + (\cos x)^{\sin x}$ , find $\frac{dy}{dx}$.

27. Evaluate: $\int \left[\frac{1}{\log x} - \frac{1}{(\log x)^2}\right] dx$

28. Evaluate: $\int \frac{\cos x}{\sin^2 x + 4 \sin x + 5}\, dx$.

29. Find the particular solution of the differential equation $\frac{dy}{dx} - 3y \cot x = \sin 2x$, given that $y = 2$ when $x = \frac{\pi}{2}$.

OR

Find the general equation of the differential equation $(x - 1)\frac{dy}{dx} = 2x^3 y$ .

30. Solve the linear programming problem graphically:

Maximise $Z = 60x + 40y$

Subject to constraints: $5x + 6y \leq 45$ ; $3x + 2y \leq 18$; $x \geq 0$, $y \geq 0$.

31. Three critics review a book. For the three critics, the odds in favour of the book are (5:2), (4:3) and (3:4) respectively. Find the probability that the majority is in favour of the books.

OR

There are 5 bags, each containing 5 white balls and 3 black balls. Also, there are 6 bags, each containing 2 white balls and 4 black balls. A white ball is drawn at random. Find the probability that this white ball is from a bag of first group.

## Section –D

[This section comprises of long answer type questions (LA) of 5 marks each]

**32. Show that the relation R on N x N, defined by (a,b) R (c, d) $\Leftrightarrow$ a + d= b + c is an equivalence relation ( where N is the set of natural numbers).**

**OR**

**Show that the function f: N → N, defined by f(n) =** $\begin{cases} \frac{n+1}{2}, & \text{if } n \text{ is odd} \\ \frac{n}{2}, & \text{if } n \text{ is even} \end{cases}$ **is not one-one but onto.**

**33. Given A =** $\begin{bmatrix} 1 & -1 & 1 \\ 1 & -2 & -2 \\ 2 & 1 & 3 \end{bmatrix}$ **and B =** $\begin{bmatrix} -4 & 4 & 4 \\ -7 & 1 & 3 \\ 5 & -3 & -1 \end{bmatrix}$**, find AB and use this result in solving the following system of equations:**

**x – y + z = 4 ; x – 2y – 2z = 9; 2x = y = 3z = 1.**

**34. Using integration, find the area of the region bounded by the ellipse** $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$ **, where a > b.**

**35. Show that the lines** $\frac{x-1}{2} = \frac{y-2}{3} = \frac{z-3}{4}$ **and** $\frac{x-4}{5} = \frac{y-1}{2} = z$ **intersect each other. Also find the point of intersection.**

**OR**

**Find the shortest distance between the following pair of lines:**

$\frac{x-5}{4} = \frac{y-7}{-5} = \frac{z+3}{-5}$ $and$ $\frac{x-8}{7} = \frac{y-7}{1} = \frac{z-5}{3}$.

## Section –E

[This section comprises of 3 case- study/passage-based questions of 4 marks each with sub parts. The first two case study questions have three sub parts (i), (ii), (iii) of marks 1,1,2 respectively].

**36. Read the following passage and Answer the questions based of the information given below:**

**Scientist want to know the Oil- Reserves in sea so they travel over the sea along the curve f(x) = $(x+1)^3 (x-3)^3$ by an helicopter. A student of class XII discuss the characteristic of the curve:**

(i) **Find the first order derivative of the given function.**

(ii) **Find the critical point of the given function.**

(iii) **Find the intervals in which the function is strictly increasing.**

**OR**

(iv) **Find the intervals in which the function is decreasing.**

**37. Answer the questions based on the given information.**
**The flight path of two airplanes in a flight simulator game are shown below. The coordinates of the airports P and Q are given.**


**Airplane 1 flies directly from P to Q.**
**Airplane 2 has a layover at R and then flies to Q.**
**The path of Airplane 2 from P to R can be represented by the vector $5\hat{\imath} + \hat{\jmath} - 2\hat{k}$.**
**(Note: Assume that the flight path is straight and fuel is consumed uniformly throughout the flight.)**

**(i)** **Find the vector that represents the flight path of Airplane 1.**
**(ii)** **Write the vector representing the path of Airplane 2 from R to Q. Show your steps.**
**(iii)** **What is the angle between the flight paths of Airplane 1 and Airplane 2 just after take-off ?**

**OR**

**(iv)** **Consider that Airplane 1 started the flight with a full fuel tank.**
**Find the position vector of the point where a third of the fuel runs out if the entire fuel is required for the flight.**

**38. In a play zone, Aastha is playing crane game. It has 12 blue balls, 8 red balls, 10 yellow balls and 5 green balls. If Aastha draws two balls one after the other without replacement, then answer the following questions.**

**(i)** **What is the probability that the first ball is blue and the second ball is green?**
**(ii)** **What is the probability that both the balls are red?**
**(iii)** **What is the probability that both the balls are not blue?**
**OR**
**(iv)** **What is the probability that the first ball is green and the second ball is not yellow?**

*************** **END OF THE PAPER** ***********************