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.: ***Maximum Marks:80***

Date: DD/MM/YYYY ***set - 1*** ***Time allowed: 3 hours***

Section –A

(Each question carries 1 mark)

(Multiple Choice Questions)

1. **If $[m \quad n]\begin{bmatrix} m \\ n \end{bmatrix} = [25]$ and m< n, then (m, n) is equal to**

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

2. **If A and B are two matrices of the order 3 x m and 3 x n, respectively and m = n, then the order of (5A – 2B) is**

   (a) m x 3 (b) 3 x 3 (c) m x n (d) 3 x n

3. **If $\begin{vmatrix} 2x & 5 \\ 8 & x \end{vmatrix} = \begin{vmatrix} 6 & 5 \\ 8 & 3 \end{vmatrix}$, then find x.**

   (a) ± 3 (b) - 3 (c) 3 (d) ± 2

4. **Let A and B are square matrices of order 2, $|A| = 2$ *and* $|B| = 6$ *then* $|5AB|$ *is***

   (a) 300 (b) 1500 (c) 500 (d) 60

5. **If there are two values of a which makes determinant, $\Delta = ½ \begin{vmatrix} 1 & -2 & 5 \\ 2 & a & -1 \\ 0 & 4 & 2a \end{vmatrix} = 86$, then the sum of these values is**

   (a) 4 (b) 5 (c) -4 (d) 9

6. **If $x^y = e^{x-y}$, then $\frac{dy}{dx}$ is**

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

7. If f(x) = log $\sqrt{tan\ x}$, then f'(x) at x = $\frac{\pi}{4}$ is

   (a) ∞ (b) 1 (c) 0 (d) ½

8. The value of $\int_{-\pi}^{\pi} sin^3 x\ \ cos^3 x\ \ dx$ is

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

9. The order and degree of the differential equation 2 $\left(\frac{dy}{dx}\right)^3$ +3 $\left(\frac{d^2y}{dx^2}\right)^4$ + $\left(\frac{d^3y}{dx^3}\right)^2$ = y is

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

10. The integrating factor of the differential equation $\frac{dy}{dx}$ + y = $\frac{1+y}{x}$ is

    (a) $\frac{x}{e^x}$ (b) $\frac{e^x}{x}$ (c) x e^x (d) e^x

11. The value of β for which two vectors $2\hat{\imath} - \hat{\jmath} + 2\hat{k}$ and $3\hat{\imath} + \beta\hat{\jmath} + \hat{k}$ is perpendicular is

    (a) 6 (b) 8 (c) -8 (d) -6

12. If $|\vec{a} + \vec{b}| = 60$, $|\vec{a} - \vec{b}| = 40\ and\ |\vec{b}| = 46\ then\ |\vec{a}|$ is

    (a) 22 (b) 20 (c) 24 (d) 20

13. The area of a triangle whose adjacent sides are $\vec{a} = \hat{\imath} + 4\hat{\jmath} - \hat{k}$ and $\vec{b} = \hat{\imath} + \hat{\jmath} + 2\hat{k}$ is

    (a) $\frac{3\sqrt{3}}{2}$ sq.units (b) $\frac{3\sqrt{5}}{2}$ sq.units (c) $\frac{3\sqrt{11}}{2}$ sq.units (d) $\frac{3\sqrt{7}}{2}$ sq.units

14. Find the value of k for which lines are $\frac{x+3}{-3} = \frac{y-1}{k} = \frac{z-5}{5}$ and $\frac{x+1}{-6} = \frac{y-2}{2}$ $\frac{5-z}{-10}$ are parallel.

    (a) k = -2 (b) k = 2 (c) k = 3 (d) k = 1

15. The corner points of the feasible region determined by the system of linear inequalities are (0,0), (4, 0), (2, 4) and (0, 5). If the maximum value of Z = a x + b y ; where a, b > 0 occurs at both (2, 4) and (4, 0), then

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

16. The point which does not lie in the half plane 2x + 3y -12 ≤ 0 is

    (a) (1, 2) (b) (2, 1) (c) (2, 3) (d) (-3, 2)

17. A speaks truth in 60% of the cases, while B in 40% of the cases. In what percent of cases are they likely to contradict each other stating the same fact?

    (a) 54% (b) 52% (c) 53% (d) 48%

18. If a line makes an angle of α, β, γ with positive direction of coordinate axes, then the value of $\sin^2\alpha + \sin^2\beta + \sin^2\gamma$ is
    (a) 1 (b) 2 (c) 0 (d) -2

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): A relation R = { (a, b) : $|a - b| < 2$ } defined on a set A = { 1, 2, 3, 4, 5 } is reflexive.
Reasoning(R): A relation R on the set A is said to be reflexive, if (a, b) ∈ R and (b, c) ∈ R, then (a, c) ∈ R.

(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): f(x) = tan x – x is always increases.
Reasoning(R): any function y = f(x) is increasing if $\frac{dy}{dx} \geq 0$.

(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. (a) Find the value of $\tan^{-1}$ (2 sin (2 $\cos^{-1} \frac{\sqrt{3}}{2}$)).
OR
(b) Is $\sin^{-1}$ (sin $\frac{5\pi}{3}$) $\neq \frac{5\pi}{3}$? if yes, find the correct value.

22. (a) A kite is moving horizontally at a height of 151.5 metres. If the speed of the kite is 10m/s, how fast is the string being let out, when the kite is 250 m away from the boy of height 1.5 m who is flying the kite?

OR

(b) 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 10 cm and its height is 20 cm. Find the rate at which the water level is dropping when it is at the depth of 5 cm from the top.

23. Prove that the function f(x) = 5 – 3x + 3 x^2 – x^3 is decreasing on R.

24. Find the maximum and the minimum values (if any) of the following function f(x) = - $|x + 1| + 3$

25. Determine the point of maximum of f(x) = sin x + $\sqrt{3}$ cos x, in [0, π].

Section – C

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

26. If x = a (cos t + log tan $\frac{t}{2}$) and y = a sin t, find the value of $\frac{dy}{dx}$ at t = $\frac{\pi}{4}$.

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

OR

Evaluate: $\int_0^{\frac{\pi}{2}} \sin 2x \;\; \log(\tan x)\,dx$

28. Evaluate: $\int \frac{e^x}{\sqrt{5-4e^x-e^{2x}}}\,dx$

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

30. Solve the linear programming problem graphically:

(a) Minimise Z = x + 2y
subject to constraints: $2x + y \geq 3$; $x + 2y \geq 6$; $x \geq 0$, $y \geq 0$.
OR
(b) Maximise Z = 50 x + 15 y
Subject to constraints: $x + y \leq 60$; $500x + 100y \leq 10000$; $x \geq 0$, $y \geq 0$.

31. Two horses are considered for a race. The probability of selection of the first horse is $\frac{1}{4}$ **and the probability of selecting second horse is** $\frac{1}{3}$**. What is the probability that:**
(i) both of them will be selected
(ii) only one of them will be selected
(iii) none of them will be selected.

Section –D

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

32. Let A = R – {3} and B = R – {1}. Consider the function f: A → B defined by f(x) = $\frac{x-2}{x-3}$**. Show that f is one- one and onto.**

OR

Let R be the relation on Z (set of integers) defined by:
R = ((a, b): a, b ∈ Z, $|a-b| \leq 5$ **}. Check whether R is reflexive, symmetric and transitive.**

33. Using matrices, solve the following system of equations:
4x + 3 y + 2z = 60; x + 2y + 3z = 45; 6x + 2y + 3z = 70.

34. Using integration, find the area of the region bounded by the line y – 1 = x, the x-axis and the ordinates x = -2 and x = 3.

35. Find the foot of the perpendicular drawn from the point P (1, 6, 3) to the line $\frac{x}{1} = \frac{y-1}{2} = \frac{z-2}{3}$.

OR

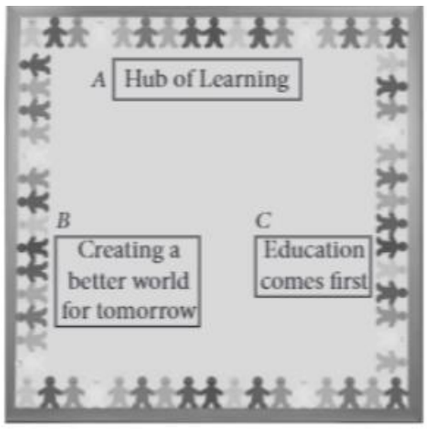
Find the shortest distance between the following pair of lines and determine whether they intersect or not:
$\frac{x-5}{4} = \frac{y-7}{-5} = \frac{z+3}{-5}$ *and* $\frac{x-8}{7} = \frac{y-7}{1} = \frac{z-5}{3}$.

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 given below:

Three slogans on chart papers are to be placed on a school bulletin board at the point A, B and C displaying. A (Hub of learning), B (Creating a better world for tomorrow) and C (Education comes first) coordinates of the points are (1, 4, 2), (3, -3, -2) and (-2, 2, 6) respectively.



(i) Let $\vec{a}$, $\vec{b}$ and $\vec{c}$ be the position vectors of points A, B and C respectively; then find a unit vector in the direction of ($\vec{a}$ + $\vec{b}$ + $\vec{c}$).

(ii) Find the direction cosines of $\overrightarrow{BC}$.

(iii)(a) Find the area of triangle ABC.

OR

(b)Find angle ACB.

37. Three persons A, B and C apply for a job of Manager in a Private company. Chance of their selection (A, B and C) are in the ratio 1:2:4. The probability that A, B and C can introduce changes to improve profits of company are 0.8,0.5 and 0.3 respectively.

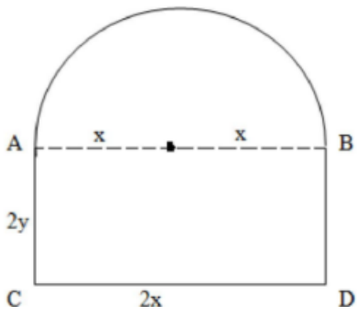
Read the above passage and answer the questions given below:

(i) what is the probability of selecting person A?
(ii) find the probability that profit has not happened by the changes introduced by A.
(iii) (a) find the probability that changes introduced but profit has not happened.

OR

(b)if the changes do not take place, find the probability that it is due to the appointment of C.

38. Mr. Niru residing in Mysore went to see an apartment of 3 BHK. The window of the house was in the form of a rectangle surmounted by a semi-circular opening. The perimeter of the window is 10 m, as shown in the figure below:



Read the above passage and answer the questions given below:

(i) Find the relation between x and y.

(ii) Find the area (A) of the window as a function expressed in term of x.

(iii) (a) Mr. Niru is interested in maximizing the area of the whole window. For what value of x this happens?

OR

(b)Find the maximum area of the window.

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