MODEL QUESTION PAPER

MATHEMATICS

XII-STANDARD (CBSE-041)

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

General Instructions:

- 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 MCQs 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 (4 marks each) with sub-parts.

SECTION A

Multiple choice questions each question carries 1 mark

Q1	$\int \sqrt{1-9x^2}\,dx = ?$ a) $\frac{3x}{2}\sqrt{1-9x^2} + \frac{1}{6}\sin^{-1}3x + C$ b) $\frac{x}{2}\sqrt{1-9x^2} + \frac{1}{6}\sin^{-1}3x + C$ c) $\frac{x}{2}\sqrt{1-9x^2} + \frac{1}{18}\sin^{-1}3x + C$ d) None of these	1
Q2	The direction ratios of the line perpendicular to the lines $\frac{x-7}{2} = \frac{y+17}{-3} = \frac{z-6}{1}$ and $\frac{x+5}{1} = \frac{y+3}{2} = \frac{z-4}{-2}$ are proportional to a) 4, 5, 7 b) -4, 5, 7 c) 4, -5, -7 d) 4, -5, 7	1
Q3	The values of x for which the angle between $\vec{a} = 2x^2\hat{i} + 4x\hat{j} + \hat{k}, \vec{b} = 7\hat{i} - 2\hat{j} + x\hat{k}$ is obtuse and the angle between $\vec{b}$ and the z-axis is a cute and less than $\frac{\pi}{6}$ are a) $\frac{1}{2} < x < 15$ b) $x > \frac{1}{2}$ or $x < 0$ c) ϕ d) $0 < x < \frac{1}{2}$	1
Q4	If A and B are two events such that $A \subset B$ and $P(B) \neq 0$, then which of the following is correct? a) None of these b) $P(A\|B) \geq P(A)$ c) $P(A\| B) = \frac{P(B)}{P(A)}$ d) $P(A\|B) < P(A)$	1

Q5	The area bounded by the curves y = sin x between the ordinates x = 0, x = π and the x-axis is a) 2 sq. units b) 4 sq. units c) 3 sq. units d) 1 sq. units	1
Q6	$\int \frac{dx}{(4+16x^2)} = ?$ a) $\frac{1}{32}\tan^{-1} 4x + C$ b) $\frac{1}{4}\tan^{-1}\frac{x}{2} + C$ c) $\frac{1}{16}\tan^{-1}\frac{x}{2} + C$ d) $\frac{1}{8}\tan^{-1} 2x + C$	1
Q7	If A and B are two independent events such that P(A) = 0.3, P(A ∪ B) = 0.5, then P(A / B) - P(B / A) = a) $\frac{2}{7}$ b) $\frac{1}{7}$ c) $\frac{1}{70}$ d) $\frac{3}{35}$	1
Q8	The area of the region bounded by the curve $x^2 = 4y$ and the straight line x = 4y - 2 is a) $\frac{5}{8}$ sq.units b) $\frac{9}{8}$ sq.units c) $\frac{3}{8}$sq.units d) $\frac{7}{8}$ sq.units	1
Q9	Find the equation of the line which passes through the point (1, 2, 3) and is parallel to the vector $3\hat{i} + 2\hat{j} - 2\hat{k}$. a) $\vec{r} = \hat{i} + 2\hat{j} + 3\hat{k} + \lambda\left(3\hat{i} + 2\hat{j} - 2\hat{k}.\right)$, $\lambda \in R$ b) $\vec{r} = \widehat{2i} + 2\hat{j} + 3\hat{k} + \lambda\left(3\hat{i} + 2\hat{j} - 2\hat{k}.\right)$ $\lambda \in R$ c) $\vec{r} = 4\hat{i} + 2\hat{j} + 3\hat{k} + \lambda\left(3\hat{i} + 2\hat{j} - 2\hat{k}.\right)$ $\lambda \in R$ d) $\vec{r} = 3\hat{i} + 2\hat{j} + 3\hat{k} + \lambda\left(3\hat{i} + 2\hat{j} - 2\hat{k}.\right)$ $\lambda \in R$	1
Q10	If $\vec{a}$ and $\vec{b}$ are unit vectors inclined at an angle θ, then the value of $\|\vec{a} - \vec{b}\|$ is a) $2\cos\frac{\theta}{2}$ b) $2\sin\frac{\theta}{2}$ c) $2\cos$ d) $2\sin\theta$	1
Q11	What is the equation of a curve passing through (0, 1) and whose differential equation is given by dy = y tan x dx? a) y = sec x b) y = sin x c) y = cosec x d) y = cos x	1

Q12	$\int_0^{\frac{2}{3}} \frac{dx}{4+9x^2}$ equals a) $\frac{\pi}{4}$ b) $\frac{\pi}{12}$ c) $\frac{\pi}{6}$ d) $\frac{\pi}{24}$	1
Q13	The least value of k for which f(x) = x^2 + kx +1 is increasing on (1, 2), is a) -2 b) 2 c) 1 d) -1	1
Q14	The least value of k for which f(x) = x^2 + kx +1 is increasing on (1, 2), is a) -2 b) 2 c) 1 d) -1	1
Q15	If A is an invertible matrix, then det (A^{-1}) is equal to a) $\frac{1}{\det(A)}$ b) 1 c) det(A) d) none of these	1
Q16	The existence of the unique solution of the system of equations: x + y + z= λ 5x - y + μ z = 10 2x+ 3y - z = 6 depends on a) λ and μ both b) λ only c) neither λ nor μ d) μ only	1
Q17	Range of $\sec^{-1}x$ is a) $[0, \pi]$ b) $[0,\pi] - \{\frac{\pi}{2}\}$ c) None of these d) $[0, \frac{\pi}{2}]$	1
Q18	The equation of the curve satisfying the differential equation y (x + y^3) dx = x (y^3 -x)dy and passing through the point (1, 1) is , a) None of these b) $y^3 + 2x + 3x^2y = 0$ c) $y^3 + 2x - 3x^2y = 0$ d) $y^3 - 2x + 3x^2 y = 0$	1

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.
(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.

Q19	**Assertion (A):** The function f(x) = sin x decreases on the interval $(0, \frac{\pi}{2})$. **Reason (R):** The function f(x) = cos x decreases on the interval $(0, \frac{\pi}{2})$. 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.	1
Q20	**Assertion (A):** $\triangle = a_{11}A_{11} + a_{12}A_{12} + a_{13}A_{13}$ where, A_{ij} is cofactor of a_{ij}. **Reason (R):** $\triangle$ = Sum of the products of elements of any row (or column) with their corresponding cofactors. 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.	1

SECTION – B

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

Q21	Find the domain of $f(x) = \sin^{-1}(-x^2)$.	2
Q22	Find the general solution of the differential equation $(x+2)\frac{dy}{dx} = x^2 + 5x - 3 (x \neq -2)$	2
Q23	If $A = \begin{bmatrix} 4 & 5 \\ 2 & 1 \end{bmatrix}$, then show that $A - 3I = 2(I + 3A^{-1})$	2
Q24	If D, E, F are the mid-points of the sides BC, CA and AB respectively of a triangle ABC, write the value of $\overrightarrow{AD} + \overrightarrow{BE} + \overrightarrow{CF}$.	2
Q25	Probability of solving specific problem independently by A and B are $\frac{1}{2}$ and $\frac{1}{3}$ respectively. If both try to solve the problem independently, find the probability that the problem is solved.	2

SECTION – C

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

Q26	Evaluate $\int_{-2}^{2} xe^{\lvert x\rvert}dx$	3
Q27	Solve : $\frac{dy}{dx}$ = cos(x + y) + sin (x + y). [Hint: Substitute x + y = z] OR Solve $\left[x\sin^2\left(\frac{y}{x}\right) - y\right]dx + xdy = 0;$ $y = \pi/4$, when x = 1	3
Q28	Express the vector $\vec{a} = 5\hat{i} - 2\hat{j} + 5\hat{k}$ as the sum of two vectors such that one is parallel to the vector $\vec{b} = 3\hat{i} + \hat{k}$ and other is perpendicular to $\vec{b}$. OR Find λ when the projection of $\vec{a} = \lambda\hat{i} + \hat{j} + 4\hat{k}$ on $\vec{b} = 2\hat{i} + 6\hat{j} + 3\hat{k}$ is 4 units.	3
Q29	Evaluate the integral: $\int \frac{x^5}{\sqrt{1+x^3}}dx$ OR Evaluate: $\int \frac{x}{(1+\sin x)}dx$	3
Q30	Discuss the continuity of the f(x) at the indicated point: f(x) = |x| + |x - 1| at x = 0, 1	3
Q31	Find the area bounded by the curves $y = \sqrt{x},\ 2y - x + 3 = 0,\ X - axis$ and lying in the first quadrant	3

SECTION - D

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

Q32	Solve the following linear programming problem graphically: Maximize Z = 50x + 15y Subject to $5x + y \leq 100$ $x + y \leq 60$ $x, y \geq 0$	5

Q33	Show that the relation R in the set A = {1, 2, 3, 4, 5} given by R = {(a, b) : |a – b| is divisible by 2} is an equivalence relation. Write all the equivalence classes of R. OR Let n be a positive integer. Prove that the relation R on the set Z of all integers numbers defined by (x, y) ∈ R ⇔ x y is divisible by n, is an equivalence relation on Z.	5
Q34	Show that the lines $\vec{r} = (\hat{i} + 2\hat{j} + 3\hat{k}) + \lambda(2\hat{i} + 3\hat{j} + 4\hat{k})$ and $\vec{r} = (4\hat{i} + \hat{j}) + \mu(5\hat{i} + 2\hat{j} + \hat{k})$ intersect. Also, find their point intersection. OR Find the vector equation of the line passing through (1,2,3) and || to the plane $\vec{r}.\left(\hat{i} - \hat{j} + 2\hat{k}\right) = 5$ and $\vec{r}.\left(3\hat{i} + \hat{j} + \hat{k}\right) = 6$	5
Q35	Show that the lines $\vec{r} = (\hat{i} + 2\hat{j} + 3\hat{k}) + \lambda(2\hat{i} + 3\hat{j} + 4\hat{k})$ and $\vec{r} = (4\hat{i} + \hat{j}) + \mu(5\hat{i} + 2\hat{j} + \hat{k})$ intersect. Also, find their point intersection. OR Find the vector equation of the line passing through (1,2,3) and || to the plane $\vec{r}.\left(\hat{i} - \hat{j} + 2\hat{k}\right) = 5$ and $\vec{r}.\left(3\hat{i} + \hat{j} + \hat{k}\right) = 6$	5

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.
The third case study question has two sub parts of 2 marks each.)

Q36	Read the following passage and answer the questions given below: In an Office three employees James, Sophia and Oliver process incoming copies of a certain form. James processes **50%** of the forms, Sophia processes **20%** and Oliver the remaining **30%** of the forms. James has an error rate of **0.06**, Sophia has an error rate of **0.04** and Oliver has an error rate of **0.03**. Based on the above information, answer the following questions.  (i) Find the probability that Sophia processed the form and committed an error. (ii) Find the total probability of committing an error in processing the form. (iii) 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 form. If the form selected at random has an error, find the probability that the form is **not** processed by James. **OR** (iii) Let E be the event of committing an error in processing the form and let E_1, E_2 and E_3 be the events that James, Sophia and Oliver processed the form. Find the value of $\sum_{i=1}^{3} P(E_i \mid E)$.	4

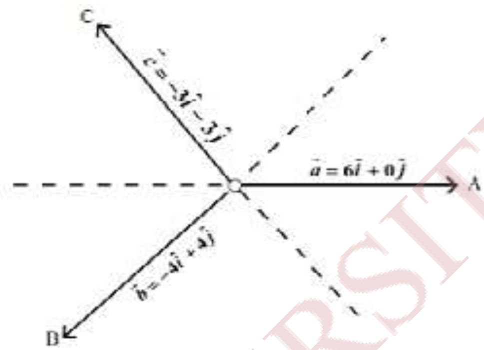
Q37 Read the following passage and answer the questions given below: **4**

Teams A, B, C went for playing a tug of war game. Teams A, B, C have attached a rope to a metal ring and is trying to pull the ring into their own area.

Team A pulls with force $F_1 = 6\hat{i} + 0\hat{j}\ kN$,

Team B pulls with force $F_2 = -4\hat{i} + 4\hat{j}\ kN$,

Team C pulls with force $F_3 = -3\hat{i} - 3\hat{j}\ kN$,



(i) What is the magnitude of the force of Team A?

(ii) Which team will win the game?

(iii) Find the magnitude of the resultant force exerted by the teams.

OR

(iii) In what direction is the ring getting pulled?

Q38 Read the following passage and answer the questions given below: **4**

The relation between the height of the plant ('y' in cm) with respect to its exposure to the sunlight is governed by the following equation $y = 4x - \frac{1}{2}x^2$, where 'x' is the number of days exposed to the sunlight, for $x \leq 3$.

(i) Find the rate of growth of the plant with respect to the number of days exposed to the sunlight.

(ii) Does the rate of growth of the plant increase or decrease in the first three days?

What will be the height of the plant after 2 days?