KENDRIYA VIDYALAYA SANGATHAN

SAMPLE QUESTION PAPER 1

CLASS – XII **MAX.MARKS – 80**

SUB. – MATHEMATICS (Code – 041) **TIME – 03 HOURS**

General Instructions:

1. This question paper contains 38 questions. All questions are compulsory.
2. This Question paper contains **- five sections** A, B, C, D and E. Each section is compulsory. However, there are internal choices in some questions.
3. **Section A** has **18 MCQ's and 02 Assertion-Reason** based questions of 1 mark each.
4. **Section B** has **5 Very Short Answer (VSA)-type** questions of 2 marks each.
5. **Section C** has **6 Short Answer (SA)-type** questions of 3 marks each.
6. **Section D** has **4 Long Answer (LA)-type** questions of 5 marks each.
7. **Section E** has **3 source based/case based/passage based/integrated units of assessment** (4 marks each) with sub parts
8. There is no overall choice. However, an internal choice has been provided in 2 questions in Section B, 3 questions in Section C, 2 questions in Section D and 2 questions in Section E.
9. Use of calculator is not allowed.

SECTION A

This section comprises multiple choice questions (MCQs) of 1 mark each.

1. let Z denote the set of integers , then the function f: Z→ $Z\ defined\ as\ f(x) = x^3$-1 is

   (A) both on-one and onto (B) one-one but not onto

   (C) onto but not one-one (D) neither one-one nor onto

2. if A = $[a_{ij}]\ is\ a\ diagonal\ matrix, then\ which\ of\ the\ following\ is\ true$?

   (A) $a_{ij} = \begin{cases} 0\ if\ i = j \\ 1\ if\ i\ \neq j \end{cases}$ (B) $a_{ij} = 1$, $\forall\ i, j$

   (C) $a_{ij} = 0\ if\ i \neq j$ & $a_{ij} \neq 0\ if\ i = j$ (D)$a_{ij} = 1$, $\forall\ i, j$

3. Let $A = \begin{bmatrix} p & q \\ r & s \end{bmatrix}$ be a square matrix such that $adj\ A = A$. Then $(p + q + r + s)\ is\ equal\ to$

   (A) 2p (B) 2q (C) 2r (D)0

4. If A and B are symmetric matrix of the same order , then $(AB' - BA')$ is a

   (A) Skew Symmetric matrix (B)Null matrix (C) Symmetric matrix (D) None of these

5. If $x, y \in R, then\ the\ determinant\ \Delta = \begin{vmatrix} cosx & -sinx & 1 \\ sinx & cosx & 1 \\ \cos(x+y) & -\sin(x+y) & 0 \end{vmatrix}$ lies in the interval

(A)$[-\sqrt{2}, \sqrt{2}]$ (B)$[-1,1]$ (C)$[-\sqrt{2}, 1]$ (D)$[-1, \sqrt{2}]$

6. The area of the triangle with vertices (-3,0), (3,0) and (0,k) is 9 square units. The value of k will be

(A) 9 (B)3 (C) -9 (D) 6

7. The number of points at which the function $f(x) = \frac{1}{x-[x]}$ is not continuous is

(A) 1 (B)2 (C) 3 (D) None of these

8. Differential coefficient of $sec(tan^{-1}x)$ with respect to x is

(A) $\frac{x}{\sqrt{1+x^2}}$ (B) $\frac{x}{1+x^2}$ (C)$x\sqrt{1+x^2}$ (D)$\frac{1}{\sqrt{1+x^2}}$

9. The function $f(x) = tanx - x$

(A) Always increases (B)Always decreases

(C)Never increases (D)Sometimes increases and sometime decreases

10. $\int_{a+c}^{b+c} f(x)dx\ \ is\ equal\ to$

(A) $\int_a^b f(x-c)dx$ (B) $\int_a^b f(x+c)dx$ (C)$\int_a^b f(x)dx$ (D)$\int_{a-c}^{b-c} f(x)dx$

11. The solution of the differential equation $2x\frac{dy}{dx} - y = 3$ represents a family of

(A) Straight lines (B)Circles (C)Parabolas (D)Ellipses

12. The angle between the vectors $\hat{\imath} - \hat{\jmath}\ and\ \hat{\jmath} - \hat{k}$ is

(A)$\frac{\pi}{3}$ (B)$\frac{2\pi}{3}$ (C)$\frac{-\pi}{3}$ (D)$\frac{5\pi}{6}$

13. If $|\vec{a}|$ = 8, $|\vec{b}|$ = 3 and $|\vec{a} \times \vec{b}|$ = 12 then $\vec{a} . \vec{b}$ is

(A) $6\sqrt{3}$ (B)$8\sqrt{3}$ (C)$12\sqrt{3}$ (D)None of these

14. The equation of x-axis in space are

(A)$x = 0,\ y = 0$ (B)$x = 0,\ z = 0$ (C)$x = 0$ (D)$y = 0, z = 0$

15. If a line makes equal acute angles with coordinate axes , then direction cosines of the line is

(A)1,1,1 (B)$\frac{1}{\sqrt{3}}, \frac{1}{\sqrt{3}}, \frac{1}{\sqrt{3}}$ (C)$\frac{1}{3}, \frac{1}{3}, \frac{1}{3}$ (D)$\frac{1}{\sqrt{3}}, \frac{-1}{\sqrt{3}}, \frac{-1}{\sqrt{3}}$

16. The corner point of the feasible region determined by the system of linear constraints are (0,10), (5,5), (15,15) and (0,20) . let Z = px+ qy , where p,q >0.

    Condition on p and q so that the maximum of z occurs at both the points (15,15) and (0,20) is

    (A)p = q (B)p = 2q (C)q = 2p (D)q = 3p

17. the linear function which is to be optimized in the Linear Programming Problem is known as

    (A)constraints (B)optimal solution (C)objective function (D)decision variables

18. Let A and B be two events such that P(A) = 0.6 , P(B) = 0.2 and $P\left(\frac{A}{B}\right) = 0.5$ then $P(\frac{A'}{B'})$ equals

    (A)1/10 (B)3/10 (C)3/8 (D)6/7

In Questions number 19 and 20, 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

19. Assertion (A) : Every scalar matrix is a diagonal matrix

    Reason(R) : In a diagonal matrix , all the diagonal elements are zero.

20. Assertion (A) : Projection of $\vec{a}$ on $\vec{b}$ is same as projection of $\vec{b}$ on $\vec{a}$.

    Reason(R) : Angle between $\vec{a}$ and $\vec{b}$ is same as angle between $\vec{b}$ and $\vec{a}$

SECTION B

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

21. Find the value of tan^{-1}(-1) + $sin^{-1}\left(-\frac{1}{2}\right) + cos^{-1}\left(\frac{-1}{\sqrt{2}}\right)$.

22. (a) for what value of μ is the function defined by

$$f(x) = \begin{cases} \mu(x^2 - 2x) & if\ x < 0 \\ x + 1 & if\ x \geq 0 \end{cases}$$

    Continuous at x= 0 ?

    OR (b) Find $\frac{dy}{dx}$ $if\ x = a(\theta - sin\theta)\ and\ y = a(1 + cos\theta)$

23. (a) Evaluate: $\int_0^{\pi/2} \frac{sinx}{1+cos^2x}\, dx$

OR (b) Evaluate: $\int_0^4 |x-1|\, dx$

24. Find the area of the parallelogram whose diagonals are $4\hat{\imath}$ -$\hat{\jmath}$ - $3\hat{k}$ and $-2\hat{\imath}$ +$\hat{\jmath}$ - $2\hat{k}$.

25. If $\vec{a}$, $\vec{b}$, $\vec{c}$ are unit vectors such that $\vec{a}$ + $\vec{b}$ + $\vec{c}$ = $\vec{0}$, find the value of $\vec{a}$. $\vec{b}$ + $\vec{b}$. $\vec{c}$ + $\vec{c}$. $\vec{a}$

SECTION C

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

26. (a) If $f(x) = \begin{cases} 3ax+b & if x<1 \\ 11 & if x=1 \\ 5ax-2b, & if x>1 \end{cases}$ is continuous at x = 1, find a and b

OR (b) If $y = x^{sinx} + (sinx)^{cosx}\ then\ find \frac{dy}{dx}$

27. (a) It is given that $\mathrm{f(x)} = \mathrm{x}^4 - 62\mathrm{x}^2 + \mathrm{ax} + 9$ attains local maximum value at $x = 1$. Find the value of 'a ', hence obtain all other points where the given function $f(x)$ attains local maximum values.

OR (b) A ladder 5 m long is leaning against a wall. The bottom of the ladder is pulled along the ground, away from the wall, at the rate of 2cm/s. How fast is its height on the wall decreasing when the foot of the ladder is 4 m away from the wall ?

28. Find : $\int \frac{x^3}{x^4+3x^2+2}\, dx$

29. (a) Find: $\int e^{tan^{-1}x} \left(\frac{1+x+x^2}{1+x^2}\right) dx$

OR (b) Evaluate : $\int_0^{\pi/4} \log(1+tanx)\, dx$

30. Solve the linear programming problem graphically

Maximize $Z = 510\,x + 675\,y$

subject to the constraints:

$x + y \le 300$; $2x + 3y \le 720$; $x \ge 0, y \ge 0$

31. A laboratory blood test is 99% effective in detecting a certain disease when it is in fact, present. However, the test also yields a false positive result for 0.5% of the healthy person tested (i.e. if a healthy person is tested, then, with probability 0.005, the test will imply he has the disease). If 0.1 percent of the population actually has the disease, what is the probability that a person has the disease given that his test result is positive.

SECTION D

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

32. Show that the relation R in the set A = {x ∈ Z : 0 ≤ x ≤ 12}, given by R = {(a, b) : |a – b| is a multiple of 4} is an equivalence relation. Find the set of all elements related to 1. Also find the equivalence class [3]

33. (a) Find the critical points and hence find absolute maximum and minimum values of a function f given by $f(x) = 12x^{4/3} - 6x^{\frac{1}{3}},\ x \epsilon [-1,1]$.

    OR (b) A rectangular sheet of tin 45 cm by 24 cm is to be made into a box without top, by cutting off square from each corner and folding up the flaps. What should be the side of the square to be cut off so that the volume of the box is maximum ?

34. Using integration Find the area of the region in the first quadrant enclosed by x-axis, line $x = \sqrt{3}\, y$ and the circle $x^2 + y^2 = 4$.

35. (a) Find the distance of a point (2,4, –1) from the line $\frac{x+5}{1} = \frac{y+3}{4} = \frac{z-6}{-9}$

    OR (b) Find the vector equation of the line passing through the point (1, 2, – 4) and perpendicular to the two lines: $\frac{x-8}{3} = \frac{y+19}{-16} = \frac{z-10}{7}\ \ and\ \frac{x-15}{3} = \frac{y-29}{8} = \frac{z-5}{-5}$

SECTION E

This section comprises 3 case study based questions of 4 marks each.

Case Study -1

1. Self-study helps students to build confidence in learning. It boosts the self-esteem of the learners. Recent surveys suggested that close to 50% learners were self-taught using internet resources and unskilled themselves.

A student may spend 1 hour to 6 hours in a day in upskilling self. The probability distribution of the number of hours spent by a student is given below:

$$P(X = x) = \begin{cases} kx^2, & for\ x = 1,2,3 \\ 2kx, & for\ x = 4,5,6 \\ 0, & otherwise \end{cases}$$

Where x denotes the number of hours.

Based on the above information, answer the following questions:

(i) Express the probability distribution given above in the form of a probability distribution table. 1

(ii) Find the value of k. 1

(iii) (a) Find the mean number of hours spent by the student. 2

OR (b) Find P(1<X<6).

Case Study - 2

2. It is known that, if the interest is compounded continuously, the principal changes at the rate equal to the product of the rate of bank interest per annum and the principal. Let P denotes the principal at any time t and rate of interest be $r\%$ per annum.

Based on the above information answer the following questions.

iii) At what interest rate will Rs. 100 double itself in 10 years. 2

iv) (a) How much will Rs. 1000 be worth at 5% interest after 10 years? 2

OR (b) If the interest is compounded continuously at 5% per annum, in how many years will Rs. 100 double itself? 2

[Use $\ln 2 = 0.6931; e^{0.5} = 1.648$]

Case Study -3

3. The monthly income of two sisters Ojaswini and Tejaswini are in the ratio 3:4 and their monthly expenditures are in the ratio 5:7. Each sister saves ₹ 15,000 per month.

a) Write the information in the matrix equation. 1

b) Is the system of equation consistent? 1

c) Find the monthly income of both sisters by matrix method. 2

OR Find the monthly expenditure of both sisters by matrix method.

KENDRIYA VIDYALAYA SANGATHAN

SAMPLE PAPER 1

MARKING SCHEME

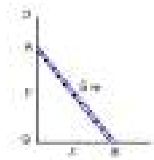
CLASS – XII **SUB : MATHEMATICS (041)**

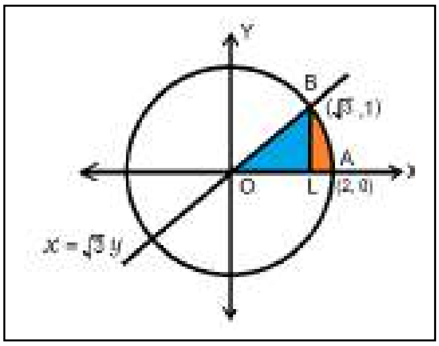
MCQ ANSWERS

1.(A) 2.(C) 3.(A) 4.(A) 5.(A) 6.(B) 7.(D) 8.(A) 9.(B) 10.(C)

11.(C) 12.(B) 13.(C) 14.(D) 15.(B) 16.(D) 17.(C) 18.(C) 19.(C) 20.(A)

Q.NO	ANSWER	VALUE POINTS
21)	For each value of tan^{-1}(-1), $sin^{-1}\left(-\frac{1}{2}\right)$ and $cos^{-1}\left(\frac{-1}{\sqrt{2}}\right)$ For final correct answer	$3\text{x}\frac{1}{2}$ $\frac{1}{2}$
22)	(a) LHL = 0, RHL =1 = f(0) Equating and finding the value of μ as no such value of μ exists **OR(b)** Finding the values of $\frac{dy}{d\theta}$ and $\frac{dx}{d\theta}$ Finding $\frac{dy}{dx}$	1 1 1.5 0.5
23)	(a) Putting cosx = t so that -sinxdx = dt and limits of t will be 1 to 0 $\therefore I = \int_1^0 \frac{-dt}{1+t^2} = \frac{\pi}{4}$ after simplification **OR** Writing I = $\int_0^4 \|x-1\|\, dx = \int_0^1 \|x-1\|\, dx + \int_1^4 \|x-1\|\, dx$ $= \int_0^1 -(x-1)dx + \int_1^4 (x-1)\, dx$ For correct answer	1 1 1 1
24)	Finding adjacent sides of the parallelogram as vectors $\vec{a}$ and $\vec{b}$ Finding area of the parallelogram using $\left\|\vec{a} \times \vec{b}\right\|$	1 1
25)	$\left\|\vec{a}+\vec{b}+\vec{c}\right\|^2 = (\vec{a}+\vec{b}+\vec{c}).(\vec{a}+\vec{b}+\vec{c})$ and using $\vec{a}, \vec{b}, and \vec{c}$ as a unit vector For correct answer -3/2	1 1
26)	LHL = 3a + b, RHL = 5a – 2b and f(1) = 11 Equating all and getting the values of a and b as 3 and 2 respectively	1.5 1.5
27)	(a) Finding $f'(x)$ and equating $f'(a)$ to 0 to find the value of $a = 120$ Then $\text{f(x)} = \text{x}^4 - 62\text{x}^2 + 120\text{x} + 9$ and finding other points where the given function $f(x)$ attains local maximum values.	1.5 1.5

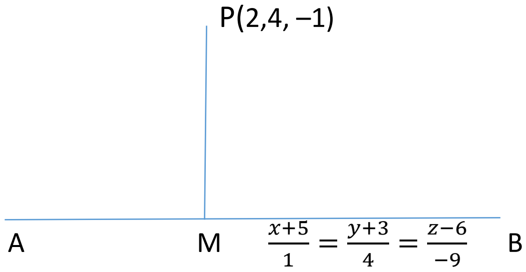
	OR (b) Let PQ be the wall. At certain time t, let AB be the position of the ladder such that $\mathrm{QB} = x$ and $\mathrm{AQ} = y$  Then $x^2 + y^2 = 5^2$ ……..(1) Diff. both sides with respect to t, we get $\Rightarrow 2x\frac{dx}{dt} + 2y\frac{dy}{dt} = 0$ $\Rightarrow \frac{dy}{dt} = -\frac{2x}{2y} \times \frac{dx}{dt} \Rightarrow \frac{dy}{dt} = -\frac{x}{y} \times 2\ \mathrm{cm/s} \Rightarrow \frac{dy}{dt} = -\frac{2x}{y}\ \mathrm{cm/s}$ ……..(2) When $x = 4\,m$, then from (1), $y = \sqrt{5^2 - 4^2} = 3\ \mathrm{m}$ Putting these values of x and y in equation (2), we find $\frac{dy}{dt} = -\frac{2 \times 4\,m}{3\,m}\ \mathrm{cm/s} = -\frac{8}{3}\ \mathrm{cm/s}$ Thus, the rate of decrease of height on the wall is $\frac{8}{3}$ cm/s	1.5 1.5
28)	Let $I = \int \frac{x^3}{x^4+3x^2+2}\,dx$ Putting $x^2 = t\ so\ that\ 2xdx = dt\ and\ \therefore I = \int \frac{t.dt/2}{t^2+3t+2}$ Finding correct integral by partial fraction or any other method	1.5 1.5
29)	(a) $let\ I = \int e^{tan^{-1}x}\left(\frac{1+x+x^2}{1+x^2}\right)dx$ Putting $x = \tan t\ so\ that\ dx = sec^2t\ dt$ and $\therefore I = \int e^t\left(\frac{1+tant+tan^2t}{1+tan^2t}\right)sec^2t\ dt$ $= \int e^t(tant + sec^2t)\,dt = e^t(tant) + \mathrm{C}$ **OR (b)** $taking\ \int_0^{\frac{\pi}{4}} \log(1 + tanx)\ dx$ as Integral I and applying the property $\int_0^a f(x)\,dx = \int_0^a f(a-x)\,dx$ Adding both integral and finding the value of I as $\frac{\pi}{8}\log 2$	1.5 1.5 1.5 1.5
30)	For correct feasible region For corner point, corresponding value of Z and finding solution	1.5 1.5
31)	Let E1 = Event that the person has a disease. E2 = Event that the person is healthy. $\therefore P(E_1) = 0.1\% = \frac{0.1}{100} = \frac{1}{1000}\ \ and\ \ P(E_2) = 1 - \frac{1}{1000} = \frac{999}{1000}$ A = Event that the test result is positive. $\therefore P(A\vert E_1) = 99\ \% = \frac{99}{100}\ \ P(A\vert E_2) = 0.5\% = \frac{0.5}{100} = \frac{5}{1000}$ $\therefore$ By Bayes' Theorem, $P(E_1\vert\,A) = \frac{P\,(E_1)\,.P\,(A\vert E_1)}{P\,(E_1).P\,(E_1)+P\,(E_2).P\,(E_2)} = \frac{\frac{1}{1000}\times\frac{99}{100}}{\frac{1}{1000}\times\frac{99}{100}+\frac{999}{1000}\times\frac{5}{1000}} = \frac{22}{133}$	1 2

<table>
<tr><td>32)</td><td>For showing relation reflexive
For showing relation symmetric
For showing relation transitive
Finding the set of all elements related to 1 and [3]</td><td>1
1
1.5
1.5</td></tr>
<tr><td>33)</td><td>(a) Critical points are the points where $f'(x) = 0 \; or \; f'(x) \; does \; not \; exist.$
$after \; solving \; critical \; points \; are \; x = 0 \; and \; x = \frac{1}{8}$
$finding \; the \; value \; of \; f(x)$ at critical and boundary points and deciding absolute maximum is 18 which occurs at x = -1 and absolute minimum is -9/4 which occurs at x = 1/8
OR (b) Let x = side of the square to be cut-off
So that Volume of the box , V= (45-2x)(24-2x)x
Taking first derivative of Volume to zero and finding the value of critical point x = 5cm, 18cm and rejecting 18 cm ,
2^{nd} derivative of V = (-)ve so Volume is maximum at x = 5 cm
Thus Side of the square to be cut-off and Maximum volume = 2450 cm^3.</td><td>1
1
3
1.5
2
1.5</td></tr>
<tr><td>34)</td><td>For the points of intersection, we solve equations of given circles
The point of intersection are $(\sqrt{3}, 1)$ and $(-\sqrt{3}, -1)$
The rough sketch of the given curve is as follows:


The required area
= Area of the shaded region OBALO
= Area of OBLO + Area of BLAB
$= \int_0^{\sqrt{3}} (y \text{ of line}) \; dx + \int_{\sqrt{3}}^{2} (y \text{ of circle}) \; dx$
$= \int_0^{\sqrt{3}} \frac{x}{\sqrt{3}} \, dx + \int_{\sqrt{3}}^{2} \sqrt{4 - x^2} \, dx$</td><td>1
1.5
1.5</td></tr>
</table>

For integrating and finding the area $\frac{\pi}{3}$ sq. units 1

35) (a)



Let M be the foot of the perpendicular from given point to given line

Taking the general point $(\mu - 5, 4\mu - 3, -9\mu + 6)$ on the line AB and taking this is the coordinate of M. 1.5

The d. r. of PM $= \mu - 7, 4\mu - 7, -9\mu + 7$ 1.5

d.r. of AB = 1,4,-9

since AB⊥PM

$\therefore 1(\mu - 7) + 4(4\mu - 7) - 9(-9\mu + 7) = 0$ 1

$\mu = 1$ 1

∴ Coordinate of M = (-4,1,-2) and so PM = $\sqrt{46}$ units

OR

(b) Let the d.r. of the required line is a, b, c

Since required line is perpendicular to given two line so 2

$3a - 16b + 7c = 0 \text{ and } 3a + 8b - 5c = 0$ 1.5

Solving and getting the direction ratio 1.5

Getting the equation of the required line

36) (i)

X	1	2	3	4	5	6
P(X)	k	4k	9k	8k	10k	12k

1

(ii) $\sum P(X) = 1$

$\Longrightarrow k = \frac{1}{44}$ 1

(iii) (a) Mean = $\sum XP(X) = \frac{190}{44}$ 2

OR (b) P(1<X<6) =P(2)+P(3)+P(4)+P(5) = 31/144 2

37) Now, as per question

$\frac{dP}{dt} = r\,\%$ of P OR $\int \frac{1}{P} dP = \frac{r}{100} \int dt \Rightarrow \log P = \frac{r}{100} t + C \ldots\ldots\ldots\ldots (1)$

Given that when $t = 0$ then $\log P_0 = C$ After solving $\log \frac{P}{P_0} = \frac{r}{100} t$ 1

	(i) when $t = 10$ then $\text{P} = 2P_0$ so $\log\frac{2P_0}{P_0} = \frac{r}{100} \times 10 \quad \therefore r = 6.931$ (ii) (a)$\log\frac{\text{P}}{P_0} = \frac{r}{100}t \Rightarrow \log\frac{\text{P}}{1000} = \frac{5}{100} \times 10 \Rightarrow \frac{\text{P}}{1000} = e^{1/2} \Rightarrow P = Rs.1648$ $(b)\log\frac{\text{P}}{P_0} = \frac{r}{100}t \Rightarrow \log\frac{200}{100} = \frac{5}{100}t \Rightarrow \log 2 = \frac{t}{20}t = 20\ log2 = 13.86\ years$	1 2 2
38)	(i) Let the monthly income of Ojaswini and Tejaswini are 3x and 4x and their expenditures are 5y and 7y. So the equations are $3x - 5y = 15000\ and\ 4x - 7y = 15000$ In matrix form $\begin{bmatrix} 3 & -5 \\ 4 & -7 \end{bmatrix}\begin{bmatrix} x \\ y \end{bmatrix} = \begin{bmatrix} 15000 \\ 15000 \end{bmatrix}$ or $AX = B$ (ii) $\|A\| = -1 \neq 0$ so the system is consistent (iii) Solving by matrix method and getting x = 30000 and y = 15000 $(a) \therefore Monthly\ income\ of$ Ojaswini and Tejaswini are ₹90,000 and ₹ 1,20,000 **OR** (b) Monthly expenditure of Ojaswini and Tejaswini are ₹75,000 and ₹ 1,05,000	1 1 2 2 2

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Sample Paper 2

Class-XII **Subject-Mathematics**

S.No./ Unit	Topics	MCQ (1M)	ARQ (1M)	VSA (2M)	SA (3M)	LA (5M)	CASE BASED (4M)	TOTAL
1	RELATIONS AND FUNCTIONS	-		-	-	1		**8(3)**
	INVERSE TRIGONOMETRIC FUNCTIONS	1		1	-	-		
2	MATRICES	2		-	-	1		**10(6)**
	DETERMINANTS	-		1	-	-		
3	CONTINUITY & DIFFERENTIABILITY	3		2(1)	-	-		**35(15)**
	APPLICATION OF DERIVATIVES	-		1		-	**2**	
	INTEGRALS	2		-	-	-		
	APPLICATION OF INTEGRALS	-		-	1	1		
	DIFFERENTIAL EQUATIONS	2		-	1	-		
4	VECTORS	2	1	2	-	-		**14(8)**
	3-DIMENTIONAL GEOMETRY	2		-	-	1		
5	LINEAR PROGRMMING	2		-	1	-		**5(3)**
6	PROBABILITY		1	-	1	-	**1**	**8(3)**
	TOTAL	**18**	**2**	**5**	**6**	**4**	**3**	**80(38)**

**Number written in the bracket is the number of questions.

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SAMPLE QUESTION PAPER 2

CLASS – XII **MAX.MARKS – 80**

SUB. – MATHEMATICS (Code – 041) **TIME – 03 HOURS**

GENERAL INSTRUCTION:

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 MCQS 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) questions of 3 marks each.**
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Section – A

Q.1) If $\begin{vmatrix} 2x & 5 \\ 8 & x \end{vmatrix}=\begin{vmatrix} 6 & -2 \\ 7 & 3 \end{vmatrix}$, the value of x is

a)3 b) ± 3 c) ± 6 c)6

Q.2) The domain of $\cos^{-1}(3x-2)$is

(a) $(\frac{1}{3},2)$ b)$[\frac{1}{3},1]$ c)[-1,1] d)$[\frac{-1}{3},\frac{1}{3}]$

Q.3) If $ax+\frac{b}{x}\geq c$ for all positive x where a,b >0

a)ab $<c^2/4$ b)ab $\geq c^2/4$ c)ab ≥ c/4 d)none of these

Q.4) Let A be a square matrix of order 3 such that adj(4A)=λ(adj A);Then the value of λ is

a) 4 b)8 c)12 d) 16

Q.5) The area of a triangle with vertices (-3,0),(3,0) and (0,k) is 9 sq unit .The value of k is

a) 9 b) 3 c) -3 d) 6

Q.6) The set of points of discontinuity of the function f(x)=2x-[x] is a)Q b)R c)Z d)W

Q.7)If the function is f(x)= $\begin{cases} \frac{x^3-a^3}{x-a} & , x \neq a \\ b, & x = a \end{cases}$ is continuous at x=a then b is equal to

a) a^2 b) $2a^2$ c) $3a^2$ d) $4a^2$

Q.8)If y=$\tan^{-1}\left(\frac{sinx+cosx}{cosx-sinx}\right)$, then $\frac{dy}{dx}$ is equal to

a) $\frac{1}{2}$ b)0 c)1 d)None of these

Q.9) If $x=at^2$; y=2at,then $\frac{d^2y}{dx^2}$ =

a) $\frac{-1}{t^2}$ b) $\frac{1}{2at^3}$ c) $\frac{-1}{t^3}$ d) $\frac{-1}{2at^3}$

Q.10)Degree of the differential equation $\frac{d^2y}{dx^2} + \sqrt{\frac{dy}{dx}}=0$ is

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

Q.11)The Integrating factor of the differential equation (x log x)$\frac{dy}{dx}$ +y=2 log x ,is given by

a)log(log x) b) e^x c) log x d)x

Q.12) $\int 2^{x+2}\, dx$ is equal to

a) 2^{x+2} +c b) $2^{x+2}\log 2$ +c c) $\left(\frac{2^{x+2}}{log2}\right)$+c d) $\frac{2.2^x}{log2}$ +c

Q.13) $\int_0^{\pi/2} log\ \left(\frac{4+3sin\,x}{4+3cosx}\right) dx\ is$

a)2 b) $\frac{3}{4}$ c)0 d)-2

Q.14) If the diagonals of a parallelogram are represented by the vectors 3î+ĵ-2k̂ and î+3ĵ-4k̂, then its area in square unit is:

a) $5(3)^{1/2}$ b) $6(3)^{1/2}$ c) $(42)^{1/2}$ d) $(28)^{1/2}$

Q.15) Objective function of a L.P.P is

a) a constraint b) a function to be optimize c)a relation between the variable d) none of these

Q.16)if the constraint in a LPP are changed

a)the problem is to be re-evaluated b)solution is not defined

c) the objective function has to be modified d) the change in constraint is ignored.

Q17) If α is the angle between two vectors $\vec{a}$ and $\vec{b}$ then$\vec{a}.\vec{b}$ ≥ 0 only when

(a) $0 < \alpha < \pi/2$ (b) $0 \le \alpha \le \pi/2$ (c) $0 < \alpha < \pi$ (d) $0 \le \alpha \le \pi$

Q 18)If a line make angles a, b, c with the co-ordinate axes respectively, then, cos(2a)+cos(2b)+cos(2c) = ?

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

Q.19) **Assertion(A):** 20 persons are sitting in a row.Two of these person are not at random. The probability that the two selected person are not together is 0.9.

Reason(R): If $\overline{A}$ denotes the negation of an event A, then P($\overline{A}$)=1-P(A)

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

Q.20) **Assertion(A):** if the vectors $\overrightarrow{AB}$ =3 $\hat{\imath}$ + 4$\hat{\jmath}$ and $\overrightarrow{AC}$= 5$\hat{\imath}$ - 2$\hat{\jmath}$ + 4$\hat{k}$ are sides of a triangle ABC then the length of the median AD through A is $\sqrt{33}$.

Reason(R): if AD is the median of triangle ABC then $\overrightarrow{AB}$ + $\overrightarrow{AC}$ = 2$\overrightarrow{AD}$

a) Both A and R are true but 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

Q.21)Find the value of $\cos^{-1}(\cos\frac{5\pi}{3})+\sin^{-1}(\sin\frac{5\pi}{3})$

Or Find the value of $\sin^{-1}(\cos\frac{43\pi}{5})$

Q.22) Find the dimensions of the rectangle with perimeter 36 cm. which will generate maximum volume when resolved about one of its sides

Or If f(x)=2x+cos x + b; b∈R, find the interval for which f(x) is strictly increasing.

Q.23) If $e^y(x+y)=1$ then show that $\frac{d^2y}{dx^2}=(\frac{dy}{dx})^2$

Q.24) If $\vec{a}+\vec{b}+\vec{c}=0$ and $|\vec{a}|=3$, $|\vec{b}|=5$ and $|\vec{c}|= 7$, then find the value of $\vec{a}.\vec{b}+\vec{b}.\vec{c}+\vec{c}.\vec{a}$

Or If the vertices A, B, C of a triangle ABC are (1,2,3), (-1,0,0), (0,1,2) respectively, find ∠ABC

Q.25) Find the vector and Cartesian equation of the line through the point (1,2, -4) and perpendicular to the lines $\vec{r}=(3\hat{i}-19\hat{j}+10\hat{k}) +\lambda(3\hat{i} -10\hat{j} +7\hat{k})$ and $\vec{r}= (15\hat{i}+29\hat{j}+5\hat{k}) +\mu (3\hat{i} +8\hat{j} -5\hat{k})$

Section-C

Q.26) Find a matrix A such that 2A-3B+5C=0

Where B=$\begin{bmatrix} -2 & 2 & 0 \\ 3 & 1 & 4 \end{bmatrix}$ and C =$\begin{bmatrix} 2 & 0 & -2 \\ 7 & 1 & 0 \end{bmatrix}$

Or If A = $\begin{bmatrix} 2 & 0 & 1 \\ 2 & 1 & 3 \\ 1 & -1 & 0 \end{bmatrix}$; then find the value of A^2-5A

Q.27) The volume of a cube is increasing at a rate of 9 cubic centimetre per second. How fast is the surface area increasing when the length of an edge is 10 centimetres?

Q.28) $\int \frac{1}{\sqrt{sin^3 x sin(x+\alpha)}}dx$

Q.29) Solve the differential equation $\left[\frac{e^{-2\sqrt{x}}}{\sqrt{x}} - \frac{y}{\sqrt{x}}\right]\frac{dy}{dx}=1$, (x≠0)

Q.30) Solve the following linear programming problem graphically

Minimizing z=200x + 500y

Subject to the constrains X+2y≥10; x≥0, y≥0

Q.31) A fair die is rolled . Consider the events E={1,3,5},F={2,3} and G={2,3,4,5}

Find:

1) P(E/F) and P(F/E)
2) P(E/G) and P(G/E)
3) P[(E U F)/G] and P[(E ∩F)/G]

Section-D

Q.32) Let N denotes the set of all natural numbers and R be the relation on NxN Defined by (a,b) R (c,d) ⇔ad(b+c) =bc(a+d).Prove that R is an equivalence relation

Or Show that the function: f:R→{ x∈R :-1≤ x ≤ 1}defined by f(x)= $\frac{x}{1+|x|}$, x+R is both one-one and onto function.

Q.33) use the product $\begin{bmatrix} 1 & -1 & 2 \\ 0 & 2 & -3 \\ 3 & -2 & 4 \end{bmatrix}\begin{bmatrix} -2 & 0 & 1 \\ 9 & 2 & -3 \\ 6 & 1 & -2 \end{bmatrix}$ to solve a system of equations

x-y+2z=1, 2y-3z=1, 3x-2y+4z=2

Q.34) Using method of integration find the area of the region in the quadrant enclosed by the x-axis, the line y= $\sqrt{3}$x and $x^2+y^2=9$

Q.35)Find the equation of the line through A(5, -3, -2) And through the intersection point of the lines:

$\frac{x-2}{1} = \frac{y-2}{3} = \frac{z-4}{4}$ and $\frac{x-4}{3} = \frac{y-2}{4} = \frac{z+3}{-3}$

Or Find the coordinates of the foot of the perpendicular drawn from point A(5,4,2) to the line $\vec{r}$ =(î+3ĵ+k̂) +λ(2î+3ĵ-k̂) also find the image of A in this line.

SECTION-E

Q.36) In the survey of a town it was found that 6% of people with blood group O are left handed and 10% of those with other blood group are left handed. 30% of the people have blood group O. Based o the above information answer the following questions :

A) Probability of selecting a left handed person given that he/she has blood group O

(i) 0.3 (ii) 0.6 III)0.1 (iv)0.06

B) Probability of selecting a left handed person given that he/she dosn't have blood group O

I) (i) 0.06 (ii)0.01 III)0.6 (iv) 0.1

C) Probability of selecting a left handed person is

(i) 0.088 (ii) 0.08 III)0.88 (iv) 0.80

D) The probability that a randomly selected person is right handed

I)0.88 II)104/125 III)114/125 IV)114/250

Q.37) the use of electric vehicles will curb air pollution in the long run . The electric vehicles is increasing every year and estimated electric vehicles in use at any time tis given by the function :

$V(t) = \frac{1}{5}t - \frac{5}{2}t^2 + 25t - 2$

Where t represents the time t=1,2,3,…. correspond to year 2001,2002,2003,….respectively.

Answer the following

I) Can the above function be used to estimate number of vehiclesin the year 2000?justify

II) Prove that the function V(t) is an increasing function .

Q.38) A company x units of output at a total cost of $C=\frac{1}{3}x^3 - 18x^2 + 160x$.the average cost(AC) is the cost per unit and marginal cost is the rate of change of C with respect to x. Based on the above information answer the following questions

A)The average cost(AC) is given by:

I)$\frac{x^2}{3} - 18x + 160$ II)$x^2 - 36x + 160$ (iii) $\frac{x^3}{3} - 18x + 160$ (iv) none of the above

B)The output at which average cost is equal to marginal cost , is

I)27 units II)18 units III)9units IV) 36units

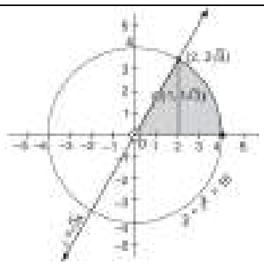
C) The output at which marginal cost is minimum

I)27units II)18units III)16units IV) 12units

D)The output at which AC is minimum

I)27units II)18units III)9units IV)12units

	KENDRIYA VIDYALAYA SANGATHAN SAMPLE PAPER 2 MARKING SCHEME CLASS – XII SUB :MATHEMATICS (041) MARKING SCHEME	
Q.NO	**ANSWER**	**VALUE POINTS**
MCQ	**1)(C) 2)(B) 3)(B) 4)(D) 5)(B) 6)(C) 7)(C) 8)(C) 9)(D) 10)(B)** **11)(C) 12)(C) 13)(C) 14)(A) 15)(B) 16)(A) 17)(B) 18)(B) 19)(A) 20)(A)**	
21	$Cos^{-1}Cos\left(\frac{6\pi-\pi}{3}\right)+Sin^{-1}Sin(\frac{6\pi-\pi}{3})$ Result= 0 OR $Sin^{-1}Cos\left(\frac{40\pi+3\pi}{5}\right)= Sin^{-1}Cos\left(8\pi+\frac{3\pi}{5}\right)= Sin^{-1}Cos\left(\frac{3\pi}{5}\right)= Sin^{-1}Sin\left(\frac{\pi}{2}-\frac{3\pi}{5}\right)$ Result=$\frac{-\pi}{10}$	**1** **1** **1** **1**
22.	Development of proper Function V=πl^2b L=12, b=6	1 1
23	To find correct $\frac{dy}{dx}$ To find correct$\frac{d^2y}{dx^2}$ To show the result correctly after Simplification	½ ½ 1
24	To get correct expression for $(\vec{a}+\vec{b}+\vec{c})^2$ To get correct value of $\vec{a}.\vec{b}+\vec{b}.\vec{c}+\vec{c}.\vec{a}$	1 1
25	To get correct perpendicular vector from the cross product of (3î -10ĵ +7k̂) and (3î +8ĵ -5k̂) To get correct vector and Cartesian Equation	1 (1/2+1/2)
26	To assume A with proper order To get correct value of A=$\begin{bmatrix}-8 & 3 & 5\\ -13 & -1 & -9\end{bmatrix}$ Or To get correct value of A^2 To get correct value of 5A To get correct value of A^2-5A	1 2 1 1 1
27	To assume correct function To find out correct value of the differentiation To get the correct result =3.6cm^2/s	1 1

		1
28	To convert the expression in the form $=\int \frac{dx}{sin^2x\sqrt{\frac{\sin(x+\alpha)}{sinx}}}$ To assume z=$\frac{\sin(x+\alpha)}{sinx}$ To get correct integration	1 1 1
29	To convert the equation in the form $\frac{dy}{dx}$+Py=Q To get correct integrating factor To get the correct result	1 1 1
30	To draw the lines correctly To get correct feasible region and the vertices To get correct value of z	1 1 1
31	P(E/F)=1/2, P(F/E)=1/3 P(E/G)=1/2,P(G/E)=2/3 P(E∪ $F/G) = 3/4$,P(E∩ F/G)=1/4	½+1/2 ½+1/2 ½+1/2
32	To show reflexivity correctly To show symmetricity correctly To show transitivity correctly To conclude properly OR To show one one properly(considering three different cases) To show onto properly(considering two cases)	1 1 2 1 3 2
33	To get proper multiplication as AB=I To write X=A^{-1}B To get proper values of x,y,z	2 1 2
34	 To get diagram properly Putting $y=\sqrt{3}x$ in $x^2+y^2=16$ we get $x^2+(\sqrt{3}x)^2=16$ $\Rightarrow \quad 4x^2=16 \quad \Rightarrow \quad x=\pm 2$ $\therefore \quad y=\pm 2\sqrt{3}.$ Therefore, intersecting point of circle and line is $(\pm 2, \pm 2\sqrt{3})$ To get correct area=4πsq.unit	1 2 2

35	To express the general point of the 1st line and 2nd line correctly To get correct point of intersection To get correct equation of the line	1 3 1
36	I)d II)b III)a IV)c	1 1 1 1
37	I)V(t)=$\frac{1}{5}$t $-\frac{5}{2}t^2+$25t$-$2 to estimate no of vehicles in the year 2000 we need to know the value at t=0 which cannot be determined by V(t) as it is defined for t=1,2,3…. II)V'(t)=$\frac{3}{5}$ $\{(t-\frac{25}{6})^2+\frac{875}{36}\}$>0 for all t then V(t) is an increasing function	2 2
38	I)A II)A III)B IV)A	1 1 1 1

KENDRIYA VIDYALAYA SANGATHAN

Blue-Print
Sample Paper 3

Class-XII **Subject-Mathematics (041)**

Units and Chapters	MCQ	Assertion/Reasoning	2 Marks	3 Marks	5 Marks	4 marks Case Based	Total
1. Relation & Function & I.T. Functions	1	-	1	-	1	-	8(3)
2. Matrices and Determinants	6		-	-	-	1	10(6)
3. Calculus	4	1	2	4	2	1	35(14)
4. Vector Algebra & 3-D Geometry	4	1	2	-	1	-	14(8)
5. Linear programming Problem	2	-	-	1	-	-	5(4)
6. Probability	1	-	-	1	-	1	8(3)
Total	**18**	**2**	**5**	**6**	**4**	**3**	**80(38)**

KENDRIYA VIDYALAYA SANGATHAN

SAMPLE QUESTION PAPER 3

CLASS – XII **MAX.MARKS – 80**

SUB. – MATHEMATICS (Code – 041) **TIME – 03 HOURS**

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(20x1=20)

1 Let R be a relation on the set N of natural numbers defined by nRm if n divides m. Then R is

(a) Reflexive and symmetric (b) Transitive and symmetric

(c) Equivalence (d) Reflexive, transitive but not symmetric

2 If AB = A and BA =B, where A and B are square matrices , then

(a) $B^2 = B$ and $A^2 = A$ (b) $B^2 \neq B$ and $A^2 = A$

(c) $A^2 \neq A$ and $B^2 = B$ (d) $A^2 \neq A$ and $B^2 \neq B$

3 Given that A is a square matrix of order 3 and $|A| = -2$, then $|\text{adj}(2A)|$ is equal to

(a) -26 (b) +4 (c) -28 (d)28

4 If the area of triangle is 40 sq units with vertices (1,-6), (5,4) and (k,4). then k is

(a) 13 (b) -3 (c) -13,-2 (d) 13,-3

5 If $x=t^2$, $y=t^3$ then $\frac{dy}{dx}$ is

(a)$\frac{3t}{2}$ (b) $\frac{3t^2}{2}$. (c) $\frac{3}{2}$ (d) $\frac{2}{3t}$

6 The anti-derivative of $cosec^2\ 2x$ is

(a) sec 2x (b) tan x +cot x +C (c) $\frac{1}{4}$(tan x -cot x+C) (d) tan x -cotx+C

7 The rate of change of area of a circle with respect to its radius r at r=6 is

(a)10π (b)12π (c)11π (d)8π

8 Choose the correct option :

(a) Every scalar matrix is an identity matrix

(b) Every square matrix whose each element is 1 is an identity matrix

(c) Every scalar matrix is a diagonal matrix

(d) Every diagonal matrix is a scalar matrix

9 Corner points of the feasible region for an LPP are (0,2), (3,0), (6,0), (6,8) and (0,5). Let F=4x+6y be the objective function. Maximum of F – Minimum of F =

(a)60 (b) 48 (c)42 (d)18

10 Which of the following function is decreasing in (0, $\frac{\pi}{2}$)

(a) sin 2x (b) tan x (c) cos x (d) cos 3x

11 The area of the quadrilateral ABCD where A (0,4,1), B (2,3,-1), C(4,5,0) and D(2,6,2) is equal to

(a) 9 sq units (b) 18 sq units (c) 27 sq units (d) 81 sq units

12 The value(s) of p for which the vectors joining (3,p,2), (1,0,5) and (1,0, -2) , (0,-p,-4) are orthogonal is (are)

(a) 1 (b) $\frac{1}{2}$ (c) 2 or -2 (d)1 or -1

13 The reflection of the point (1,-2,3) in the XY- plane is

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

14 Which among the following is an intersecting point of the two lines x-1=y=5-z and x+2=y+3=z

(a)(1,2,3) (b)(2,1,4) (c)(3,0,-1) (d)(-1,2,1)

15 The equation of the line joining the points (1, 2) and (3, 6) is

(a) $y = 2x$ (b) $x = 3y$ (c) $y = x$ (d) $4x - y = 5$

16 The corner points of the feasible region determined by the following system of linear inequalities: $2x + y \leq 10$, $x + 3y \leq 15$, $x, y \geq 0$ are (0,0), (5,0), (3,4), (0,5). Let $Z = px + qy$, where $p,q > 0$. Condition on p and q so that the maximum of Z occurs at both (3,4) and (0,5) is

(a) $p = q$ (b) $p = 2q$ (c) $p = 3q$ (d) $q = 3p$

17 A flashlight has 8 batteries of which 3 are dead. If two batteries are selected without replacement and tested then probability that both are dead is

(a) $\frac{33}{56}$ (b) $\frac{9}{64}$ (c) $\frac{1}{14}$ (d) $\frac{3}{28}$

18 The minor M_{ij} of an element a_{ij} of a determinant is defined as the value of the determinant obtained after deleting the

(a) j^{th} row of the determinant

(b) i^{th} column and jth row of the determinant

(c) i^{th} row and jth column of the determinant

(d) i^{th} row of the determinant

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.

19 The total revenue received from the sale of x units of a product is given by $R(x) = 3x^2 + 36x + 5$ in rupees.

Assertion (A): The marginal revenue when $x = 5$ is 66.

Reason (R): Marginal revenue is the rate of change of total revenue with respect to the number of items sold at an instance.

20 Assertion (A): The area of parallelogram with the diagonals a and b is $|\vec{a} \times \vec{b}|$.

Reason (R): If a and represent the adjacent sides of a triangle, then the area of triangle can be obtained by evaluating $\frac{1}{2}|\vec{a} \times \vec{b}|$.

Section B (5x2=10)

21 Express $\tan^{-1}\left(\frac{\cos x}{1-\sin x}\right)$ in simplest form , $\frac{-3\pi}{2} < x < \frac{\pi}{2}$.

22 Whether the function f: R→ R defined by $f(x)=x^3-x$, has any critical point/s or not ?If yes, then find the point/s.

Or Prove that the function f given by $f(x) = |x - 1|$, $x \in R$ is not differentiable at x=1

23(a) Find $\int x^2 \tan^{-1}x \, dx$

23(b) Or Integrate: $\int \sin 3x \cos 2x \, dx$.

24 Find the direction ratio and direction cosines of a line parallel to the line whose equations are $6x-2 = 3y+1 = 2z - 4$.

25 Find the vector equation of the line joining (1, 2, 3) and (–3, 4, 3) and show that it is perpendicular to the z-axis.

Section-C (6X3=18)

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

26(b) Or Solve the differential equation $xy \log x \, dy - y^3 \, dx=0$.

27(a) Find the intervals of increasing and decreasing nature of the function $f(x)=x^3+6x^2+9x-8$.

27(b) Or A tank with rectangular base and rectangular sides, open at the top is to be constructed so that its depth is 2m and volume is 8m3.If building of tank costs Rs.70 per sq. metre for the base and Rs. 45 per sq. metre for sides, that is the cost of least expensive tank?

28 Evaluate : $\int \frac{x^2}{x^4+x^2-2}dx$.

29(a) Find $\int_0^{\pi/2} \frac{\sin^2 x}{\sin x + \cos x} dx$

29(b) Or Find the area of the region bounded by y2 = 9x, x = 2, x = 4 and the x-axis in the first quadrant.

30 Find the maximum value of the objective function

$Z = 5x + 10y$

subject to the constraints

$x + 2y \leq 120$, $x + y \geq 60$, $x - 2y \geq 0$, $x \geq 0$, $y \geq 0$.

31 In answering a question on a multiple choice test, a student either knows the answer or guesses. Let $\frac{3}{4}$ be the probability that he knows the answer and $\frac{1}{4}$ be the probability that he guesses. Assuming that a student who guesses at the answer will be correct with probability $\frac{1}{4}$ What is the probability that the student knows the answer given that he answered it correctly?

Section-D (4X5=20)

32(a) Find the subsets of the set of real numbers in which the following function is (a) increasing (b)decreasing , $f(x) = x^4 - 8x^3 + 22x^2 - 24x + 21$.

32(b) **Or** Find the ratio of the volume of the largest cone that can be inscribed in sphere of radius R and the volume of the sphere.

33 Find the area of the triangular region whose sides are y=2x+1 ,y =3x +1 , x=4 .

34(a) If $\vec{a} + \vec{b} + \vec{c} = \vec{0}$ and $|\vec{a}| = 3$, $|\vec{b}| = 5$ and $|\vec{c}| = 7$, then find the angle between $\vec{a}$ and $\vec{b}$.

34(b) **Or** Find the foot of perpendicular from the point (3, -1, -11) to line $\frac{x}{2} = \frac{y-2}{3} = \frac{z-3}{4}$.

35) Let N be the set of all natural numbers and R be a relation on NxN defined by (a,b)R(c,d) if and only if ad= bc for all (a,b), (c,d) in NxN. Show that R is an equivalence relation on NxN. Also, find a pair which is related to (2,6) .

Section-E (3X4=12)

36) A helicopter moves on a path in such a way that at any point (x,y) of the path the derivative of ordinate w. r.t. abscissa is twice the slope of the line – segment joining the point of contact to the point $(-4,-3)$.

(i) Write The differential equation according to the given condition.

(ii) Find the solution of the differential equation.

(iii) If the helicopter passes through the point $(-2, 1)$, then find the equation of the path.

37) Three car dealers, say A, B and C, deals in three types of cars, namely Hatchback cars, Sedan cars, and SUV cars. The sales figure for 2019 and 2020 showed that dealer A sold 120 Hatchback, 50 Sedan, and 10 SUV cars in 2019 and 300 Hatchback, 150 Sedan, and 20 SUV cars in 2020; dealer B sold 100 Hatchback, 30 Sedan, and 5 SUV cars in 2019 and 200 Hatchback, 50 Sedan, 6 SUV cars in 2020; dealer C sold 90 Hatchback, 40 Sedan, 2 SUV cars in 2019 and 100 Hatchback, 60 Sedan,5 SUV cars in 2020.

Based on the above information, answer the following questions.

(i) The matrix summarizing sales data for 2019 is

(a) $\begin{bmatrix} 120 & 50 & 10 \\ 100 & 30 & 5 \\ 90 & 40 & 2 \end{bmatrix}$ (b) $\begin{bmatrix} 120 & 50 & 15 \\ 100 & 30 & 5 \\ 95 & 40 & 2 \end{bmatrix}$

(c) $\begin{bmatrix} 300 & 150 & 20 \\ 200 & 50 & 6 \\ 100 & 60 & 5 \end{bmatrix}$ (d)) $\begin{bmatrix} 120 & 50 & 10 \\ 200 & 50 & 6 \\ 90 & 40 & 2 \end{bmatrix}$

(ii) Suppose dealer A sells two types of Hatchback cars Indica and Alto in 2019 and showroom price for Indica and Alto are Rs 600000 and 500000 respectively. If one-third of dealer A's 2019 profit of Rs 60000000 is from Hatchback, express this in matrix form.

(iii) Calculate the increase in sales of Hatchback cars by A from 2019 to 2020 if it sells 100 Indica and 200 Alto in 2020.

Or Calculate the sales of Sedan and SUV cars by A in 2019 .

38) Rubiya, Thaksh, Shanteri, and Lilly entered a spinning zone for a fun game, but there is a twist: they don't know which spinner will appear on their screens until it is their turn to play. They may encounter one of the following spinners, or perhaps even both. Spinners have numbers 1 to 9 on those: Different combinations of numbers will lead to exciting prizes. Below are some of the rewards they can win:

- Get the number '5', from Spinner A and '8' from Spinner B, and you'll win a music player!
- You win a photo frame if Spinner A lands on a value greater than 4.
- You win an earplug if you get even in spinner A or odd in spinner B.

i)Thaksh spun both the spinners, A and B in one of his turns. What is the probability that Thaksh wins a music player in that turn?

ii) Lilly spun spinner A in one of her turns. What is the probability that the number she got is even given that it is a multiple of 3?

iii) Rubiya spun both the spinners. What is the probability that she wins a photo frame only?

Or

As Shanteri steps up to the screen, the game administrator reveals that she would see either Spinner A or Spinner B for her turn, the probability of seeing Spinner A on the screen is 65%, while that of Spinner B is 35%. What is the probability that Shanteri wins an earplug?

KENDRIYA VIDYALAYA SANGATHAN

SAMPLE PAPER 3

MARKING SCHEME

CLASS – XII **SUB : MATHEMATICS (041)**

Section-A(20x1=20)		
	MCQ ANSWERS **1) (d) 2)(a) 3) (d) 4) (b) 5) (a) 6) (c)7)(b) 8) (c) 9) (a) 10) (c)** **11) (a)12) (c) 13) (a) 14)(b) 15)(a) 16) (d) 17) (d) 18)(c) 19(a) 20 (a)**	
21	$\frac{\cos x}{1-\sin x}=\frac{\cos\frac{x}{2}+\sin\frac{x}{2}}{\cos\frac{x}{2}-\sin\frac{x}{2}}=\frac{1+\tan\frac{x}{2}}{1-\tan\frac{x}{2}}=\tan\left(\frac{\pi}{4}-\frac{x}{2}\right)$ Therefore $\tan^{-1}\left(\frac{\cos x}{1-\sin x}\right)=\frac{\pi}{4}-\frac{x}{2}$	
22	critical points are $\frac{1}{\sqrt{3}}, -\frac{1}{\sqrt{3}}$. **Or** At x =1 , LHD = -1, RHD =1 So not differentiable at x=1	
23	(a) $\frac{x^3}{3}\tan^{-1}x - \frac{x^2}{6} + \frac{1}{6}\log(x^2+1)+C$ Or (b) $\frac{\cos^3 x}{3}+\frac{\cos^5 x}{5}+C$	
24)	the line has direction ratios 1,2,3 & d.c. of the line: $\frac{1}{\sqrt{14}},\frac{2}{\sqrt{14}},\frac{3}{\sqrt{14}}$.	
25)	Equation of line is $\vec{r}=\hat{i}+2\hat{j}+3\hat{k}+\lambda(-4\hat{i}+2\hat{j})$ and of Z-axis is $\vec{r}=\hat{k}$	
26	(a) $\frac{dy}{dx}=x^{\sin x}\left(\cos x \log x+\frac{\sin x}{x}\right)$. Or (b) $-\frac{1}{y}=\frac{1}{2x^2}+C$	
27)	(a) f is increasing in (-∞ ,-3)∪ (-1,∞) & f is decreasing in (-3,-1). Or (b) The cost of least expensive tank =Rs 70 x 4+45(8+8)=Rs 1000.	
28)	$\frac{\sqrt{2}}{3}\tan^{-1}x+\frac{1}{6}\log\frac{x+1}{x-1}+C$.	
29	(a) $\frac{1}{\sqrt{2}}\log(2+\sqrt{2})$. Or (b) $4(4-\sqrt{2})$ sq unit	

30)	Z has a maximum value 600 at x=60,y=30 and at x=0,y=60 [at all points of AB].	
31)	$\frac{12}{13}$	
32)	(a) So f is Increasing in the subset (1,2)U (3,∞) and f is decreasing in the subset (−∞,1)U(2,3). **Or** (b) $\frac{1}{2\sqrt{2}}$	
33)	Required area=$\int_0^4(3x+1)dx$ -$\int_0^4(2x+1)dx$=8 sq unit	
34	(a) the angle between $\vec{a}$ and $\vec{b}$ =$\frac{\pi}{3}$ Or (b) foot of the perpendicular $(-\frac{118}{29},-\frac{119}{29},-\frac{149}{29})$	
35)	A pair which is related to (2,6) is (3,9).	
36)	(i) $\frac{dy}{dx}$=2y+3x+4 (ii) y+3=C (x+4) (iii) y=2x+5.	
37)	(i) (a) (ii) The matrix form of AX=B where A=$\begin{bmatrix}1 & 1\\6 & 5\end{bmatrix}$, X=$\begin{bmatrix}x\\y\end{bmatrix}$ and B= $\begin{bmatrix}120\\200\end{bmatrix}$. (ii) 140000000. **Or** The sales of Sedan and SUV cars by A Rs 40000000	
38)	(i) $\frac{1}{81}$ (ii) $\frac{1}{9}$ (iii) $\frac{5}{9}$ or $\frac{107}{180}$	

KENDRIYA VIDYALAYA SANGATHAN

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Sample Paper 4

Class-XII **Subject-Mathematics (041)**

UNITS	NAME OF THE CHAPTERS	SECTION - A (Objective Type) (1 Mark each)		SECTION - B (VSA) (2 MARKS EACH)	SECTION - C (SA) (3 MARKS EACH)	SECTION - D (LA) (5 MARKS EACH)	SECTION - E (CBQ) (4 MARKS EACH)	TOTAL
		MCQ	ARQ					
UNIT-I (RELATIONS AND FUNCTIONS)	RELATIONS AND FUNCTIONS		1(1)			5(1)		8(3)
	INVERSE TRIGONOMETRIC FUNCTIONS			2(1)				
UNIT-II (ALGEBRA)	MATRICES	4(4)				5(1)		10(6)
	DETERMINANTS	1(1)						
UNIT-III (CALCULUS)	CONTINUITY AND DIFFERENTIABILITY	2(2)		2(1)	3(1)			35(16)
	APPLICATION OF DERIVATIVES		1(1)		3(1)		4(1)	
	INTEGRALS	2(2)		2(1)	3(1)	5(1)		
	APPLICATION OF INTEGRALS				3(1)			
	DIFFERENTIAL EQUATIONS	2(2)			3(1)			
UNIT-IV (VECTORS AND 3D)	VECTORS	1(1)		2(1)			4(1)	14(6)
	THREE-DIMENSIONAL GEOMETRY	2(2)				5(1)		
UNIT-V (LPP)	LPP	2(2)			3(1)			5(3)
UNIT-VI (PROBABILITY)	PROBABILITY	2(2)		2(1)			4(1)	8(4)
TOTAL		18(18)	2(2)	10(5)	18(6)	20(4)	12(3)	80(38)

KENDRIYA VIDYALAYA SANGATHAN

EXCELLENCE SERIES SAMPLE QUESTION PAPER 4

CLASS – XII **MAX.MARKS – 80**

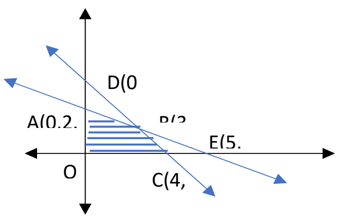
SUB. – MATHEMATICS (Code – 041) **TIME – 03 HOURS**

General Instructions:

1. This question paper contains 38 questions divided into three sections- A, B, C & D
2. All questions are compulsory.
3. Section - A contains **20 very short answer type (VSA)** of 1 mark each.
4. Section - B contains **5 short answer type (SA-I)** questions of 2 marks each.
5. Section - C contains **6 short answer type (SA-II)** of 3 marks each.
6. Section -D contains **4 long answer type questions (LA)** of 5 marks each.
7. Section -E contains **3 case based questions (CBQ)** of 4 marks each.

SECTION-A

1	If $A = [a_{ij}]$ is an identity matrix, then which of the following is true? (A) $a_{ij} = \begin{cases} 0, \text{if } i = j \\ 1, \text{if } i \neq j \end{cases}$ (B) $a_{ij} = 1, \forall i, j$ (C) $a_{ij} = 0, \forall i, j$ (D) $a_{ij} = \begin{cases} 0, \text{if } i \neq j \\ 1, \text{if } i = j \end{cases}$	1
2	If $A = \begin{bmatrix} 2 & 0 & 0 \\ 0 & 3 & 0 \\ 0 & 0 & 5 \end{bmatrix}$, then A^{-1} is : (A) $\begin{bmatrix} \frac{1}{2} & 0 & 0 \\ 0 & \frac{1}{3} & 0 \\ 0 & 0 & \frac{1}{5} \end{bmatrix}$ (B) $30 \begin{bmatrix} \frac{1}{2} & 0 & 0 \\ 0 & \frac{1}{3} & 0 \\ 0 & 0 & \frac{1}{5} \end{bmatrix}$ (C) $\frac{1}{30} \begin{bmatrix} 2 & 0 & 0 \\ 0 & 3 & 0 \\ 0 & 0 & 5 \end{bmatrix}$ (D) $\frac{1}{30} \begin{bmatrix} \frac{1}{2} & 0 & 0 \\ 0 & \frac{1}{3} & 0 \\ 0 & 0 & \frac{1}{5} \end{bmatrix}$	1
3	For any square matrix A, $(A - A^t)^t$ is always : (A)An identity matrix (B)A null matrix (C)A skew symmetric matrix (D) A symmetric matrix	1
4	If $A.(\text{adj } A) = \begin{bmatrix} 3 & 0 & 0 \\ 0 & 3 & 0 \\ 0 & 0 & 3 \end{bmatrix}$, then the value of $\lvert A \rvert + \lvert \text{adj } A \rvert$ is equal to : (A)12 (B)9 (C) 3 (D)27	1
5	Let, A be the area of a triangle having vertices $(x_1, y_1), (x_2, y_2)$ and (x_3, y_3). Which of the following is correct? (A) $\begin{vmatrix} x_1 & y_1 & 1 \\ x_2 & y_2 & 1 \\ x_3 & y_3 & 1 \end{vmatrix} = \pm A$ (B) $\begin{vmatrix} x_1 & y_1 & 1 \\ x_2 & y_2 & 1 \\ x_3 & y_3 & 1 \end{vmatrix} = \pm 2A$	1

<table>
<tr><td></td><td>(C) $\begin{vmatrix} x_1 & y_1 & 1 \\ x_2 & y_2 & 1 \\ x_3 & y_3 & 1 \end{vmatrix} = \pm\frac{A}{2}$ (D) $\begin{vmatrix} x_1 & y_1 & 1 \\ x_2 & y_2 & 1 \\ x_3 & y_3 & 1 \end{vmatrix}^2 = A^2$</td><td></td></tr>
<tr><td>6</td><td>The value of k for which the function $f(x) = \begin{cases} x^2, x \geq 0 \\ kx, x < 0 \end{cases}$ is differentiable at $x = 0$
is : (A)1 (B)2 (C)Any real number (D)0</td><td>1</td></tr>
<tr><td>7</td><td>If $y = \frac{\cos x - \sin x}{\cos x + \sin x}$, then $\frac{dy}{dx}$ is :
(A) $-\sec^2\left(\frac{\pi}{4} - x\right)$ (B)$\sec^2\left(\frac{\pi}{4} - x\right)$ (C)$\ln\left|\sec\left(\frac{\pi}{4} - x\right)\right|$ (D)$-\ln\left|\sec\left(\frac{\pi}{4} - x\right)\right|$</td><td>1</td></tr>
<tr><td>8</td><td>$\int 2^{x+2}dx$ is equal to :
(A)$2^{x+2} + c$ (B)$2^{x+2}\ln 2 + c$ (C)$\frac{2^{x+2}}{\ln 2} + c$ (D)$2.\frac{2^x}{\ln 2} + c$</td><td>1</td></tr>
<tr><td>9</td><td>$\int_0^2 \sqrt{4 - x^2}\,dx$ equals :
(A)$2\ln 2$ (B)$-2\ln 2$ (C)$\frac{\pi}{2}$ (D)π</td><td>1</td></tr>
<tr><td>10</td><td>What is the product of the order and degree of the differential equation
$\frac{d^2y}{dx^2}\sin y + \left(\frac{dy}{dx}\right)^3 \cos y = \sqrt{y}$?
(A)3 (B) 2 (C)6 (D)Not defined</td><td>1</td></tr>
<tr><td>11</td><td>$x\ln x\frac{dy}{dx} + y = 2\ln x$ is an example of a :
(A)Variable separable diff equation. (B) Homogeneous diff l equation.
(C)First order linear diff equation. (D) Diff equation whose degree is not defined.</td><td>1</td></tr>
<tr><td>12</td><td>Besides non negativity constraints, the figure given below is subject to which of the following constraints


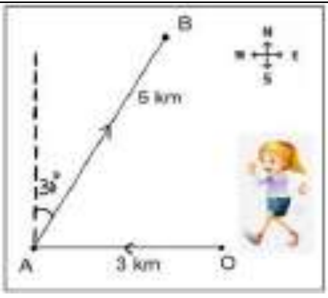
(A)$x + 2y \leq 5 ; x + y \leq 4$ (B)$x + 2y \geq 5 ; x + y \leq 4$
(C)$x + 2y \geq 5 ; x + y \geq 4$ (D)$x + 2y \leq 5 ; x + y \geq 4$</td><td>1</td></tr>
<tr><td>13</td><td>In ΔABC, $\overrightarrow{AB} = \hat{i} + \hat{j} + 2\hat{k}$ and $\overrightarrow{AC} = 3\hat{i} - \hat{j} + 4\hat{k}$. If D is the mid-point of BC, then $\overrightarrow{AD}$ is equal to :
(A)$4\hat{i} + 6\hat{j}$ (B)$2\hat{i} - 2\hat{j} + 2\hat{k}$ (C)$\hat{i} - \hat{j} + \hat{k}$ (D)$2\hat{i} + 3\hat{k}$</td><td>1</td></tr>
<tr><td>14</td><td>If the point $P(a, b, 0)$ lies on the line $\frac{x+1}{2} = \frac{y+2}{3} = \frac{z+3}{4}$, then (a, b) is :</td><td>1</td></tr>
</table>

	(A) $(1, 2)$ (B) $\left(\frac{1}{2}, \frac{2}{3}\right)$ (C) $\left(\frac{1}{2}, \frac{1}{4}\right)$ (D) $(0, 0)$	
15	If α, β and γ are the angles which a line makes with positive directions of x, y and z axes respectively, then which of the following is not true? (A) $\cos^2\alpha + \cos^2\beta + \cos^2\gamma = 1$ (B) $\sin^2\alpha + \sin^2\beta + \sin^2\gamma = 2$ (C) $\cos 2\alpha + \cos 2\beta + \cos 2\gamma = -1$ (D) $\cos\alpha + \cos\beta + \cos\gamma = 1$	1
16	The restrictions imposed on decision variables involved in an objective function of a linear programming problem are called : (A) Feasible solutions (B) Constraints (C) Optimal solutions (D) Infeasible solutions	1
17	If $P(A \cap B) = \frac{1}{8}$ and $P(A') = \frac{3}{4}$, then $P\left(\frac{B}{A}\right)$ is equal to : (A) $\frac{1}{2}$ (B) $\frac{1}{3}$ (C) $\frac{1}{6}$ (D) $\frac{2}{3}$	1
18	If A and B are independent events, then which of the following is not true? (A) A' and B are independent events. (B) A and B' are independent events. (C) A' and B' are independent events. (D) None of these	1
	Question number 19 and 20 are Assertion and Reason based question. Two statements are given, one labelled Assertion (A) and the other labelled Reason (R). Select the correct answers from the codes A, B C and D as given below. 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 and R is false. D. A is false and R is true.	
19	Assertion(A): The relation $R = \{(1, 2)\}$ on the set $A = \{1, 2, 3\}$ is transitive. Reasoning (R): A relation R on a non-empty set A is said to be transitive if $(a, b), (b, c) \in R \Rightarrow (a, c) \in R$, for all $a, b, c \in A$.	1
20	Assertion(A): The function $f(x) = (x + 2)e^{-x}$ is strictly increasing on $(-1, \infty)$. Reasoning (R): A function $f(x)$ is strictly increasing if $f'(x) > 0$.	1
	SECTION-B	
21	Find the principal value of $\cos^{-1}\left(\cos\frac{13\pi}{6}\right)$. **OR** Find the value of $\tan^{-1}(\sqrt{3}) - \sec^{-1}(-2)$.	2
22	If $x = a\tan^3\theta$ and $y = a\sec^3\theta$, then find $\frac{d^2y}{dx^2}$ at $\theta = \frac{\pi}{3}$. .	2

23	Evaluate : $\int \frac{\sec^2 x}{\sqrt{\tan^2 x + 4}} dx$ **OR** Evaluate $\int \sqrt{1 - \sin 2x}\ dx, \frac{\pi}{4} < x < \frac{\pi}{2}$.	2
24	If $\|\vec{a}\| = 2, \|\vec{b}\| = 7$ and $\vec{a} \times \vec{b} = -3\hat{\imath} + \hat{\jmath} + 2\hat{k}$, find the angle between $\vec{a}$ and $\vec{b}$.	2
25	Let X be a random variable which assumes values x_1, x_2, x_3, x_4 such that $2P(X = x_1) = 3P(X = x_2) = P(X = x_3) = 5P(X = x_4)$. Find the probability distribution of X. **OR** A die, whose faces are marked 1, 2, 3 in red and 4, 5, 6 in green is tossed. Let, A be the event “number obtained is even” and B be the event “number is marked red”. Find whether the events A and B are independent or not.	2
	SECTION-C	
26	If $(\cos y)^x = (\sin x)^y$, then find $\frac{dy}{dx}$.	3
27	Find the intervals in which the function f(x) = $3x^4 - 4x^3 - 12x^2 + 5$ is (I) strictly increasing (II) strictly decreasing	3
28	Evaluate : $\int_0^{\frac{\pi}{4}} \frac{\sin x + \cos x}{16 + 9 \sin 2x} dx$ **OR** Prove that $\int_0^a f(x)\, dx = \int_0^a f(a - x)\, dx$, and hence evaluate $\int_0^1 x^2(1 - x)^n\, dx$.	3
29	Find the area of the region $\{(x, y): y \geq x^2, y \leq \|x\|\}$ **OR** If the area bounded by the parabola $y^2 = 16ax$ and the line $y = 4mx$ is $\frac{a^2}{12}$ sq. units, then using integration, find the value of m.	3
30	Find the particular solution of the differential equation $\frac{dy}{dx} = 1 + x^2 + y^2 + x^2y^2$, given that $y = 0$ when $x = 1$. **OR** Find the particular solution of the differential equation $x\frac{dy}{dx} \sin\left(\frac{y}{x}\right) + x - y\sin\left(\frac{y}{x}\right) = 0$, given that $y(1) = \frac{\pi}{2}$.	3
31	Solve the above L. P. P graphically : Maximize $Z = 3x + 9y$ Subject to constraints $x + 3y \leq 60$, $x + y \geq 10$, $x \leq y$ $x, y \geq 0$	3

SECTION-D		
32	Let $\mathbb{N}$ be the set of natural numbers and R be the relation on $\mathbb{N} \times \mathbb{N}$ defined by $(a, b)\ R\ (c, d)$ iff $ad = bc$ for all $a, b, c, d \in \mathbb{N}$. Show that R is an equivalence relation. **OR** Show that the function $f: \mathbb{N} \to \mathbb{N}$ defined by $f(x) = x^2 + x + 1$ is one-one but not onto.	5
33	If $A = \begin{pmatrix} 1 & 1 & 1 \\ 0 & 1 & 3 \\ 1 & -2 & 1 \end{pmatrix}$, then find A^{-1} and hence solve the system of system of linear equations: $x + y + z = 6,\ \ y + 3z = 7\ \text{ and }\ x - 2y + z = 0.$	5
34	Evaluate: $\int_1^4 [\lvert x-1\rvert + \lvert x-2\rvert + \lvert x-3\rvert]\, dx$	5
35	Find the co-ordinates of the foot of the perpendicular drawn from the point $A(-1, 8, 4)$ to the line joining points $B(0, -1, 3)$ and $C(2, -3, -1)$. Hence find the image of the point A in the line BC.	5
SECTION-E		
36	Read the following passage and answer the questions given below: In an Office three employees Jayant, Sonia and Olivia process a calculation in an excel form. Probability that Jayant, Sonia, Olivia process the calculation respectively is 50%, 20% and 30% . Jayant has a probability of making a mistake as 0.06, Sonia has probability 0.04 to make a mistake and Olivia has a probability 0.03. Based on the above information, answer the following questions. I. Find the probability that Sonia processed the calculation and committed a mistake. II. Find the total probability of committing a mistake in processing the calculation. III. The boss wants to do a good check. During check, he selects a calculation form at random from all the days. If the form selected at random has a mistake, find the probability that the form is not processed by Jayant.	 1 1 2
37	A girl walks 3 km towards west to reach point A and then walks 5 km in a direction 30° east of north and stops at point B. Let the girl starts from O (origin) and take $\hat{\imath}$ along east and $\hat{\jmath}$ along north.	

Based on the above information, answer the following questions.



(I) Find the scalar components of $\overrightarrow{AB}$. 1

(II) Find the unit vector along $\overrightarrow{AB}$. 1

(III)Find the position vector of point B. 2

38 In order to set up a rain water harvesting system, a tank to collect rain water is to be dug. The tank should have a square base and a capacity of 250 cubic m. The cost of land is Rs 5000 per sq m and cost of digging increase with depth and for the whole tank it is 40,000 h^2 , where h is the depth of the tank in metres. x is the side of the square base of the tank in metres.

Based on the above information answer the following questions:

I. Find the total cost C of digging the tank in terms of x. 1

II. Find $\frac{dC}{dx}$. 1

III. Find the value of x for which cost C is minimum 2

OR

Check whether the cost function C(x) expressed in terms of x increasing or not, where x >0.

KENDRIYA VIDYALAYA SANGATHAN

SAMPLE QUESTION PAPER 4

CLASS – XII **MAX.MARKS – 80**

SUB. – MATHEMATICS (Code – 041) **TIME – 03 HOURS**

MARKING SCHEME

1-20	**1)(D) 2)(A) 3)(C) 4)(A) 5)(B) 6)(D) 7)(A) 8)(C) 9)(D) 10)(B)** **11)(C) 12)(A)13)(D) 14)(C) 15)(D) 16)(B) 17)(A 18)(D) 19)(A) 20)(D)**	
21	$\frac{\pi}{6}$ **OR** $-\frac{\pi}{3}$	
22	(-1)/(54 a)	
23	$\log\left\|\tan x + \sqrt{\tan^2 x + 4}\right\| + c$ **OR** $-\cos x - \sin x + c$	
24	$\sin^{-1}\left(\pm\frac{1}{\sqrt{14}}\right)$	
25	X: x_1, x_2, x_3, x_4; P(X): $\frac{30}{122}$, $\frac{30}{183}$, $\frac{30}{61}$, $\frac{30}{305}$ **OR** $P(A) = \frac{1}{2}, P(B) = \frac{1}{2}, P(A \cap B) = \frac{1}{6}$ So $P(A \cap B) \neq P(A).P(B)$ so dependent	
26	$\frac{dy}{dx} = \frac{\log\cos y - y\cot x}{\log\sin x + x\tan y}$	
27	f(x) is strictly decreasing in $(-\infty, -1) \cup (0,2)$ f(x) is strictly increasing in $(-1,0) \cup (2, \infty)$	
28	$\frac{1}{30}\log 4$ **OR** $\left[\frac{1}{n+1} - \frac{2}{n+2} + \frac{1}{n+3}\right]$	
29	$y = \frac{1}{3}$ sq. units **OR** $m = 2$	

30	$\tan^{-1} y = x + \frac{x^3}{3} - \frac{4}{3}$ **OR** the complete sol^{n} is : $\cos\left(\frac{y}{x}\right) = \log\lvert x\rvert$	
31	Maximum value of Z is 180 and which is at any point on the line segment joining B and C.	
SECTION-D		
32	R is Reflexive , symmetric and transitive and so equivalence on $\mathbb{N} \times \mathbb{N}$: **OR** f is one-one but f is not onto	
33	$\therefore A^{-1} = \frac{adjA}{\lvert A\rvert} = \frac{1}{9}\begin{bmatrix} 7 & -3 & 2 \\ 3 & 0 & -3 \\ -1 & 3 & 1 \end{bmatrix}$ and $x = \frac{7}{3}, y = 2, z = \frac{5}{3}$	
34	$\int_1^4 [\lvert x-1\rvert + \lvert x-2\rvert + \lvert x-3\rvert]\, dx = \int_1^4 \lvert x-1\rvert\, dx + \int_1^4 \lvert x-2\rvert\, dx + \int_1^4 \lvert x-3\rvert\, dx$ $= 4.5 + 2.5 + 2.5 = 9.5$	
35	Coordinates of foot of perpendicular is (- 2, 1, 7) and image is (-3,-6,10).	
SECTION-E		
36	(i) $\frac{8}{47}$ (ii) 0.047 (iii) $\frac{17}{47}$	
37	(i) So, scalar components of $\overrightarrow{AB}$ are 2.5, $2.5\sqrt{3}$. (ii) Unit vector along $\overrightarrow{AB} = \frac{1}{2}\left(\hat{\imath} + \sqrt{3}\hat{\jmath}\right)$. $(iii)\overrightarrow{OB} = -\frac{1}{2}\hat{\imath} + \frac{5\sqrt{3}}{2}\hat{\jmath}$.	
38	(i) C = $5000\, x^2 + 2500000000/x^4$ (ii) $\frac{dC}{dx}$= $10000x - 10000000000/x^5$ (iii)(a)For C to be minimum , $\frac{dC}{dx}$=0 ⇒$10000x - 10000000000/x^5=0$ ⇒ x = 10 OR (b) $\frac{dC}{dx}$ = $10000x - 100000\ 00000/x^5$ Which is <0 for 0<x<10. So, the cost function C(x) is not increasing where 0<x<10	

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Sample Paper 5

Class-XII **Subject-Mathematics (041)**

Chapters	MCQ	Assertion/ Reasoning	2 Marks	3 Marks	5 Marks	Case Based	Total
1. Relation & Function & I.T. Functions	1	-	1	-	1	-	8(3)
2. Matrices and Determinants	5	-	-	-	1	-	10(6)
3. Calculus	5	1	2	4	1	2	35(15)
4. 3-D Geometry	1	1	1	-	1	-	9(4)
Vector Algebra	3	-	1	-	-	-	5(4)
5. L.P.P.	2	-	-	1	-	-	5(3)
6. Probability	1	-	-	1	-	1	8(3)
Total	**18**	**2**	**5**	**6**	**4**	**3**	**80(38)**

KENDRIYA VIDYALAYA SANGATHAN

SAMPLE QUESTION PAPER 5

CLASS – XII **MAX.MARKS – 80**

SUB. – MATHEMATICS (Code – 041) **TIME – 03 HOURS**

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** 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.

	Section-A **(Multiple Choice Questions)** **Each question carries 1 mark**
1	If A, B are symmetric matrices of some order, then AB-BA is a (a) Skew symmetric matrix (b) Symmetric matrix (c) Zero matrix (d) Identity matrix
2	If $\begin{bmatrix} xy & 4 \\ z+6 & x+y \end{bmatrix} = \begin{bmatrix} 8 & w \\ 0 & 6 \end{bmatrix}$, then the value of (x+y+z) is (a) 6 (b) -6 (c) 0 (d) can't be determined
3	If for matrix A=$\begin{bmatrix} \propto & -2 \\ -2 & \propto \end{bmatrix}$,$\|A^3\|$=125, then the value of $\propto$ is: (a)± 3 (b) -3 (c) ± 1 (d) 1
4	The interval in which $y = -x^3 + 3x^2 + 2021$ is increasing in: (a) (-∞, ∞) (b) (0,2) (c) (2,∞) (d) (-2,∞)
5	Let R be a relation in the set N given by R={(a,b): a=b-2,b>6} then (a) (2,4)∈R (b) (3,8)∈R (c) (6,8)∈R (d) (8,7)∈R
6	The order and degree of the differential equation- $\left[1 + \left(\frac{dy}{dx}\right)^2\right]^{\frac{3}{2}} = \frac{d^2y}{dy^2}$ is (a) 2,1 (b)1,2 (c) 2,Not defined (d) 2,2
7	If the objective function Z=ax+y is minimum at (1,4) and its minimum value is 13, then value is 13, then value of a is: (a) 1 (b) 9 (c) 4 (d)13
8	If $\cos\alpha, \cos\beta, \cos\gamma$ are the direction cosines of the vector $\vec{a}$ then $\cos 2\alpha + \cos 2\beta + \cos 2\gamma$ is equal to: (a) 3 (b) 0 (c) 2 (d) -1

9	The value of $\int \left(x^2 - \frac{1}{x^2}\right)^2 dx$ is: (a) $\frac{x^5}{5}+\frac{1}{3x^3} + 2x + C$ (b) $\frac{x^5}{5} - \frac{1}{3x^3} - x + C$ (c) $\frac{x^5}{5} - \frac{1}{3x^3} - 2x + C$ (d) $\frac{x^5}{5} - \frac{1}{x^3} - 2x + C$
10	For what value of K, the matrix $\begin{bmatrix} 2-K & 3 \\ -5 & 1 \end{bmatrix}$ is not invertible (a) 17 (b) 2 (c) 13 (d) None of these
11	In a linear programming problem, the constraints on the decision variables x and y are x-3y≥0, y≥0, 0≤x≤3, the feasible region: (a) Is not in the first quadrant, (b) is bounded in the first quadrant, (c) is unbounded in the first quadrant (d) does not exists
12	The position vector of the point which divides the join of points $2\vec{a}$-$3\vec{b}$ and $\vec{a} + \vec{b}$ in the ratio 3:1 internally is: (a) $\frac{5\vec{a}}{4}$ (b) $\frac{3\vec{a}-2\vec{b}}{2}$ (c) $\frac{7\vec{a}-8\vec{b}}{2}$ (d) $\frac{3\vec{a}}{4}$
13	For A=$\begin{bmatrix} 3 & 1 \\ -1 & 2 \end{bmatrix}$ then $14A^{-1}$ is given by: (a) $14\begin{bmatrix} 2 & -1 \\ 1 & 3 \end{bmatrix}$ (b) $2\begin{bmatrix} 2 & -1 \\ 1 & -3 \end{bmatrix}$ (c) $2\begin{bmatrix} -3 & -1 \\ 1 & -2 \end{bmatrix}$ (d) $\begin{bmatrix} 4 & -2 \\ 2 & 6 \end{bmatrix}$
14	If A and B are two events such that P(A)=$\frac{1}{2}$, P(B)=$\frac{1}{3}$ and P(A/B)=$\frac{1}{4}$ then P(A'∩B') equals (a) $\frac{1}{12}$ (b) $\frac{3}{4}$ (c) $\frac{1}{4}$ (d) $\frac{3}{16}$
15	The integrity factor of the differential equation: $x\frac{dy}{dx} - y = 2x^2$ is (a) e^{-x} (b) $\frac{1}{x}$ (c) x (d) None of these
16	The angle between the lines 2x=3y=-z and 6x=-y=-4z is: (a) 0° (b) 45° (c) 90° (d) 30°
17	The maximum value of the function f(x)=4.$\sin x \cos x$ is: (a) 2 (b) 4 (c) 1 (d) 8
18	The value of x if x($\hat{\imath} + \hat{\jmath} + \hat{k}$) is a unit vector, is: (a) $\pm\sqrt{3}$ (b) $\pm\frac{1}{\sqrt{3}}$ (c)$\pm\frac{1}{3}$ (d) ± 3
	ASSERTION REASON BASED QUESTIONS The following questions 19 and 20 consist of two statements-Assertion(A) and Reason (R). Answer the questions selecting the appropriate option given below: (a) Both A and R are true, and R is the correct explanation for A. (b) Both A and R are true, and R is not the correct explanation for A. (c) A is true but R is false. (d) A is false but R is true.
19	Assertion(A): The acute angle between the lines $\vec{r} = \hat{\imath} + \hat{\jmath} + 2\hat{k} + \lambda(\hat{\imath} - \hat{\jmath})$ and the x-axis is π/4. Reason(R): The acute angle θ between the lines $\vec{r} = x_1\hat{\imath} + y_1\hat{\jmath} + z_1\hat{k} + \lambda(a_1\hat{\imath} + b_1\hat{\jmath} + c_1\hat{k})$ and $\vec{r} = x_2\hat{\imath} + y_2\hat{\jmath} + z_2\hat{k} + \mu(a_2\hat{\imath} + b_2\hat{\jmath} + c_2\hat{k})$ is given by

	$\cos\theta = \frac{\lvert a_1a_2+b_1b_2+c_1c_2\rvert}{\sqrt{a_1^2+b_1^2+c_1^2}\sqrt{a_2^2+b_2^2+c_2^2}}$
20	Assertion(A): If $y = \sin^{-1}(6x\sqrt{1-9x^2})$ then $\frac{dy}{dx} = \frac{6}{\sqrt{1-9x^2}}$ Reason(R): $\sin^{-1}(6x\sqrt{1-9x^2})$=3$\sin^{-1}(2x)$
	Section-B **Each question carries 2 marks each**
21	Find the value of $\tan^{-1}(\frac{-1}{\sqrt{3}}) + \cot^{-1}(\frac{1}{\sqrt{3}}) + \tan^{-1}\left[\sin\left(\frac{-\pi}{2}\right)\right]$ **Or,** Find the value of $\tan^{-1}\left(\tan\frac{5\pi}{6}\right) + \cos^{-1}\left(\cos\frac{13\pi}{6}\right)$
22	The side of an equilateral triangle is increasing at the rate of 30 cm/s. At what rate is its area increasing when the side of the triangle is 30 cm? **Or,** A stone is dropped into a quiet lake and waves move in a circle at a speed of 3.5 cm/sec. At the instant when the radius of the circular wave is 7.5 cm, how fast is the enclosed area increasing?
23	Let $\vec{a}, \vec{b}\ and\ \vec{c}$ be three vectors such that $\lvert\vec{a}\rvert = 3, \lvert\vec{b}\rvert = 4, \lvert\vec{c}\rvert = 5$ and each one of them being perpendicular to the sum of the other two, find $\lvert\vec{a}+\vec{b}+\vec{c}\rvert$
24	Find the area enclosed by the ellipse $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$
25	Find the shortest distance between the lines- $\frac{x+1}{7} = \frac{y+1}{-6} = \frac{z+1}{1}\ and\ \frac{x-3}{1} = \frac{y-5}{-2} = \frac{z-7}{1}$
	Section-C **This section comprises of short answer type questions (SA) of 3 marks each**
26	Solve the following linear programming problem graphically minimize z=3x+5y Subject to constraints- x+3y≥ 3, x+y≥2, x≥0, y≥0
27	Two cards are drawn successively with replacement from a well shuffled deck of 52 cards. Find the probability distribution of the number of aces. **Or,** The probabilities of two students A and B coming to the school in time are 3/7 and 5/7 respectively. Assuming that the events 'A coming in time' and 'B coming in time' are independent, find the probability of only one of them coming to the school in time.
28	Find $\int x\sin^{-1}x\,dx$ **Or,** Find $\int \frac{(x^2+1)(x^2+2)}{(x^2+3)(x^2+4)}dx$
29	Solve the differential equation: $(x^2+xy)\,dy - (x^2+y^2)\,dx = 0$ **Or**, Solve the differential equation: $(1+x^2)\,dy + 2xy\,dx = \cot x\,dx \quad (x \neq 0)$
30	Draw a rough sketch of the curve 4y-2=x and x^2=4y and find the area bounded by these two using integration.
31	If$x = a(\theta + \sin\theta), y = a(1-\cos\theta)$ then find $\frac{d^2y}{dx^2}$ at $\theta = \pi/2$
	Section-D **This section comprises of long answer type questions (LA) of 5 marks each**

32	Determine the product of $\begin{bmatrix}-4 & 4 & 4\\-7 & 1 & 3\\5 & -3 & -1\end{bmatrix}$ and $\begin{bmatrix}1 & -1 & 1\\1 & -1 & -2\\2 & 1 & 3\end{bmatrix}$ and then use this to solve the system of equations x-y+z=4; x-2y-2z=9; 2x+y+3z=1
33	Find the vector equation of the line passing through the point (1, 2, -4) and perpendicular to the two lines: $\frac{x-8}{3}=\frac{y+9}{-16}=\frac{z-10}{7}$ and $\frac{x-15}{3}=\frac{y-29}{8}=\frac{z-5}{-5}$ **Or**, Solve that the lines: $\frac{x+1}{3}=\frac{y+3}{5}=\frac{z+5}{7}$ and $\frac{x-2}{1}=\frac{y-4}{3}=\frac{z-6}{5}$ intersect each other. Also find their point of intersection.
34	Evaluate $\int_0^{\pi/2} \log \sin x\, dx$ **Or**, Evaluate $\int_0^{\pi} \frac{x\, dx}{a^2\cos^2 x+b^2\sin^2 x}$
35	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.
	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.**
36	In pre-board examination of class XII, commerce stream with Economics and Mathematics of a particular school 50% of the students failed in Economics, 35% failed in Mathematics and 25% failed in both Economics and Mathematics. A student is selected at random from the class.  Based on the above information answer the following questions- (i) The probability that the selected student has failed in Economics if it is known that he has failed in Mathematics. (ii) The probability that the selected student has failed in Mathematics if it is known that he has failed in Economics. (iii) The probability that the selected student has failed in at least one of the two subjects.

37	The relation between the height of the plant (y in cm) with respect to exposure to sunlight is governed by the following equation: $y = 4x - \frac{1}{2}x^2$ Where x is the number of days exposed to sunlight.  Based on the above information answer the following questions: (i) Find the rate of the plant with respect to sunlight. (ii) What is the number of days it will take for the plant to grow to the maximum height? (iii) If the height of the plant is 7/2 cm, find the number of days it has been exposed to the sunlight.
38	Megha wants to prepare a handmade gift box for her friend's birthday at home. For making the lower part of box, she takes a square piece of cardboard of side 20 cm.  Based on the above information, answer the following- If x can be the length of each side of the square cardboard which is to be cut off from corners of the square piece of side 20 cm. (i) What should be the side of square to be cut off so that volume of the box is maximum? (ii) The maximum value of the volume?

KENDRIYA VIDYALAYA SANGATHAN

SAMPLE QUESTION PAPER 5

CLASS – XII **MAX.MARKS – 80**

SUB. – MATHEMATICS (Code – 041) **TIME – 03 HOURS**

Marking Scheme

	Section-A **For each correct option- 1 mark** **1(a),2(c),3(a),4(b),5(c),6(d),7(d),8(d),9(c),10(b),11(a),12(d),13(d),14(c),15(b),16(c),17(a), 18(b),19(a),20(c)**	
21	**Section-B** Value=$\frac{-\pi}{6}+\frac{\pi}{3}-\frac{\pi}{4}$ $=\frac{-\pi}{12}$ **Or,** Value=$\frac{-\pi}{6}+\frac{\pi}{6}$ =0	1 1 1 1
22	A=$\frac{\sqrt{3}}{4}a^2$ $(\frac{dA}{dt})_{a=30}=45\sqrt{3}$ cm^2/s **Or,** A=πr^2 $(\frac{dA}{dt})_{r=7.5}=52.5\pi$ cm^2/s	0.5 1.5 0.5 1.5
23	$\vec{a}.(\vec{b}+\vec{c})=\vec{b}.(\vec{c}+\vec{a})=\vec{c}.(\vec{a}+\vec{b})=0$ $\lvert\vec{a}+\vec{b}+\vec{c}\rvert=5\sqrt{2}$	0.5 1.5
24	Correct figure Area=πab	0.5 1.5
25	S.D.=$\left\lvert\frac{(\overrightarrow{a_2}-\overrightarrow{a_2}).(\overrightarrow{b_1}\times\overrightarrow{b_2})}{\lvert\overrightarrow{b_1}\times\overrightarrow{b_2}\rvert}\right\rvert$ =$2\sqrt{29}$	0.5 1.5
26	**Section-C** Drawing correct graph For showing unbounded feasible solution region For finding minimum value	 1 1 1
27	X=0,1,2 <table><tr><td>X</td><td>0</td><td>1</td><td>2</td></tr><tr><td>P(x)</td><td>$\frac{144}{169}$</td><td>$\frac{24}{169}$</td><td>$\frac{1}{169}$</td></tr></table>**Or,** Required probability=$\frac{3}{7}\left(1-\frac{5}{7}\right)+\frac{5}{7}\left(1-\frac{3}{7}\right)$ $=\frac{6}{49}+\frac{20}{49}=\frac{26}{49}$	0.5 2.5 2 1

28	$$\int x\sin^{-1}x\,dx = \sin^{-1}x\int x\,dx - \left[\frac{d}{dx}\left(\sin^{-1}x\int x\,dx\right)\right]dx$$ $= \frac{1}{4}(2x^2-1)\sin^{-1}x + \frac{x}{4}\sqrt{1-x^2} + C$ **Or,** $\int \frac{(x^2+1)(x^2+2)}{(x^2+3)(x^2+4)}dx = \int\left(1 - \frac{4x^2+10}{(x^2+3)(x^2+4)}\right)dx$ $= \int\left(1+\frac{2}{x^2+3} - \frac{6}{x^2+4}\right)dx$ $= x + \frac{2}{\sqrt{3}}\tan^{-1}\frac{x}{\sqrt{3}} - 3\tan^{-1}\frac{x}{2} + C$	1 2 0.5 1.5 1
29	$\frac{dy}{dx} = \frac{x^2+y^2}{x^2+xy}$ Putting y=vx, $\frac{dy}{dx} = V + x\frac{dV}{dx}$ Solving and getting- $(x-y)^2 = Cxe^{-y/x}$ **Or,** $\frac{dy}{dx} + \frac{2xy}{1+x^2} = \frac{\cot x}{1+x^2}$ I.F.= $1+x^2$ Req. Soln. $y(1+x^2) = \log\lvert\sin x\rvert + C$	0.5 1 1.5 0.5 1 1.5
30	Rough Sketch Using integration and getting area enclosed= 9/8 sq. units	1 2
31	$\frac{dx}{d\theta} = 2a\cos^2\frac{\theta}{2}, \frac{dy}{d\theta} = 2a\sin\frac{\theta}{2}\cos\frac{\theta}{2}$ $\frac{dy}{dx} = \tan\frac{\theta}{2}, \frac{d^2y}{dx^2} = \frac{1}{4a}\sec^4\frac{\theta}{2}$ Value=1/a	1 1.5 0.5
32	**<u>Section-D</u>** AB=8I B^{-1}=1/8A X=B^{-1}C x=3,y=2,z=1	 2 1 2
33	$\vec{r} = (\hat{\imath} + 2\hat{\jmath} - 4\hat{k}) + \lambda(b_1\hat{\imath} + b_2\hat{\jmath} + b_3\hat{k})$---1 Line 1 is perpendicular to the two given lines $\frac{b_1}{2} = \frac{b_2}{3} = \frac{b_3}{6}$ $\therefore \vec{r} = (\hat{\imath} + 2\hat{\jmath} - 4\hat{k}) + \lambda(2\hat{\imath} + 3\hat{\jmath} + 6\hat{k})$ **Or,** For showing shortest distance between two lines=0 i.e, lines are intersecting. For finding point of intersection- x=(2λ+1);y=(3λ+2);z=(4λ+3) from 1st equation of line Putting into 2nd equation of line and getting λ=-1 Required point(-1,-1,-1)	1 3 1 2 1 1.5 0.5
34	Using property of definite integral Adding and simplifying- Getting 2I=I-$\frac{\pi}{2}\log 2$ I=-$\frac{\pi}{2}\log 2$ **Or,**	1 1 2.5 0.5

	Using property of definite integral Adding and simplifying Getting I=$\pi\int_0^{\pi/2} \frac{\sec^2 x\, dx}{a^2+b^2 \tan^2 x}$ =$\frac{\pi^2}{2ab}$	1 1 2 1
35	For proving Reflexive & Symmetric For proving transitive For writing equivalence class of R	1+1 2 1
36	**Section-E** (i) P(E/M)=5/7 (ii) P(M/E)=1/2 (iii) P(E∪M)=3/5	 1 1 2
37	(i) 4-x (ii) 4 (iii) 1	1 1 2
38	(i) x=10/3 cm (ii) Maximum Volume=16000/27 cm^3	2 2

KENDRIYA VIDYALAYA SANGATHAN

Blue-Print

Sample Paper 6

Class-XII **Subject-Mathematics (041)**

CHAPTERS	MCQ	A/R QNS	2 M	3 M	5 M	CBQ	TOT
RELATIONS AND FUNCTIONS	1		1		1		**3**
INVERSE TRIGONOMTRIC FUNCTIONS		1					**1**
MATRICES	3						**3**
DETERMINANTS	2				1		**3**
CONTINUITY AND DIFFERENTIABLIT Y	1		1	1			**3**
APPLICATION OF DERIVATIVE	2					1	**3**
INTEGRALS	2		1	1	1		**5**
APPLICATION OF INTEGRALS			1	1			**2**
DIFFERENTIAL EQUATIONS	2			1			**3**
VECTOR ALGEBRA	1		1				**2**
THREE DIMENSIONAL GEOMETRY	1	1			1	1	**4**
LINEAR PROGRAMMING	2			1			**3**
PROBABLITY	1			1		1	**3**
TOTAL	**18**	**2**	**5**	**6**	**4**	**3**	**38**

KENDRIYA VIDYALAYA SANGATHAN

SAMPLE QUESTION PAPER 6

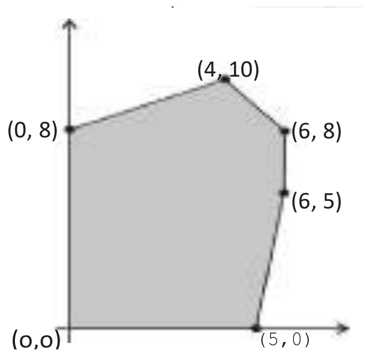
CLASS – XII **MAX.MARKS – 80**

SUB. – MATHEMATICS (Code – 041) **TIME – 03 HOURS**

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.

Q. No	Question	Marks
	Question SECTION – A (Multiple Choice Questions) Each question carries 1 mark.	
1	The number of all possible matrices of order 3 × 3 with each entry 0 or 1 is: (a) 27 (b) 18 (c) 81 (d) 512	1
2	If A = [a_{ij}] is a symmetric matrix of order n, then (a) $a_{ij} = 1/a_{ij}$ for all i,j (b) $a_{ij} \neq 0$ for all i,j (c) $a_{ij} = a_{ji}$ for all i,j (d) $a_{ij} = 0$ for all i, j	1
3	Let A be a non singular square matrix of order 3 × 3. Then |*adj* A| is equal to (a) |A| (b) $\|A\|^2$ (c) $\|A\|^3$ (d) 3|A|	1
4	The area of a triangle with vertices (–3, 0), (3, 0) and (0, *k*) is 9 sq. units. The value of *k* will be (a) 9 (b) 3 (c) – 9 (d) 6	1
5	If A and B are invertible matrices, then which of the following is not correct? (a) *adj* A = |A|. A^{-1} (b) $\det(A)^{-1} = [\det(A)]^{-1}$ (c) $(AB)^{-1} = B^{-1}A^{-1}$ (d) $(A + B)^{-1} = B^{-1} + A^{-1}$	1
6	The function *f* (*x*) = [*x*], where [*x*] denotes the greatest integer function, is continuous at (a) 4 (b) – 2 (c) 1 (d) 1.5	1

7	Differentiation of($\tan^{-1}$ x)^2 is (a) $\frac{x}{\sqrt{1+x^2}}$ (b) $\frac{2tan^{-1}x}{1+x^2}$ (c) $x\sqrt{1+x^2}$ (d) $\frac{1}{\sqrt{1+x^2}}$	1
8	The rate of change of the area of a circle with respect to its radius *r* at *r* = 6 cm is (a) 10 π (b) 12 π (c) 8 π (d) 11 π	1
9	On which of the following intervals is the function *f* given by *f* (*x*) = x^{100} + sin *x* –1 decreasing ? (a) (0,1) (b) $(\frac{\pi}{2}, \pi)$ (c) $(0,\frac{\pi}{2})$ (d) None of these	1
10	$\int e^x$ (sec x + tan x) is equal to (a) e^x cos x + c (b) e^x sec x + c (c) e^x sin x + c (d) e^x tan x + c	1
11	The value of $\int_{-a}^{a} sin^3$ x dx is equal to (a) a (b) a/3 (c) 1 (d) 0	1
12	The degree of the differential equation $\left(\frac{d^2y}{dx^2}\right)^3 + \left(\frac{dy}{dx}\right)^2 + sin\left(\frac{dy}{dx}\right) + 1 = 0\ is$ (a) 3 (b) 2 (c) 1 (d) not defined	1
13	A homogeneous differential equation of the from $\frac{dx}{dy} = h\left(\frac{x}{y}\right)$ can be solved by making the substitution. (a) *y* = *vx* (b) *v* = *yx* (c) *x* = *vy* (d) *x* = *v*	1
14	If $\vec{a}$ is a nonzero vector of magnitude '*a*' and λ a nonzero scalar, then $\lambda\vec{a}$ is unit vector if (a) λ = 1 (b) λ = – 1 (c) *a* = | λ | (d) *a* = $\frac{1}{\|\lambda\|}$	1
15	The coordinates of the foot of the perpendicular drawn from the point (2, 5, 7) on the *x*-axis are given by (a) (2, 0, 0) (b) (0, 5, 0) (c) (0, 0, 7) (d) (0, 5, 7)	1
16	The feasible solution for a LPP is shown in given figure. Let Z=3x-4y be the objective function. Minimum of Z occurs at a) (0,0) b) (0,8) c) (5,0) d) (4,10)  	1

17	Region represented by x≥ 0,y≥ 0 is: (a) First quadrant (b) Second quadrant (c) Third quadrant (d) Fourth quadrant	1
18	If A and B are two events such that P(A)+P(B)- P(A and B)=P(A), then (a) P(B/A) =1 (b) P(A/B) =1 (c) P(A/B) =0 (d) P(B/A) =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.		
19	A: The Principal value of $\cot^{-1}(-\sqrt{3}) + \tan^{-1}(1) + \sec^{-1}(2/\sqrt{3})$ is equal to $\frac{5\pi}{4}$. R: Domain of $\cot^{-1} x$ and $\sin^{-1} x$ are respectively $(0, \pi)$ and $\left[-\frac{\pi}{2}, \frac{\pi}{2}\right]$.	1
20	A: The following straight lines are perpendicular to each other. $$\frac{x+1}{2} = \frac{y-2}{5} = \frac{z+3}{4} \; and \; \frac{1-x}{-1} = \frac{y+2}{2} = \frac{3-z}{3}$$ R: Let line L-l passes through the point $(x_1, y_1, z_1,)$ and parallel to the vector whose direction ratios are a_1, b_1, and c_1, and let line L- 2 passes through the point $(x_2, y_2, z_2,)$ and parallel to the vector whose direction ratios are a_2, b_2, and c_2, · Then the lines L-1 and L-2 are perpendicular if $a_1.a_2 + b_1.b_2 + c_1.c_2 = 0$	1
SECTION – B This section comprises of very short answer type-questions (VSA) of 2 marks each.		
21	Check whether the relation R in the set **R** of real numbers, defined as R = {(*a*, *b*) : $a \leq b^2$} is transitive.	2
22	Find $\frac{dy}{dx}$ of the function $y^x = x^y$. **Or**, Find the values of *k* so that the function *f* is continuous at the indicated point $f(x) = \begin{cases} kx + 5, if & x \leq 2 \\ x - 1, if & x > 2 \end{cases} \; at x = 2$	2
23	Evaluate: $\int x$ /(x+1) (x+2) dx	2
24	Find the area of the region in the first quadrant enclosed by X-axis , line x = $\sqrt{3}$ y and the circle $x^2 + y^2 = 4$. **OR** Find the area of the region bounded by the ellipse $\frac{x^2}{16} + \frac{y^2}{9} = 1$.	2
25	If $\vec{a}, \vec{b}, \vec{c}$ are unit vectors such that $\vec{a} + \vec{b} + \vec{c} = \vec{0}$, find the value of $\vec{a}.\vec{b} + \vec{b}.\vec{c} + \vec{c}.\vec{a}$.	2

	SECTION C **(This section comprises of short answer type questions (SA) of 3 marks each)**	
26	If $y = (\tan^{-1}x)^2$, show that $(1+x^2)^2\ y_2 + (2x)(1+x^2)\ y_1 = 2$	3
27	Evaluate $\int (sinx \sin 2x\ sin3x\ )$ dx **OR** Evaluate: $\int_{-5}^{5} \|x+\ 2\ \|dx$.	3
28	Find the area of the region bounded by the curve *y = sin x* between x = 0 and x = 2π .	3
29	Solve the differential equation $(1+x^2)\frac{dy}{dx} + y = e^{tan^{-1}x}$. OR Find the general solution of $(e^x + e^{-x})\, dy - (e^x - e^{-x})\, dx = 0$.	3
30	Solve the following Linear Programming Problem graphically: Maximize and Minimize Z = x + 2y subject to the constraints: x + 2y ≥ 100, 2x - y ≤ 0, 2x + y ≤ 200, x ≥ 0, y ≥ 0.	3
31	Two numbers are selected at random (without replacement) from the first six positive integers. Let X denote the larger of the two numbers obtained. Find E(X). **OR** The random variable X can take only the values 0,1,2,3. Given that P (X = 0) P = (X = 1)= p and P (X = 2)= P (X = 3) such that $\sum pi\ xi = 2 \sum pi\ xi$. Find the value of p.	3
	SECTION D **(This section comprises of long answer-type questions (LA) of 5 marks each)**	
32	Show that the function f : R→R defined by $f(x) = \frac{x}{x^2+1}$, ∀ x∈R is neither one-one nor onto. **OR** Let f: W → W be defined by : f(n) = $\{n-1, if\ n\ is\ odd\ n+1, if\ n\ is\ even$. Show that f is one-one and onto .	5
33	If A = $\begin{bmatrix} 2 & -3 & 5 \\ 3 & 2 & -4 \\ 1 & 1 & -2 \end{bmatrix}$ find A^{-1} . Using A^{-1} Solve the following system of equations by matrix method. 2*x* – 3*y* + 5*z* = 11; 3*x* + 2*y* –4 *z* = -5; *x* + *y* - 2*z* = -3	5
34	Evaluate $\int_0^{\pi} \frac{x}{1+\sin x}\, dx$. **OR** Evaluate $\int_0^{\frac{\pi}{2}} \frac{sin^2 x}{\sin x + \cos x}$ dx .	5
35	Find the shortest distance between the lines $\vec{r} = (\hat{\imath} + 2\,\hat{\jmath} + 3\,\hat{k}) + \alpha\,(\hat{\imath} - \hat{\jmath} + \hat{k})$ and $\vec{r} = (2\hat{\imath} - \hat{\jmath} - \hat{k}) + \mu\,(2\hat{\imath} + \hat{\jmath} + \widehat{2k})$ **OR** Find the cartesian equation of the line which passes through the point (-2,4,-5) and parallel to the line given by $\frac{x+3}{3} = \frac{y-4}{5} = \frac{z+8}{6}$.	5

SECTION E

(This section comprises of 3 case-study based questions with two sub-parts. First two case study questions have three subparts of marks 1, 1, 2 respectively. The third case study question has two sub parts of 2 marks each.)

36 Read the following text and answer the following questions, on the basis

of the same:

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

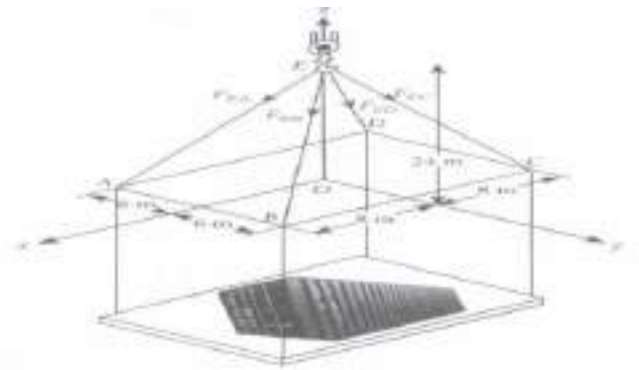
(i) Find the rate of growth of the plant with respect to sunlight. 1

(ii) Is this function satisfy the condition of second order derivative? 1

(iii) What is the number of days it will take for the plant to grow to the maximum height? 2

Or (iii) What is the maximum height of the plant?

37 A pillar is said to be constructed on a field. Radhe is an Engineer for that project . This was Radhe's first project after completing his Engineering. He draws the following diagram of that pillar for the approval.



Consider the following diagram, where the forces in the cable are given.

(i) Write the coordinates of A and B. 1

(ii) Write the coordinates of C and D. 1

(iii) Find the equation of the line along the cable AD. 2

OR

Find the sum of the distances OA, OB and OC.

38	One day, a sangeet mahotsav is to be organised in an open area of Rajasthan. In recent years, it has rained only 6 days each year. Also, it is given that when it actually rains, the weatherman correctly forecasts rain 80% of the time. When it doesn't rain, he incorrectly forecasts rain 20% of the time. If leap year is considered, then answer the following questions.  (i) Find the probability that the weatherman predict rain. (ii) Find the probability that it will rain on the chosen day, if weatherman predict rain for that day.	2 2

KENDRIYA VIDYALAYA SANGATHAN

SAMPLE QUESTION PAPER 6

CLASS – XII **MAX.MARKS – 80**

SUB. – MATHEMATICS (Code – 041) **TIME – 03 HOURS**

Marking Scheme

Q. No.	Question SECTION – A	Marks
1-20	**1)(c) 2)(c) 3)(a) 4)(c) 5) (d) 6) (d) 7) (b) 8)(b) 9) (c) 10) (a)** **11)(c) 12)(d) 13)(a) 14)(a) 15)(a) 16)(c) 17) (c) 18) (c) 19) (a) 20)(b)**	
21	Not transitive	
22	$\frac{dy}{dx} = \frac{y}{x}\left(\frac{y - x\log y}{x - y\log x}\right)$ **Or** k = -2	
23	log I(x + 2)^2/(x + 1) I + C	
24	Required area = $\int_0^{\sqrt{3}} \frac{1}{\sqrt{3}}$ x dx + $\int_{\sqrt{3}}^{2} \sqrt{4 - x^2}$ dx = $\frac{\pi}{3}$ sq unit **Or**, Area bounded by the ellipse = $4\int_0^4 \frac{3}{4}\sqrt{16 - x^2}$ dx = 12 π sq unit.	
25	$(\vec{a} \cdot \vec{b} + \vec{b} \cdot \vec{c} + \vec{c} \cdot \vec{a}) = -\frac{3}{2}$	
	SECTION C	
26	$y = (\tan^{-1}x)^2$, differentiating both sides w.r.t. x twice to get the result	
27	$-\frac{\cos 2x}{8} + \frac{\cos 6x}{24} - \frac{\cos 4x}{16} + C$ Or, $\int_{-5}^{5} I\, x + 2\, I$ dx = $\int_{-5}^{-2} -(x + 2)$dx + $\int_{-2}^{5}(x + 2)$ dx = 29	
28	Required area = $\int_0^{\pi} I \sin x$ I dx + $\int_{\pi}^{2\pi} I \sin x$ I dx = 4 sq unit	
29	y = $\frac{e^{tan^{-1}x}}{2}$+ C $e^{-tan^{-1}x}$ **Or**, y = log I (e^x + e^{-x}) I + C	
30	The maximum value of Z is 400at (0,200) and minimum value of Z is 100 at all the points on the line segment joining (0,50) and (20,40)	
31	probability distribution is X: 2, 3, 4, 5, 6 P(X): $\frac{1}{15}$, $\frac{2}{15}$, $\frac{3}{15}$, $\frac{4}{15}$, $\frac{1}{3}$ Expectation of X = E(X) = ΣXP(X)= 2 x $\frac{1}{15}$+3 x $\frac{2}{15}$+4 x $\frac{3}{15}$+5 x $\frac{4}{15}$+6 x $\frac{1}{3}$ = $\frac{2+6+12+20+30}{15}$ = $\frac{70}{15}$ **Or**, P = $\frac{3}{8}$	

	SECTION D	
32	Since f(1) = $\frac{1}{2}$ and f(-1) = $\frac{-1}{2}$, but 1 ≠ -1**, f is not one-one.** And there is no real number x such that f(x) equals any positive real number. Hence, **f is not onto**. **Or**, show that f(n) = f(m) => n = m so f is one-one. For onto show codomain = range	
33	$A^{-1} = \begin{bmatrix} 0 & 1 & -2 \\ -2 & 9 & -23 \\ -1 & 5 & -13 \end{bmatrix}$ Solving by matrix method , x = 1, y= 2, z = 3	
34	Let I = $\int_0^{\pi} \frac{x}{1+\sin x}\, dx$ ....(i) I = $\int_0^{\pi} \frac{\pi - x}{1+\sin(\pi - x)}\, dx$ or I = $\int_0^{\pi} \frac{\pi - x}{1+\sin x}\, dx$ ....(ii) On adding eqs. (i) and (ii) ,we get 2 I = $\int_0^{\pi} \frac{\pi}{1+\sin x}\, dx$ after solving I = π **Or**, Let I = $\int_0^{\frac{\pi}{2}} \frac{sin^2 x}{\sin x+\cos x}$ dx -------------------- (i) = $\int_0^{\frac{\pi}{2}} \frac{sin^2(\frac{\pi}{2}-x)}{\sin\left(\frac{\pi}{2}-x\right)+\cos\left(\frac{\pi}{2}-x\right)}$ dx or I = $\int_0^{\frac{\pi}{2}} \frac{cos^2 x}{\sin x+\cos x}$ dx ....(ii) Adding equn. (i) and (ii) 2 I =$\int_0^{\frac{\pi}{2}} \frac{1}{\sin x+\cos x}$ dx after solving I = $\frac{1}{\sqrt{2}}\log(\sqrt{2}+1)$	
35	Shortest distance = $\frac{\sqrt{2}}{2}$ units **Or**, $\frac{x+2}{3} = \frac{y-4}{5} = \frac{z+5}{6}$ is the equation of the required line.	
	SECTION E	
36	(i) 4−*x* cm/day. ii) Yes, the function satisfies the condition of the second-order derivative because the second derivative is a constant value. iii) it will take 4 days for the plant to grow to the maximum height. **Or**,Therefore, the maximum height of the plant is 8 cm.	
37	i) The coordinates of point A and B are (8,10,0) and (-6,4,0) respectively. ii) The coordinates of point C and D are (15,-20,0) and (0,0,30) respectively. iii) $\frac{x}{4} = \frac{y}{5} = \frac{30-z}{15}$ **Or**, the sum of the distances OA,OB,OC = $\sqrt{164}+\sqrt{52}+25$ = $(2\sqrt{41}+2\sqrt{13}+25)$units	
38	(i) 0.2098 (ii) 0.0625	

KENDRIYA VIDYALAYA SANGATHAN

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Sample Paper 7

Class-XII **Subject-Mathematics (041)**

Chapters	1 mark	2 marks	3 marks	5 marks	4 marks	Total questions	Total marks
Relation and Function	1				1 (2+2)	5	8
ITF	1	1 OR				3	
Matrix	3 (AR)			1		8	10
Determinant	2					2	
Continuity	1					1	35
Derivative	1	1	1			6	
Appl of derivative	1 (AR)	2 (OR)			1 (1+1+2)	9	
Integration	1		1 (OR)	1 (OR)		9	
Appl. Of Integral				1		5	
Diff Equation	2		1 (OR)			5	
Vector	1	1	1			7	14
3d Geometry	3			1 (OR)		7	
LPP	2		1 (OR)			5	5
Probability	1	1	1		1(1+1+2)	8	8
Total	20	5	6	4	3	38	80

KENDRIYA VIDYALAYA SANGATHAN

SAMPLE QUESTION PAPER 7

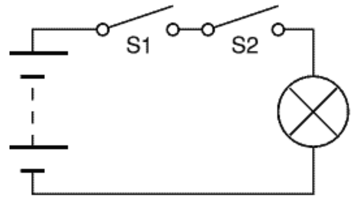
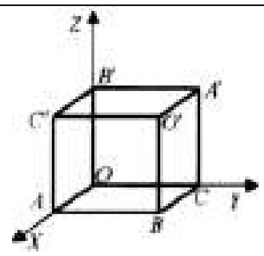
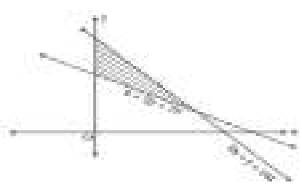
CLASS – XII | **MAX.MARKS – 80**

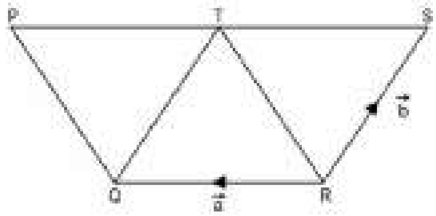
SUB. – MATHEMATICS (Code – 041) | **TIME – 03 HOURS**

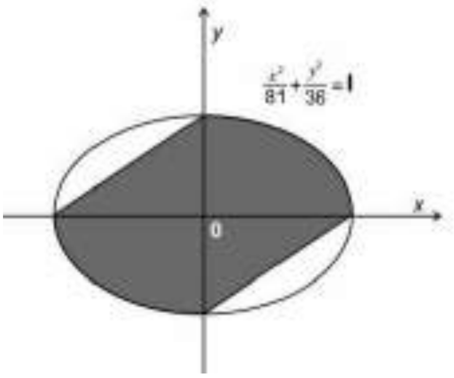
General Instructions :

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 (20 X 1)		
1	If $\begin{pmatrix} 1 & 5 & 3 \\ 4 & 6 & 2 \end{pmatrix}$ $and\ B = \begin{pmatrix} 5 & 3 \\ 1 & -1 \\ 2 & 4 \end{pmatrix}$ then value of $\sum_{i=1}^{3} a_{2i} b_{i1} =$ (a) 30 (b) 16 (c) 14 (d) 32	
2	Let A= {1,2,3,…30}. A relation R is defined in A X A by $(a,b)R(c,d) \Leftrightarrow a+d=b+c$ then number of elements related (1,3) **(a) 26** **(b) 17** **(c) 28** **(d) 21**	
3	Let $A = \begin{pmatrix} 2 & 3 \\ \alpha & 0 \end{pmatrix} = P + Q$ where P is symmetric matrix and Q is skew symmetric matrix and |Q| = 9 then value of α may be (a) 9 (b) 3 (c) 0 (d) 4	
4	Which one of the following points is at a distance of 5 units from (1,5,3) and lies on the line $\frac{x-1}{2} = \frac{y-5}{6} = \frac{z-3}{3}$ (a) $(2, 8, \frac{9}{2})$ (b) $\left(\frac{17}{7}, \frac{65}{7}, \frac{36}{7}\right)$ (c) (6,5,3) (d) (0,2,4)	
5	If $A = \begin{pmatrix} 1 & 3 \\ 2 & 1 \end{pmatrix}$ Then $\|A^2 - 2A\| =$ (a) 5 (b) 25 (c) -5 (d) -25	
6	The number of real solution of the equation $\begin{vmatrix} sinx & cosx & cosx \\ cosx & sinx & cosx \\ cosx & cosx & sinx \end{vmatrix} = 0$ lying in the interval $\left[-\frac{\pi}{4}, \frac{\pi}{4}\right]$ is (a) 0 (b) 1 (c) 2 (d) 3	
7	If $f(x) = \frac{1}{1-x}$ then the set of points of discontinuity of $f(f(f(x)))$ is (a) {1} (b) {0,1} (c) {-1,1} (d) Ø	

8	$\int_{-2023}^{2023} x^{2023}dx =$ (a) 0 (b) 2023 (c) -1 (d) $\frac{2023}{2024}$	
9	Let $S_n(x) = 1 + x + x^2 + x^3 + \cdots x^n, \lvert x \rvert < 1$ then $S_\infty{}'(\frac{1}{2})$ (where f ' (x) denotes derivative of f(x)) (a) 4 (b) 1 (c) $\frac{1}{2}$ (d)	
10	Let $y = y(x)$ be the solution of differential equation $\frac{dy}{dx} = 1 + x + y^2 + xy^2, y(0) = 0$, then y(1) = (a) $tan\frac{5}{4}$ (b) $tan\frac{3}{2}$ (c) $tan\frac{1}{2}$ (d) $tan\frac{\pi}{4}$	
11	The general solution of the differential equation $ydx - xdy = 0$; is of the form (a) $xy = c$ (b) $x = c\,y^2$ (c) $y = cx$ (d) $y = cx^2$	
12	Two switches S_1, S_2 have respectively 80% and 90% chances of working. The probabilities that circuit of the figure will work (a) $\frac{18}{25}$ (b) 49/50 (c) 20/25 (d) 35/50 	
13	$sin\left(cos^{-1}\left(tan\frac{\pi}{4}\right)\right) =$ (a) 0 (b) π (c) 2π (d) $-\pi$	
14	The figure represents a unit cube with one corner at origin. The direction cosines of the vector $\overrightarrow{OO'}$ is (a) $\langle\frac{1}{\sqrt{3}}, \frac{1}{\sqrt{3}}, \frac{1}{\sqrt{3}}\rangle$ (b) $\langle-\frac{1}{\sqrt{3}}, \frac{1}{\sqrt{3}}, -\frac{1}{\sqrt{3}}\rangle$ (c) $\langle-\frac{1}{\sqrt{3}}, -\frac{1}{\sqrt{3}}, \frac{1}{\sqrt{3}}\rangle$ (d) $\langle\frac{-1}{\sqrt{2}}, \frac{-1}{\sqrt{2}}, \frac{-1}{\sqrt{3}}\rangle$ 	
15	For which value of $\vec{a}$ the equation $\vec{a}.\hat{\imath} = \vec{a}.(\hat{\imath} + \hat{\jmath})$ =$\vec{a}.(\hat{\imath} + \hat{\jmath} + \hat{k})$ is satisfied (a) $\hat{\imath}$ (b) $\hat{\imath} + \hat{\jmath}$ (c) $\hat{\imath} + \hat{\jmath} + \hat{k}$ (d)) $\hat{\jmath}$	
16	The corner points of feasible region of the LPP $2x + y \le 7, x + y \le 4, x \ge 0, y \ge 0$ is (a) (0,0) , (4,0), (7,1), (0,4) (b) (o,0), (7/2,0), (3,1), (0,4) (c) (0,0) , (0,7), (3,1), (0,4) (d) (0,0), (7/2,0), (3,1, (4,0)	
17	Of the following , which group of constraints represents the feasible region  a) $x + 2y \le 76, 2x + y \ge 104, x, y \ge 0$ (b) $x + 2y \le 76, 2x + y \le 104, x, y \ge 0$ (c) $x + 2y \ge 76, 2x + y \ge 104, x, y \ge 0$ (d) $x + 2y \ge 76, 2x + y \le 104, x, y \ge 0$	

18	The direction ratios of the line $3x + 1 = 6y - 2 = 1 - z$ are (a) $(3, 6, 1)$ (b) $(3, 6, -1)$ (c) $(2, 1, 6)$ (d) $(2, 1, -6)$	
The following questions consist of two statements – Assertion (A) and Reason (R). Answer these questions selecting the appropriate option given below: **(a) Both A and R are true and R is the correct explanation for A.** **(b) Both A and R are true and R is not the correct explanation for A.** **(c) A is true but R is false.** **(d) A is false but R is true.**		
19	**Assertion (A):** The maximum value of the function $f(x) = x^3, x \in [-1, 1]$, is attained at its stationary point, x = 0. **Reason (R) :** for maximum value of a function $f(x)$ at a point $f'(x) = 0$ at the point	
20	**Assertion (A):** Adj(AdjA) = $\|A\|^{n-2}A$ for any square matrix A **Reason (R) :** A.AdjA = |A|I_n	
Section B		
21	Draw the graph of $\boldsymbol{y = sin^{-1}(x - 1)}$ in the principal range OR Find the value of $\boldsymbol{tan^2(sec^{-1}4) + cot^2(cosec^{-1}5)}$	**2**
22	Find $dy\ dx$ if $= (e^{secx} + x)^4$.	**2**
23	At what point of the ellipse $16x^2 + 9y^2 = 400$ does the ordinate decrease at the same rate at which abscissa increases.	**2**
24	If $f(x) = e^{(cos^2x + cos^4x + cos^6x + \cdots \infty) log_e 2}$, find whether f(x) will increase or decrease in $\left(0, \frac{\pi}{2}\right)$. OR Find the interval in which the function is increasing or decreasing $(x) = log_e(1 + x) - \frac{x}{1+x}$.	**2**
25	QRST and QRTP are parallelograms. Using the vectors shown for $\overrightarrow{RQ}$ and $\overrightarrow{RS}$, prove that the area of QRST is equal to the area of QRTP.  	**2**
Section C		
26	If $y = \sin(2sin^{-1}x)$ then prove that $(1 - x^2)y_2 - xy_1 + 4y = 0$	**3**
27	Evaluate: $\int \frac{\cos x}{(1 - \sin x)(2 - \sin x)} dx$ **Or** Evaluate: $\int_0^{\pi} \frac{x}{1+sinx} dx$	**3**
28	The probability that a married man watches a certain T.V. show is 0.4 and the probability that a married woman watches the show is 0.5. The probability that a man watches the show, given that his wife does, is 0.7. Find the probability that married couples watch the show collectively	**3**
29	Solve the following linear programming problem graphically: $Maximize\ .Z = x + 2y$ Subject to the constraints : $x + y \leq 50, 3x + y \leq 90, x \geq 0, y \geq 0.$ **Or** Solve the following Linear Programming Problem graphically: Maximize $z = 2.5x + 1.5y + 410$ Subject to $x \leq 60, y \leq 50, 60 \leq x + y \leq 100, x \geq 0, y \geq 0$	**3**

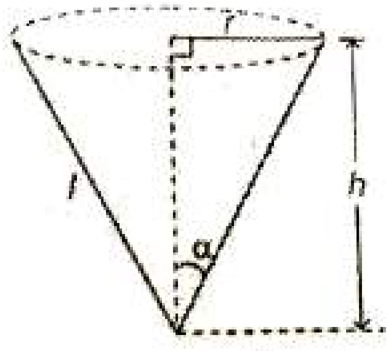
30	If $\vec{a} = \hat{\imath} + \hat{2\jmath} - \hat{k}, \vec{b} = \hat{\imath} - \hat{\jmath}$ *and* $\vec{c} = \hat{\imath} - \hat{\jmath} - \hat{k}$. Let $\vec{r}$ is a vector such that $\vec{r} \times \vec{a} = \vec{c} \times \vec{a}$ and $\vec{r}.\vec{b} = 0$ then find $\|\vec{r}\|$.	**3**
31	Solve the differential equation $ydx + (x - y^2)dy = 0$ **OR** Solve differential equation $xdy - ydx = \sqrt{x^2 + y^2}dx$	**3**
	Section D	
32	If $A = \begin{bmatrix} 1 & -1 & 0 \\ 2 & 3 & 4 \\ 0 & 1 & 2 \end{bmatrix}$ and B=$\begin{bmatrix} 2 & 2 & -4 \\ -4 & 2 & -4 \\ 2 & -1 & 5 \end{bmatrix}$ then find product AB. Use this solve the following system of equations $x - y = 3$; $2x + 3y + 4z = 17$; $y + 2z = 7$	**5**
33	$Evaluate \int_0^{\frac{\pi}{2}} logsinxdx$ **OR** $Evaluate \int \frac{x^2+1}{(x^2+2)(x^2+4)} dx$	**5**
34	 Given Figure in the graph of $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$. Find the area of shaded region with the help of integral.	**5**
35	Find the coordinate of the image of the point Q (1,6,3) w.r.t the line $\vec{r}$ = $(\hat{\jmath} + 2\hat{k})$ + $s(\hat{\imath}$ +2$\hat{\jmath} + 3\hat{k})$ **OR** An eagle is flying along the line$\frac{x-5}{1} = \frac{y-1}{-1} = \frac{z-8}{-3}$ and a snake is crawling along a path $x = 1 + 2s, y = -4 + s, z = 8 - 2s$. Will the eagle able to catch the snake? If yes find the coordinate of the point where the snake will be caught.	**5**
	SECTION E	
36	The Earth has 24 time zones, defined by dividing the Earth into 24 equal longitudinal segments. These are the regions on Earth that have the same standard time. For example, USA and India fall in different time zones, but Sri Lanka and India are in the same time zone. A relation R is defined on the set U = {All people on the Earth} such that R = {(x, y)| the time difference between the time zones x and y reside in is 6 hours}.  Based on this information answer the following question	**4**

(i) Is the relation is reflexive? 1

(ii) Check whether the relation is symmetric. 1

(iii) Is the relation is Transitive 2

37 Priyanka is very fond of ice cream cone. She selected an icecream of slant height of 110 mm as shown in figure. She wants to calculate the criteria for maximum volume of cream. Help her by answering the following questions

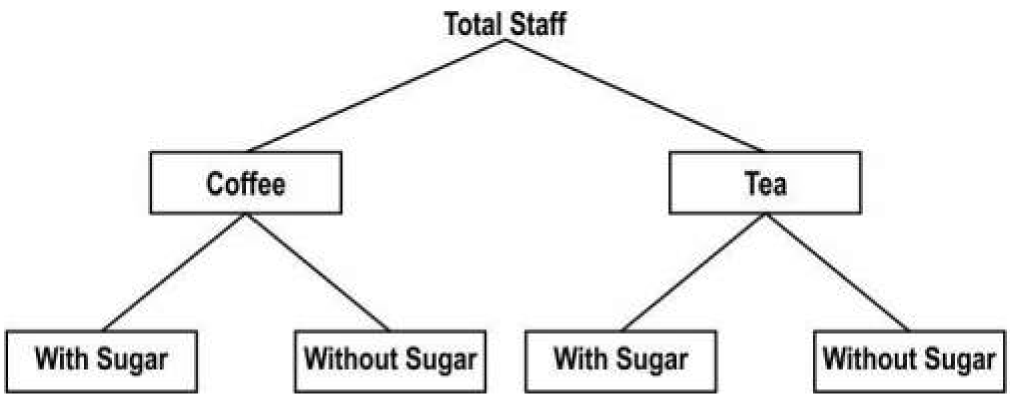


(a) If α is the semi vertical angle of cone. Find radius and height of cone 1

(b) Find volume of cone as a function of α 1

(c) Find value of α for maximum volume of cream. 2

38 A school conducted a survey of their school staff to find their beverage preferences. Each of them picked either tea or coffee as their first preference and then with sugar or without sugar as their second preference as shown in the below tree diagram. Based on the information answer the question that follow



Some of the
insights from the survey are given below.

♦ 60% percent of the staff prefer coffee.

♦ 90% of those who prefer coffee prefer it with sugar.

♦ 20% of those who prefer tea prefer it without sugar.

i) What is the probability that a person selected randomly from the staff prefers a beverage with sugar? 2

ii) ii) What is the probability that a person from the staff selected at random prefers coffee given that it is without sugar? 2

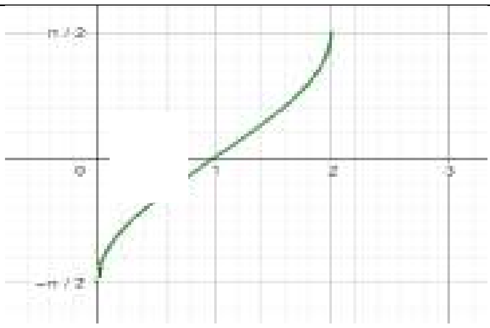
KENDRIYA VIDYALAYA SANGATHAN

SAMPLE QUESTION PAPER 7

CLASS – XII **MAX.MARKS – 80**

SUB. – MATHEMATICS (Code – 041) **TIME – 03 HOURS**

Marking Scheme

1-20	**1) (a) 2)(c) 3)(a) 4) (b) 5)(b) 6)(c) 7)(b) 8)(a) 9)(a) 10)(b)** **11)(c) 12)(a) 13)(a) 14)(a) 15)(a) 16)(b) 17)(d) 18)(d) 19)(d) 20)(a)**	
	Section B	
21)	 OR $tan^2(sec^{-1}4) + cot^2(cosec^{-1}5)$ $= (sec^2(sec^{-1}4) - 1) + (cosec^2(cosec^{-1}5) - 1)$ $= (16 - 1) + (25 - 1)$ $= 39$	**2** **1** **0.5** **0.5**
22)	$\frac{dy}{dx} = 4\,(e^{secx} + x)^3(e^{secx} + x)'$ $= 4\,(e^{secx} + x)^3(e^{secx} secxtanx + 1)$	**1** **1**
23)	$16\left(2x\frac{dx}{dt}\right) + 9\left(2y\frac{dy}{dt}\right) = 0$ $\Rightarrow 32x\frac{dx}{dt} - 18y\frac{dx}{dt} = 0 \quad \left(\because \frac{dx}{dt} = -\frac{dy}{dt} \neq 0\right)$ $\Rightarrow 32x - 18y = 0$ $\Rightarrow y = \frac{16x}{9}$ Putting the value of y in $16x^2 + 9y^2 = 400$, we get $x = \pm 3, y = \pm\frac{16}{3}$ points are (3,16/3) $(-3, -\frac{16}{3})$	**0.5** **0.5** **0.5** **0.5**
24)	$f(x) = e^{\left(\frac{cos^2x}{1-cos^2x}\right)log_e2} = e^{cot^2x log_e2} = 2^{cot^2x}$ $f'(x) = 2^{cot^2x}(log2)(2cotx)(-cosec^2x) < 0 \; in \left(0, \frac{\pi}{2}\right)$ So f(x) will decrease in given interval OR $f(x) = log_e(1 + x) - \frac{x}{1+x} \Rightarrow f'(x) = \frac{1}{1+x} - \frac{1}{(1+x)^2} = \frac{x}{(1+x)^2}$ Increasing interval $(0, \infty)$ Decreasing interval $(-1,0)$	**1** **0.5** **0.5** **1** **0.5** **0.5**

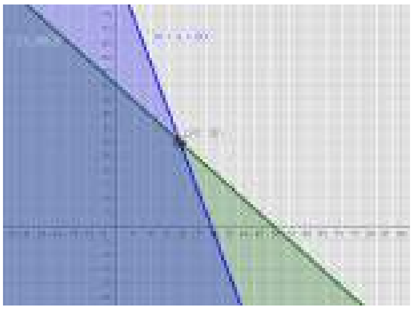
25)	Ar(QRST) = $\left\|\vec{b}\times\vec{a}\right\|$ ar(QRTP) = $\left\|\overrightarrow{RT}\times\overrightarrow{RQ}\right\|$ $= \left\|(\vec{b}+\vec{a})\times\vec{a}\right\|$ $= \left\|\vec{b}\times\vec{a}+\vec{a}\times\vec{a}\right\|$ $= \left\|\vec{b}\times\vec{a}\right\|$	**0.5** **0.5** **1**
	Section C	
26)	$y=\sin(2sin^{-1}x)$ $\Rightarrow y_1=\cos(2sin^{-1}x).\dfrac{2}{\sqrt{1-x^2}}$ $\Rightarrow (1-x^2){y_1}^2=4\cos^2(2sin^{-1}x)$ $\Rightarrow (1-x^2){y_1}^2=4(1-y^2)$ $\Rightarrow\ (1-x^2)y_2-xy_1+4y=0$	**1** **0.5** **0.5** **1**
27)	$\mathrm{I}=\int\dfrac{\cos x}{(1-\sin x)\,(2-\sin x)}\,dx$ Let $\sin x=t\ \ \therefore\cos x\,dx=dt$ $\therefore \mathrm{I}=\int\dfrac{1}{(1-t)(2-t)}\,dt\ldots\ldots\ldots\ldots\ldots(1)$ Let $\frac{1}{(1-t)(2-t)}=\frac{\mathrm{A}}{(1-t)}+\frac{\mathrm{B}}{(2-t)}\ldots\ldots\ldots\ldots\ldots(2)$ $\Rightarrow\therefore$ A $=1$ and B $=-1$ Thus from (1) and (2), we get $\mathrm{I}=\int\left[\dfrac{1}{(1-t)}+\dfrac{-1}{(2-t)}\right]dt$ $=\int\dfrac{1}{1-t}\,dx-\int\dfrac{1}{2-t}\,dx$ $=-\log\|1-t\|+\log\|2-t\|+\mathrm{C}$ $=\log\left\|\dfrac{2-t}{1-t}\right\|+\mathrm{C}=\log\left\|\dfrac{2-\sin x}{1-\sin x}\right\|+\mathrm{C}$ Or $I=\int_0^{\pi}\frac{x}{1+\sin x}dx=\int_0^{\pi}\frac{\pi-x}{1+\sin x}dx$ $2\mathrm{I}=2\pi\int_0^{\frac{\pi}{2}}\frac{1}{1+\sin x}dx=\pi\int_0^{\frac{\pi}{2}}\frac{1-\sin x}{\cos^2 x}dx$ $=\pi\int_0^{\frac{\pi}{2}}(\sec^2 x-\sec x\tan x)dx$ $=\pi[\tan x-\sec x]_0^{\frac{\pi}{2}}=\pi\left[\frac{\sin x-1}{\cos x}\right]_0^{\frac{\pi}{2}}=2\pi\Rightarrow \mathrm{I}=\ \pi$	 0.5 0.5 0.5 0.5 1 **1** **1** **0.5** **0.5**
28)	M = man watches TV show W = his wife watches TV show. P(M) = 0.4, P(W) = 0.5 P(M/W) = 0.7 $P(M\cap W)=P\left(\dfrac{M}{W}\right)P(W)$ $=0.7\times0.5=0.35$	 **1** **0.5** **1** **0.5**

29)

drawing graph and shading

drawing per line 0.5 and shading correctly 0.5 each — **2**

finding intersection pt (20,30)

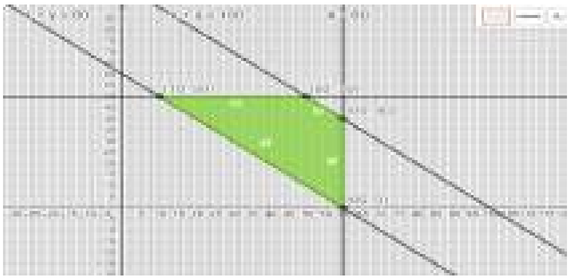


pt	X+2y
(0,0)	0
(30,0)	30
(20,30)	80
(0,50)	100 max

1

Or

Similar approach



pt	2.5x+1.5y+410
(10,50)	510
(50,50)	610 max
(60,40)	620
(60,0)	90

30)

Let $\vec{r} = x\hat{\imath} + y\hat{\jmath} + z\hat{k}$

$\vec{r} \times \vec{a} = \hat{\imath}(-y - 2z) + \hat{\jmath}(z + x) + \hat{k}(2x - y),$ **0.5**

$\vec{c} \times \vec{a} = \widehat{3\imath} + \widehat{3k}$ **0.5**

$\vec{r}.\vec{b} = 0 \Rightarrow x - y = 0$

$\therefore 2x - y = 3, \quad z + x = 0, -y - 2z = 3$ **0.5**

Solving we get x=3, y= 3 z = -3 **1**

Hence $\vec{r} = 3\hat{\imath} + 3\hat{\jmath} - 3\hat{k}$ **0.5**

31)

$ydx + (x - y^2)dy = 0$ **)**

$\Rightarrow \; y\frac{dx}{dy} + x = y^2$ linear in x **1**

$\Rightarrow \; \frac{dx}{dy} + \frac{x}{y} = y$ spotting p and Q **0.5**

Int factor = $e^{\int\frac{1}{y}dy} = y$ **1**

General solution $y.x \; = \int y^2 dy = \frac{y^3}{3} + c$ **0.5**

Or

$xdy - ydx = \sqrt{x^2 + y^2}dx$

$\Rightarrow xdy = \left(y + \sqrt{x^2 + y^2}\right)dx$

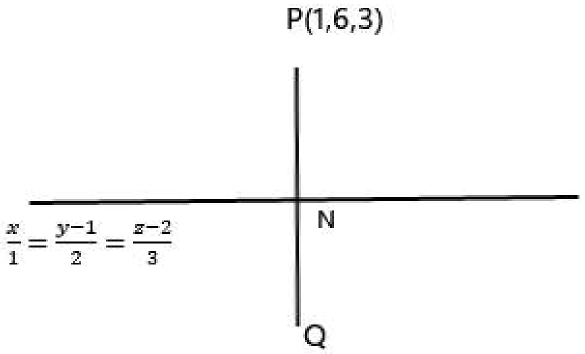
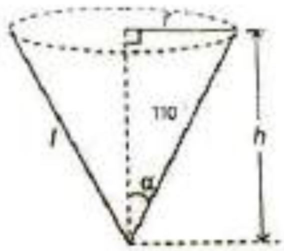
$\Rightarrow \frac{dy}{dx} = \frac{y}{x} + \sqrt{1 + \frac{y^2}{x^2}}$ **0.5**

Putting y = vx $\Rightarrow \frac{dy}{dx} = v + x\frac{dv}{dx}$ **0.5**

$v + x\frac{dv}{dx} = v + \sqrt{1 + v^2}$

$\Rightarrow \int \frac{dv}{\sqrt{1+v^2}} = \int \frac{dx}{x}$ **1**

	$\Rightarrow \log\left(v+\sqrt{1+v^2}\right) = logx + logc$ $\Rightarrow v+\sqrt{1+v^2} = cx$ $\Rightarrow \frac{y}{x}+\frac{\sqrt{y^2+x^2}}{x} = cx$	**0.5** **0.5**
	Section D	
32)	AB=6I $\Rightarrow A^{-1} = \frac{B}{6}$ $\Rightarrow \begin{bmatrix} x \\ y \\ z \end{bmatrix} = A^{-1}\begin{bmatrix} 3 \\ 17 \\ 7 \end{bmatrix}$ $\Rightarrow \begin{bmatrix} x \\ y \\ z \end{bmatrix} = \frac{1}{6}\begin{bmatrix} 2 & 2 & -4 \\ -4 & 2 & -4 \\ 2 & -1 & 5 \end{bmatrix}\begin{bmatrix} 3 \\ 17 \\ 7 \end{bmatrix}$ Solution $x = 2, y = -1, z = 4$	**2** **1** **1** **1**
33)	Let $I = \int_0^{\frac{\pi}{2}} logsinxdx$ Using prop. $I = \int_0^{\frac{\pi}{2}} logcosxdx$, Adding $2I = \int_0^{\frac{\pi}{2}} logsinx\, cosxdx = \int_0^{\frac{\pi}{2}} logsin2x/2)2dx$ $\therefore 2I = \frac{1}{2}\int_0^{\pi} logsintdt - \frac{\pi}{2}log2 \quad substituting\ t = 2x$ $2I = \frac{1}{2} \times 2\int_0^{\frac{\pi}{2}} logsintdt - \frac{\pi}{2}log2$ $using\ property \int_0^{2a} f(x)dx = 2\int_0^{a} f(x)dx \quad f(2a-x) = f(x)$ $\therefore 2I = I - \frac{\pi}{2}log2 \Rightarrow I = -\frac{\pi}{2}log2$ $I = \int \frac{x^2+1}{(x^2+2)(x^2+4)}dx$ Let $x^2 = y$, then $\frac{x^2+1}{(x^2+2)(x^2+4)} = \frac{y+1}{(y+2)(y+4)}$ Let $\frac{y+1}{(y+2)(y+4)} = \frac{A}{y+2} + \frac{B}{y+4}$ this gives $A = -\frac{1}{2}, B = \frac{3}{2}$ $\therefore I = -\frac{1}{2}\int \frac{1}{x^2+2}dx + \frac{3}{2}\int \frac{1}{x^2+4}dx$ $\Rightarrow I = -\frac{1}{2\sqrt{2}}\tan^{-1}\left(\frac{x}{\sqrt{2}}\right) + \frac{3}{4}\tan^{-1}\left(\frac{x}{2}\right) + c$	**1** **1** **1** **1** **1** **1** **1** **1** **2**
34)	*For writing the equation of line passing through (-9,0) and (0,6)* $-\frac{x}{9}+\frac{y}{6} = 1$ *Area of shaded region=* $2\left(\int_{-9}^{0} y_{st\ line} + \int_0^9 y_{ellipse}\right)$ $= 2\left(\int_{-9}^{0}\frac{2}{3}(9+x)dx + \int_0^9 \frac{2}{3}\left(\sqrt{9-x^2}\right)dx\right)$	**1** **1.5**

	$= 2\left(\frac{2}{3}\left(9x+\frac{x^2}{2}\right)_{-9}^{0}\right)+2\times\frac{2}{3}\left(\frac{x}{2}(\sqrt{81-x^2}+\frac{81}{9}sin^{-1}(\frac{x}{9})\right)_{0}^{9}$ $=2\times 27+2\times\frac{27\pi}{2}=27(\pi+2)sq\ units$	**1.5** **1**
35)	Equation of line in cartesian form $\frac{x}{1}=\frac{y-1}{2}=\frac{z-2}{3}$  Any point N on the line N ($\lambda, 2\lambda+1, 3\lambda+2$) D.r of PN ($\lambda-1, 2\lambda-5, 3\lambda-1$), but PN IS PERPENDICULAR TO GIVEN LINE $\therefore 1(\lambda-1)+2(2\lambda-5)+3(3\lambda-1)=0 \Rightarrow \lambda=1$ Hence N(1,3,5). Now N is midpoint of P and Q, where Q($\alpha,\beta,,\gamma$) is image of P, $\therefore \frac{\alpha+1}{2}=1, \frac{\beta+6}{2}=3, \frac{\gamma+3}{2}=5 \rightarrow \alpha=1, \beta=0, \gamma=7$ Therefore image of P is (1,0,7)	**1** **1** **1** **0.5** **0.5** **1**
	SECTION E	
36)	The relation can be defined as $xRy\ iff\ \lvert x_T-y_T\rvert \le 6, wher\ x_T = time\ at\ x's\ place$ (i) As $\lvert x_T-x_T\rvert=0$ so relation is reflexive (ii) If $(x,y)\in R \Rightarrow \lvert x_T-y_T\rvert \le 6 \Rightarrow \lvert y_T-x_T\rvert \le 6 \Rightarrow (y,x)\in R$ symmetric (iii) Let $(x,y)\in R$, $(y,z)\in R \Rightarrow \lvert x_T-y_T\rvert \le 6$, $\lvert y_T-z_T\rvert \le 6 \not\Rightarrow \lvert x_T-z_T\rvert \le 6$ so this relation is not transitive give example	 **1** **1** **2**
37)	(a) r=110 $sin\alpha$ $h=110cos\alpha$ from figure (b) V = $\pi r^2 h=\pi(110)^3 sin^2\alpha cos\alpha$ (c) $\frac{dV}{d\alpha}=\pi(110)^3(2sin\alpha cos^2\alpha - sin^3\alpha)$ For max or min $\frac{dV}{d\alpha}=0$ $\Rightarrow 2sin\alpha cos^2\alpha - sin^3\alpha=0$ $\Rightarrow tan^2\alpha=2$ $\Rightarrow \alpha=tan^{-1}\sqrt{2}$  	**1** **1** **1** **1**
38) (i)	Takes P(S), P(C) and P(T) as the probabilities that a person selected randomly from the staff prefers sugar, coffee and tea respectively. Finds P(T) = P(C′) = 1 − 0.6 = 0.4. Finds P(S|T) = 1 − 0.2 = 0.8. Uses theorem on total probability and finds the probability that a randomly selected staff prefers a beverage with sugar as: P(S) = P(C) × P(S|C) + P(T) × P(S|T) = 0.6 × 0.9 + 0.4 × 0.8 = 0.86 or $\frac{86}{100}$ or $\frac{43}{50}$	 **1** **1**

(ii)	Uses the sum of probabilities = 1 and finds the following probabilities: • P(without sugar|coffee) = 1 − 0.9 = 0.1 • P(tea) = 1 − 0.6 = 0.4 Uses Bayes' theorem to find the probability that a staff selected at random prefers coffee given that it is without sugar. P(coffee|without sugar) as: $\frac{\text{P(coffee)} \times \text{P(without sugar\|coffee)}}{\text{P(coffee)} \times \text{P(without sugar\|coffee)} + \text{P(tea)} \times \text{P(without sugar\|tea)}}$ $= \frac{0.6 \times 0.1}{0.6 \times 0.1 + 0.4 \times 0.2}$ (Award 0.5 marks if only the formula for Bayes' theorem is written correctly.) Simplifies the above expression and finds the required probability as $\frac{6}{14}$ or $\frac{3}{7}$.	**0.5** **0.5** **1**

तत् त्वं पूषन् अपावृणु

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