तत् त्वं पूषन् अपावृणु

केन्द्रीय विद्यालय संगठन

केंद्रीय विद्यालय संगठन

(जम्मू संभाग)

KENDRIYA VIDYALAYA SANGATHAN

(JAMMU REGION)

SAMPLE PAPER

FOR CLASS XII

MATHEMATICS (041)

क्षेत्रीय कार्यालय, जम्मू, नज़दीक राजकीय चिकित्सालय, गाँधी नगर

जम्मू-180004

REGIONAL OFFICE, JAMMU, NEAR GOVT. HOSPITAL,

GANDHI NAGAR, JAMMU-180004

KENDRIYA VIDYALAYA SANGATHAN, JAMMU REGION SAMPLE PAPER SET -1 CLASS : XII SUBJECT: MATHEMATICS TIME: 3 hrs M.M: 80

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 type (VSA) – type questions of 2 marks each.
4. Section C has 6 Short Answer (SA) – type questions of 3 mark each.
5. Section D has 4 Long Answer (LA) – type questions of 5 mark each.
6. Section E has 3 source based / case based / passage based / integrated units of assessment (4 marks each) with sub parts.

	Section – A	
1.	If A = $\begin{bmatrix} a & 2 \\ 2 & a \end{bmatrix}$ and $\lvert A^3 \rvert$ = 27, then the value of A is: (a) ±1 (b) ±2 (c)$\pm\sqrt{5}$ (d)$\pm\sqrt{7}$	1
2.	If X + Y = $\begin{bmatrix} 5 & 2 \\ 0 & 9 \end{bmatrix}$ and X - Y = $\begin{bmatrix} 3 & 6 \\ 0 & -1 \end{bmatrix}$, then Y =? (a) $\begin{bmatrix} 2 & 2 \\ 0 & 3 \end{bmatrix}$ (b) $\begin{bmatrix} 1 & -2 \\ 0 & 5 \end{bmatrix}$ (c)$\begin{bmatrix} -1 & -2 \\ 0 & -5 \end{bmatrix}$ (d) $\begin{bmatrix} 2 & -4 \\ 0 & 10 \end{bmatrix}$	1
3.	The projection of vector $\vec{a} = 2\,\hat{\imath} - \hat{\jmath} + \hat{k}$ along $\vec{b} = \hat{\imath} + 2\,\hat{\jmath} + 2\hat{k}$ is: (a) $\frac{2}{3}$ (b)$\frac{1}{3}$ (c) 2 (d) $\sqrt{6}$	1
4.	Let $f(x) = \frac{1-tanx}{4x-\pi}$, when 0 ≤ x ≤$\frac{\pi}{4}$ and x ≠ $\frac{\pi}{4}$; if $f(x)$ is continuous at x = $\frac{\pi}{4}$, then value of $f\left(\frac{\pi}{4}\right)$ is (a) $\frac{1}{2}$ (b) $-\frac{1}{2}$ (c) -1 (d)1	1
5.	If I=$\int \frac{dx}{x\,cos^2(\,1+logx\,)}$ = ________? (a)tan(1 + log x) + C (b) tan (log x) + C (c) tan x + C (d)none of these	1
6.	The solution set of the inequation x + 2y > 3 is : (a) half plane containing the origin (b) open half plane not containing the origin (c) first quadrant (d) none of these	1

7.	Area of parallelogram whose adjacent sides are $\hat{\imath} + \hat{k}$ and $2\,\hat{\imath} + \hat{\jmath} + \hat{k}$ is : (a) 4 (b)3 (c)$\sqrt{2}$ (d)$\sqrt{3}$	1
8.	Let I=$\int_{-\frac{\pi}{2}}^{\frac{\pi}{2}}(x^3 + x\cos x + \tan^5 x + 1)dx$ is equal to: (a)0 (b)2 (c) π (d)1	1
9.	If A, B are non – singular square matrices of the same order , then $(A^{-1}B)^{-1}$ is: (a)$A^{-1}B$ (b)$B^{-1} A$ (c)AB (d)$A^{-1}B^{-1}$	1
10.	The objective function of a L.P.P. is : (a) A constraint (b) A function to be optimized (c) A relation between the variables (d) none of these	1
11.	The value of x so that the points (3, -2) , (x , 2) and (8, 8) lie on a line is: (a) 0 (b) 4 (c) 5 (d) 3	1
12.	If A is a square matrix such that $A^2 = I$, then A-1 is equal to: (a) 2A (b) 0 (c) A (d)A + I	1
13.	If two events are independent , then : (a) they must be mutually exclusive (b) the sum of their probabilities must be equal to 1 (c) (a) and (b) both are correct (d) none of the above is correct	1
14.	The integrating factor of x log x $\frac{dy}{dx} + y = 2\,logx\ is$: (a)$\frac{1}{x}$ (b) x (c)log x (d)e^x	1
15.	The function $f(x) = e^{\|x\|}$ is : (a) continuous everywhere but not differentiable (b) continuous and differentiable everywhere (c) not continuous but differentiable (d) not continuous at x = 0	1
16.	The degree of the differential equation $\left[1 + \left(\frac{dy}{dx}\right)^2\right]^{\frac{3}{2}} = \frac{d^2y}{dx^2}$ is:	1

	(a)$\frac{3}{2}$ (b)4 (c) 2 (d)not defined	
17.	If two vectors $\vec{a}$ and $\vec{b}$ are such that $\|\vec{a}\|$ = 2 and $\|\vec{b}\|$ = 3 and $\vec{a}.\vec{b} = 4$ then $\|\vec{a} - 2\,\vec{b}\|$ is equal to: (a)$\sqrt{2}$ (b) $2\sqrt{6}$ (c) 24 (d) $2\sqrt{2}$	1
18.	Distance of the point (a, b, c) from y-axis is : (a) b (b) a (c)$\|a\| + \|b\|$ (d)$\sqrt{a^2+b^2}$	1
	Assertion Reasoning Based Questions	
19.	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 and R is not the correct explanation of A (c) A is true but R is false (d) A is false but R is true Assertion (A) : The value of cot $\left(cos^{-1}\frac{7}{25}\right)$ $is\ \frac{7}{24}$ Reason (R) : cot^{-1}(cotθ) $= \theta\ for\ all\ \theta \in (\,0\,, \pi\,)$	1
20.	Assertion (A) : The angle between the straight lines : $\frac{x+1}{2} = \frac{y-2}{5} = \frac{z+1}{4}$ and $\frac{x-1}{1} = \frac{y+2}{2} = \frac{z-1}{-3}$ is 90^0 Reason (R) : Skew lines are lines in different planes which are parallel and intersecting.	1
	SECTION B	2
21.	Find the principal value $cos^{-1}\left(cos\frac{2\pi}{3}\right) + sin^{-1}\left(sin\frac{2\pi}{3}\right)$. OR Prove that Greatest Integer Function f : R → R given by $f(x) = [x]$, is neither one one nor onto , where [x] denotes the greatest integer less than or equal to x .	
22.	Find the intervals in which the function f(x) = 2 x ^{2} – 3x is: (i) strictly increasing (ii) strictly decreasing	2
23.	If $\vec{a}$, $\overrightarrow{b}$ $and\ \vec{a} + \sqrt{3}\,\vec{b}$ be three unit vectors. Find angle between $\overrightarrow{a}$ $and\ \vec{b}$ OR Find the vector and Cartesian equation of the line that passes through the origin and (5, -2 , 3)	2
24.	If x = a cost , y = b sint find $\frac{d^2y}{dx^2}$	2

25.	Find a unit vector perpendicular to each of the vectors $\vec{a} + \overrightarrow{b}$ and $\vec{a} - \overrightarrow{b}$ where $\vec{a} = 3\,\hat{\imath} + 2\,\hat{\jmath} + 2\hat{k}$ and $\overrightarrow{b} = \hat{\imath} + 2\,\hat{\jmath} - 2\,\hat{k}$.	2
	SECTION C	
26.	Integrate: $\int \frac{\cos x}{(1-sinx)(2-sinx\,)}\,dx$	3
27.	A bag contains 3 red and 7 black balls. Two balls are drawn one after the other with replacement at random from the bag. If the second selection is given to be red, what is probability that the first is also red? OR From a lot of 30 bulbs which include 6 defective, a sample of 4 bulbs is drawn at random with replacement. Find the probability distribution of number of defective bulbs.	3
28.	Evaluate : $\int_0^{\pi} \frac{x}{1+sinx}\,dx$ OR Evaluate : $\int_1^4 [\|x-1\| + \|x-2\| + \|x-3\|]\,dx$	3
29.	Solve the initial value problem $e^{\frac{dy}{dx}} = x + 1\,;\ y(0) = 5$ OR Solve the differential equation : $\frac{dy}{dx} + 2\,y = x^2\ (x \neq 0)$. Also find the particular solution when x = 1 , y = $\frac{1}{4}$	3
30.	Find the minimum and maximum value of Z = 5x + 10 y : If x + 2y ≤ 120 $, x + y \geq 60, x - 2y \geq 0\,, x\,, y \geq 0$	3
31.	Integrate : - $\int \frac{sin^8x - cos^8x}{1-2\,sin^2x cos^2x}\,dx$	3
	SECTION D	
32.	Find the area bounded by the curve x ^{2} = 4y and the straight line x = 4y – 2.	5
33.	Let R be a relation on the set A of ordered pairs of integers defined by (x, y) R (u, v) iff if xv = y u . Show that R is an equivalence relation. OR Let N be the set of all Natural numbers. Show that the relation R on $\times N$, defined by (a, b) R (c, d) iff a + d = b + c ∀ (a, b) , (c, d) $\in N \times N$ is an equivalence relation.	5
34.	Find the co-ordinates of the foot of perpendicular drawn from the point A (-1 , 8, 4) to the line joining the points B (0 , -1 , 3) and C (2 , -3 , -1) . Hence find the image of the point A in the line BC. OR By computing the shortest distance, determine whether the following pairs of lines intersect or not.	5

	$\vec{r} = (\hat{\imath} + 2\hat{\jmath} + 3\hat{k}) + \mu(\hat{\imath} - 3\hat{\jmath} + 2\hat{k})$ and \ $\vec{r} = (4\hat{\imath} + 5\hat{\jmath} + 6\hat{k}) + \rho(2\hat{\imath} + 3\hat{\jmath} + \hat{k})$	
35.	If $A^{-1} = \begin{bmatrix} 3 & -1 & 1 \\ -15 & 6 & -5 \\ 5 & -2 & 2 \end{bmatrix}$ $and\ B = \begin{bmatrix} 1 & 2 & -2 \\ -1 & 3 & 0 \\ 0 & -2 & 1 \end{bmatrix}$ find $(AB)^{-1}$	5
	SECTION E CASE STUDY BASED QUESTIONS	
36.	In an amusement park , the track of the snake slide is given by the curve $y = x(2-x)^2$. It starts from a point O where x = 0 and goes till point A where x = 3 (i)At how many point(s) , the track takes a smooth turn ? (ii)In which interval track is strictly decreasing with respect to the ground level. (iii)Slope of the curve y = f(x) is defined as $\frac{dy}{dx}$. What is the rate of change of the slope of the track when x = 2 units? Given that x changes at the rate of 0.05 units per unit time OR (iii)For what value of x , tangent drawn to the track has a slope – 1 ?	1,1,2
37.	A window of perimeter 12 m (including the base of the arch) is in the form of a rectangle surmounted by a semicircle on upper side of length. The semicircular portion is fitted with coloured glass while the rectangular part is fitted with clear glass. Clear glass transmits three times as much light per square meter as the coloured glass does. Let x and y be the length and breadth of the rectangular portion. Let coloured glass transmits μ light per square meter.  (i) Find a relation between x and y (ii) If f (x) be the total light transmitted by window , then find f (x) (iii)Use first derivative test to find the length x to transmits maximum light OR (iii) Use second derivative test to find the length x to transmits maximum light	1,1,2
38.	In a certain city only two newspapers A and B are published. It is known that 25% of the	1,1,2

	city population reads newspaper A and 20% reads newspaper B while 8% reads both the newspaper A and B. It is also known that 30% of those who read A but not B look into the advertisements and 40% of those who read B but not A look into the advertisement while 50% of those who read both A and B look into advertisements . Let us define the following events: E_1 = person reads only newspaper A E_2 = person reads only newspaper B E_3 = person reads both the newspapers A and B E = person looks into the advertisement (i) Find P(E) (ii) Find P (E_1/E) (iii) Find P (E_2/E)	

KENDRIYA VIDYALAYA SANGATHAN, JAMMU REGION SAMPLE PAPER SET -2 CLASS : XII — SUBJECT: MATHEMATICS TIME: 3 hrs — M.M: 80

General Instructions:

1. This Question paper contains - five sections A, B, C, D and E. Each section is compulsory. However, there are internal choices in some questions.
2. Section A has 18 MCQ's and 02 Assertion-Reason based questions of 1 mark each.
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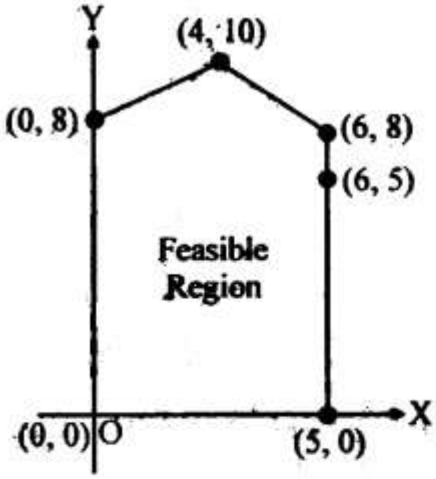
Sr. No.	**SECTION A** **All questions are compulsory. In case of internal choices attempt any one.**	**Marks**
1	A matrix A = $[a_{ij}]_{m\times n}$ is said to be symmetric if ∀ i, j (a) $a_{ij} = 0$ (b) $a_{ij} = a_{ji}$ (c) $a_{ij} = a_{ij}$ (d) $a_{ij} = 1$	1
2	If A is a square matrix of order 3, $\|A\| = 3$, then $\|A'\| =$ (a) 9 (b) -9 (c) 3 (d) -3	1
3	The scalar product of $5\hat{i} + \hat{j} - 3\hat{k}$ and $3\hat{i} - 4\hat{j} + 7\hat{k}$ is (a) 10 (b) -10 (c) 15 (d) -15	1
4	For what value of λ is the function defined by $f(x) = \begin{cases} \lambda(x^2 - 2), & if \quad x \leq 0 \\ 4x + 8 & if \quad x > 0 \end{cases}$ continuous at $x = 0$? (a) - 4 (b) -3 (c) 3 (d) None of these	1
5	$\int e^x(\ sinx + cosx)dx =$ (a) $e^x \sin x + C$ (b) $e^x \cos x + C$ (c) e^x (d) None of these	1
6	If m and n, respectively, are the order and the degree of the differential equation $\frac{d^2y}{dx^2} + y = 0$ then m + n is (a) 1 (b) 2 (c) 3 (d) none of these	1

7	The feasible region for a LPP is shown in the figure. Let Z = 3x – 4y be the objective function. Minimum of Z occurs at  (a) (0, 0) (b) (4, 10) (c) (5, 0) (d) (0, 8)	1
8	The scalar projection of the vector $2\mathrm{i} - \mathrm{j} + \mathrm{k}$ on the vector $\mathrm{i} - 2\mathrm{j} + \mathrm{k}$ is (a) $4/\sqrt{6}$ (b) $5/\sqrt{6}$ (c) $4/\sqrt{3}$ (d) $7/\sqrt{6}$	1
9	$\int \frac{e^{\sin^{-1} x}}{\sqrt{1-x^2}}$ dx is (a) $e^{\sin^{-1} x}$ + C (b) $e^{\cos^{-1} x}$ + C (c) e^{x} (d) None of these	1
10	If A, B are non-singular square matrices of the same order, then $(AB)^{-1}$ = (a) BA (b) $A^{-1} B^{-1}$ (c) AB (d) $B^{-1}A^{-1}$	1
11	Objective function of a linear programming problem is (a) a constraint (b) function to be optimized (c) A relation between the variables (d) None of these	1
12	If the matrix $A = \begin{bmatrix} 3 & x-1 \\ 2x+3 & x+2 \end{bmatrix}$ is a symmetric matrix, then the value of x is (a) – 4 (b) 4 (c) 3 (d) None of these	1

13	If A and B are symmetric matrices of the same order, then (a) AB is a symmetric matrix (b) A + B is a skew-symmetric matrix (c) AB + BA is a symmetric matrix (d) AB – BA is a symmetric matrix	1
14	Given two independent events A and B such that P(A) =0.3, P(B) = 0.6 and P($A' \cap B'$) is (a) 0.9 (b) 0.18 (c) 0.28 (d) 0.1	1
15	The general solution of the differential equation $ydx - xdy = 0$ is (a) $xy = C$ (b) $x = Cy^2$ (c) $y = Cx$ (d) $y = Cx^2$	1
16	$\frac{dy}{dx}$ when x = $2at^2$, $y = at^4$ is (a) t^3 (b) t^2 (c) t (d) 0	1
17	If $\lvert\vec{a}\rvert = \sqrt{26}$, $\lvert b\rvert = 7$ and $\lvert\vec{a} \times \vec{b}\rvert = 35$, then $\vec{a}.\vec{b}$ = (a) 8 (b) 12 (c) 9 (d) 7	1
18	P is a point on the line joining the points $A(0,5,-2)$ and $B(3,-1,2)$. If the x-coordinate of P is 6, then its z-coordinate is (a) 10 (b) 6 (c) -6 (d) -10	1
19	**ASSERTION-REASON BASED QUESTION** 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. **Question 19**. Assertion (A): The value of $\cos^{-1}(-\frac{1}{2})$ is $-\pi/3$	1

	Reason (R): $\cos^{-1}(-x) = \pi - x$	
20	**Question 20**. Assertion (A): The direction ratios of the line joining the points (1, 2, 3) and (-1, 2, 0) are -2,0,-3 Reason (R): The direction ratios of the line joining the points (x_1, y_1, z_1) and (x_2, y_2, z_2) are $x_2 - x_1, y_2 - y_1, z_2 - z_1$	1
	Section B	
21	Let R be the relation in the set **Z** of integers given by R = {(a, b): 3 divides a – b}. Show that the relation R is transitive. OR Find the value of $\sin^{-1}\sin\left(\frac{15\pi}{7}\right)$	2
22	Show that $y = \log(1+x) - \frac{2x}{2+x}$, $x > -1$, is an increasing function of x throughout its domain.	2
23	Find the value of p for which $3\hat{i} + 2\hat{j} + 9\hat{k}$ and $\hat{i} + p\hat{j} + 3\hat{k}$ are parallel vectors. OR Write the direction cosines of the line $\frac{x-2}{2} = \frac{2y-5}{-3} = \frac{z}{2}$	2
24	Find $\frac{dy}{dx}$ if $y = \sin^{-1}\left(\frac{2x}{1+x^2}\right)$	2
25	Find $\lvert\vec{x}\rvert$ if $(\vec{x} - \vec{a}).(\vec{x} + \vec{a}) = 12$, where $\vec{a}$ is a unit vector.	2
	Section C	
26	Evaluate : $\int \frac{1}{\sqrt{3-2x-x^2}}dx$	3
27	Two cards are drawn from a well shuffled pack of 52 cards. Find the probability distribution of the number of spades. OR Consider the experiment of tossing a coin. If the coin shows tail, toss it again but if it shows head, then throw a die. Find the conditional probability of the event 'the die shows a number greater than 3'given that 'there is at least one head'.	3
28	Evaluate $\int_0^4 \lvert x-1\rvert dx$	3

	OR Evaluate $\int_1^2 \frac{1}{x(1+logx)^2} dx$	
29	Solve the differential equation: $ydx + (x - y^2)dy = 0$ OR Solve the differential equation: $xdy - ydx = \sqrt{x^2 + y^2}\, dx$	3
30	Minimise Z = – 3x + 4 y subject to x + 2y ≤ 8, 3x + 2y ≤ 12, x ≥ 0, y ≥ 0	3
31	Evaluate $\int \frac{x}{(x+1)(x+2)(x+3)} dx$	3
	Section D	
32	Find the area of the region bounded by the curve $y^2 = x$ and the lines $x = 1$ and $x = 4$ and the $x - axis$ in the first quadrant.	5
33	Show that the relation R defined in the set A of all triangles as R = $\{(T_1, T_2)$: T_1 is similar to $T_2\}$, is equivalence relation. Consider three right angle triangles T_1 with sides 3, 4, 5, T_2 with sides 5, 12, 13 and T_3 with sides 6, 8, 10. Which triangles among T_1, T_2 and T_3 are related? OR Show that the relation R in set A of points in a plane given by R = { (P ,Q) : distance of the point P from the origin is same as the distance of the point Q from the origin } , is an equivalence relation. Further show that set of all points related to P ≠ (0 , 0) is the circle passing through P with origin as Centre.	5
34	Find the shortest distance between the following lines $\vec{r} = (\hat{i} + 2\hat{j} + 3\hat{k}) + \lambda(\hat{i} - 3\hat{j} + 2\hat{k})$ and $\vec{r} = 4\hat{i} + 5\hat{j} + 6\hat{k} + \mu(2\hat{i} + 3\hat{j} + \hat{k})$ OR Find the image of the point (1, -2, 1) in the line $\frac{x-2}{3} = \frac{y+1}{-1} = \frac{z+3}{2}$	5
35	If $A = \begin{bmatrix} 1 & 1 & 1 \\ 1 & 2 & -3 \\ 2 & -1 & 3 \end{bmatrix}$, prove that $A^3 - 6A^2 + 5A + 11I = O$. Hence, find A^{-1}.	5
36	**CASE STUDY 1** P(x) = $-5x^2 + 125x + 37500$ is the total profit function of a company, where x is the production of the company.	4

	1. What will be the production when the profit is maximum? **2.** What will be the maximum profit? **3.** Check in which interval the profit is strictly increasing.	
37	The relation between the height of a plant (y in cm) with respect to the exposure to sunlight is given by $y = 4x - \frac{1}{2}x^2$, where x is the number of days it is exposed to sunlight. Based on the above information, answer the following 1. Find the rate of growth of the plant with respect to sunlight. 2. What number of days it will take for the plant to grow to the maximum height? 3. What will be the height of the plant after 2 days ?	1,1,2
38	The reliability of a COVID PCR test is specified as follows: Of people having COVID, 90% of the test detects the disease but 10% goes undetected. Of people free of COVID, 99% of the test is judged COVID negative but 1% are diagnosed as showing COVID positive. From a large population of which only 0.1% have COVID, one person is selected at random, given the COVID PCR test, and the pathologist reports him/her as COVID positive. Based on the above information, answer the following **1.** What is the probability of the 'person to be tested as COVID positive' given that 'he is actually having COVID? **2.** What is the probability of the 'person to be tested as COVID positive' given that 'he is actually not having COVID'? **3.** What is the probability that the 'person is actually having COVID given that 'he is tested as COVID positive'?	4

KENDRIYA VIDYALAYA SANGATHAN, JAMMU REGION

SAMPLE PAPER SET -3

CLASS : XII **SUBJECT: MATHEMATICS**

TIME: 3 hrs **M.M: 80**

General Instructions :

1. This Question paper contains - five sections A, B, C, D and E. Each section is compulsory. However, there are internal choices in some questions.
2. Section A has 18 MCQ's and 02 Assertion-Reason based questions of 1 mark each. 3. Section B has 5 Very Short Answer (VSA)-type questions of 2 marks each.
4. Section C has 6 Short Answer (SA)-type questions of 3 marks each.
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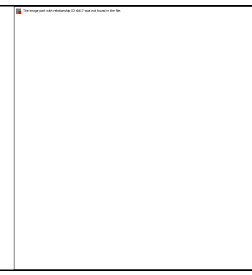
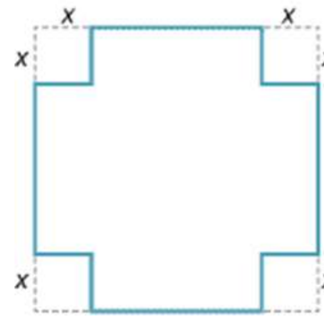
S.NO		MARKS
	SECTION A (Multiple Choice Questions) Each question carries 1 mark	
1	The order of $[x\ y\ z]\begin{bmatrix} a & h & g \\ h & b & f \\ g & f & c \end{bmatrix}\begin{bmatrix} x \\ y \\ z \end{bmatrix}$ is (a)3×1 (b)1×1 (c)1×3 (d)3×3	1
2	If A is an invertible matrix of order 2, then det (A^{-1}) is equal to (a) det (A) (b) 1/det (A) (c) 1 (d) 0	1
3	If $\|a \times b\| = 4$ and $\|a.b\| = 2$, then $\|a\|^2\ \|b\|^2$ is equal to: A. 4 B. 6 C. 20 D. 2	1
4	If $f(x) = \log(\log x)$, then $f'(x)$ at $x = e$ is (a) e (b) 1/e (c) 1 (d)None of these	1
5	$\int_1^{\sqrt{3}} \frac{dx}{1+x^2}$ equals (a)$\frac{\pi}{3}$ (b) $\frac{2\pi}{3}$ (c) $\frac{\pi}{6}$. (d) $\frac{\pi}{12}$	1
6	The order and degree of the differential equation $(y''')^2 + (y'')^3 + \sin y' + 1 = 0$ is (a)3,3 (b) 3,2 (c) 2,3 (d) 3,not defined	1
7	The point which does not lie in the half-plane 2x + 3y -12 < 0 is: A. (2,1) B. (1,2) C. (-2,3) D. (2,3)	1

8	The Area of triangle whose adjacent sides are $2\,\hat{\imath} + \hat{\jmath} - \hat{k}$ and $\hat{\jmath} + \hat{k}$ is (a)3 sq. units b) $\sqrt{3}$ sq. units c)2 sq. units d)1 sq. units	1
9	The value of the integral $\int_{\frac{1}{3}}^{1} \frac{\left(x-x^{3}\right)^{\frac{1}{3}}}{x^{4}} dx$ is A. 6 B. 0 C. 3 D. 4	1
10	Given that A is a square matrix of order 3 and |A| = -4, then |adj A| is equal to (a) -4 (b) 4 (c) -16 (d) 16	1
11	The feasible region for a LPP is shown shaded in the 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
12	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
13	If $A^2 - A + I = 0$, then $A^{-1} =$ (a) A^{-2} (b) A + I (c) I – A (d) A – I	1
14	If P (A) = 6/11, P (B) = 5/11 and P (A ∪ B) = 7/11, what is the value of P(B|A)? A. ⅓ B. ⅔ C. 1 D. None of the above	1
15	The number of arbitrary constants in the particular solution of a differential equation of third order is: A. 3 B. 2 C. 1 D. 0	1
16	A function $f(x)=\begin{cases} \frac{\sin x}{x}+\cos x & , \quad x \neq 0 \\ 2k & , \quad x=0 \end{cases}$ is continuous at x = 0 for (a) k = 1 (b) k = 2 (c) 3 (d)4	1

17	$\lvert a \times b\rvert^2 + \lvert a.b\rvert^2 = 144$ and $\lvert a\rvert = 4$, then $\lvert b\rvert$ is equal to (a) 12 (b) 3 (c) 8 (d) 4	1
18	The vector equation for the line passing through the points (–1, 0, 2) and (3, 4, 6) is: A. i + 2k + λ(4i + 4j + 4k) B. i – 2k + λ(4i + 4j + 4k) C. -i+2k+ λ(4i + 4j + 4k) D. -i+2k+ λ(4i – 4j – 4k)	1
	Read Assertion and reason carefully and write correct option for each question (a) Both A and R are correct; R is the correct explanation of A. (b) Both A and R are correct; R is not the correct explanation of A. (c) A is correct; R is incorrect. (d) R is correct; A is incorrect.	
19	Assertion(A): $\sin^{-1}(\sin\frac{2\pi}{3})= \frac{2\pi}{3}$ Reason(R) : $\sin^{-1}(\sin\varphi)= \varphi$,if $\varphi\epsilon[\frac{-\pi}{2}, \frac{\pi}{2}]$	1
20	Assertion (A): The points with position vectors a,b,c are collinear if $2\vec{a} - 7\vec{b} + 5\vec{c}$=0. Reason (R): The points with position vectors a,b,c are collinear if $l\vec{a} + m\vec{b} + n\vec{c} = 0$	1
	SECTION B This section comprises of very short answer type-questions (VSA) of 2 marks each	
21	Find the values of $\tan^{-1}\left(\tan\frac{3\pi}{4}\right)$ OR Check whether the function f: R→R be given by f(x) =$\lvert x\rvert$ is one-one or onto	2
22	The volume of a sphere is increasing at the rate of 8 cm^3/s. Find the rate at which its surface area is increasing when the radius of the sphere is 12 cm.	2
23	If a line makes angles 90°, 135°, 45° with the x, y and z-axes respectively, find its direction cosines. OR If $\vec{a} = 4\hat{i} - \hat{j} + \hat{k}$ and $\vec{b} = 2\hat{i} - 2\hat{j} + \hat{k}$, then find a unit vector parallel to the vector $\vec{a} + \vec{b}$.	2
24	If $x = at^2$, $y = 2at$, then find $\frac{dy}{dx}$	2
25	If $\vec{a}, \vec{b}, \vec{c}$ are unit vectors such that $\vec{a} + \vec{b} + \vec{c} = 0$, then write the value of $\vec{a}\cdot\vec{b} + \vec{b}\cdot\vec{c} + \vec{c}\cdot\vec{a}$.	2
	SECTION C (This section comprises of short answer type questions (SA) of 3 marks each)	
26	Evaluate $\int \frac{1}{\sqrt{(x-1)(x-2)}}dx$	3

27	Probabilities of solving a specific problem independently by A and B are 1/2 and 1/3, respectively. If both try to solve problem independently, then find the probability that (i) problem is solved. (ii) exactly one of them solves the problem. Or A class has 15 students whose ages are 14, 17, 15, 14, 21, 17, 19, 20, 16, 18, 20, 17, 16, 19 and 20 years. One student is selected in such a manner that each has the same chance of being chosen and the age X of the selected student is recorded. What is the probability distribution of the random variable X. Find the mean of X.	3
28	Evaluate $\int x \sin^{-1} x \, dx$ Or Evaluate $\int_{\frac{\pi}{6}}^{\frac{\pi}{3}} \frac{Sin\, x + Cos\, x}{\sqrt{Sin\, 2x}} dx$	3
29	Solve the differential equation $(1 + e^{2x})dy + (1 + y^2)e^x dx = 0$, given that $x = 0, y = 1$ Or Solve the differential equation $(1 + x^2)\frac{dy}{dx} + y = e^{\tan^{-1} x}$	3
30	Solve the following linear programming problem graphically: Minimize Z = 200 x + 500 y subject to the constraints: $x + 2y \geq 10$,$3x + 4y \leq 24$,$x \geq 0$, $y \geq 0$	3
31	Evaluate $\int_{\frac{\pi}{6}}^{\frac{\pi}{3}} \frac{dx}{1+\sqrt{Tan\, x}}$	3
	SECTION D (This section comprises of long answer-type questions (LA) of 5 marks each)	
32	Find the area of the region bounded by the parabola $y = x^2$ and $y = \|x\|$.	5
33	Show that the relation S defined on set N × N by (a, b) S (c, d) ⇒ a + d = b + c is an equivalence relation Or 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	5
34	Find the distance between the lines l_1 and l_2 given by: $\vec{r} = \hat{\imath} + 2\hat{\jmath} - 4\hat{k} + \lambda(2\hat{\imath} + 3\hat{\jmath} + 6\hat{k})$ $\vec{r} = 3\hat{\imath} + 3\hat{\jmath} - 5\hat{k} + \mu(2\hat{\imath} + 3\hat{\jmath} + 6\hat{k})$ Or Prove that the line through A (0, – 1, – 1) and B(4, 5, 1) intersects the line through C (3, 9, 4) and D (- 4, 4, 4).	5
35	Determine the product $\begin{bmatrix} -4 & 4 & 4 \\ -7 & 1 & 3 \\ 5 & -3 & -1 \end{bmatrix}\begin{bmatrix} 1 & -1 & 1 \\ 1 & -2 & -2 \\ 2 & 1 & 3 \end{bmatrix}$ and using it solve the equations.	5

	$x + y + 2z = 1, -x - 2y + z = 4, x - 2y + 3z = 0$	
	SECTION E (This section comprises of 3 case study/ passage-based questions of 4 marks each with two sub parts. First two case study questions have three sub parts (i), (ii) and(iii) of marks 1,1 and 2 respectively. The third case study question has two sub parts of 2 marks each.)	
36	A square sheet of cardboard with each side *a* centimeter is to be used to make an open-top box by cutting a small square of cardboard from each of the corners and bending up the sides  i) The Volume function will be: ii) What is the length of side of the small squares if the box is to have volume as large as possible? iii) Maximum volume is OR What will be the lateral surface area of the box when the volume is maximum?	1,1,2
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: i. The rate of the growth of the plant with respect to sunlight is. ii. What is the number of days it will take for the plant to grow to the maximum height. iii. What will be the maximum height of the plant OR What will be the height of the after two days.	1,1,2
38	There are three categories of students in a class of 60 students: A: Very hard-working students B: Regular but not so hard working C: Careless and irregular. It's known that 10 students are in category A, 30 in category B and rest in category C. It is also found that probability of students of category A, unable to get good marks in the final year examination is, 0.002, of category B it is 0.02 and of category C, this	2,2

	probability is 0.20. i. Assume that a student selected at random was found to be the one who could not get good marks in the examination. Then the probability that this student is either of category A or of category B is. ii. The probability that the student is unable to get good marks in the examination is.	

KENDRIYA VIDYALAYA SANGATHAN, JAMMU REGION

SAMPLE PAPER SET -4

CLASS : XII **SUBJECT: MATHEMATICS**

TIME: 3 hrs **M.M: 80Time**

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 (Multiple Choice Questions)

Each question carries 1 mark

Q1. Let f : **R** □ **R** be defined as f(x) = 3x. Choose the correct answer:

(a) f is one-one onto (b) f is many-one onto

(c) f is one-one but not onto (d) f is neither one-one nor onto

Q2. Assume X, Y, Z, W and P are matrices of order 2 · n, 3 · k, 2 · p, n · 3 and p · k, respectively. The restriction on n, k and p so that PY + WY will be defined are:

(a) k = 3, p = n (b) k is arbitrary, p = 2

(c) p is arbitrary, k = 3 (d) k = 2, p = 3

Q3. If $\vec{a}, \vec{b}, \vec{c}$ are any three mutually perpendicular vectors of equal magnitude a, then $|\vec{a}+\vec{b}+\vec{c}|$ is equal to:

(a) a (b) $\sqrt{2}a$ (c) $\sqrt{3}a$ (d) 2a

Q4. The function f(x) = $\begin{cases} \frac{\sin 3x}{x}, & x \neq 0 \\ \frac{k}{2}, & x = 0 \end{cases}$ is continuous at x = 0, then k =

(a) 3 (b) 6 (c) 9 (d) 12

Q5. The value of $\int \frac{\cos\sqrt{x}}{\sqrt{x}}dx$ is:

(a) $2\cos\sqrt{x}+C$ (b) $\sqrt{\frac{\cos x}{x}}+C$ (c) $\sin\sqrt{x}+C$ (d) $2\sin\sqrt{x}+C$

Q6. Integrating factor of the differential equation $\cos x \frac{dy}{dx} + y \sin x = 1$, is:

(a) sin x (b) sec x (c) tan x (d) cos x

Q7. The region represented by the inequation system x, y ε 0, y δ 6, x + y δ 3 is:

(a) Unbounded in first quadrant

(b) Unbounded in first and second quadrants

(c) Bounded in first quadrant

(d) None of these

Q8. If the vectors $3\hat{i} + \lambda\hat{j} + \hat{k}$ and $2i - \hat{j} + 8\hat{k}$ are perpendicular, then ⌊ is equal to:

(a) 14 (b) 7 (c) 14 (d) $\frac{1}{7}$

Q9. $\int \frac{dx}{\sin^2 x \cos^2 x}$ equals:

(a) tan x + cot x + C (b) tan x   cot x + C

(c) tan x cot x + C (d) tan x   cot 2x + C

Q10 . If A = $\begin{vmatrix} a_{11} & a_{12} & a_{13} \\ a_{21} & a_{22} & a_{23} \\ a_{31} & a_{32} & a_{33} \end{vmatrix}$ and C_{ij} is cofactor of a_{ij} in A, then value of |A| is given by:

(a) $a_{11} C_{31} + a_{12} C_{32} + a_{13} C_{33}$ (b) $a_{11} C_{11} + a_{12} C_{21} + a_{13} C_{31}$

(c) $a_{21} C_{11} + a_{22} C_{12} + a_{23} C_{13}$ (d) $a_{11} C_{11} + a_{21} C_{21} + a_{31} C_{31}$

Q11. Objective function of a LPP is:

(a) A constraint (b) A function to be optimized

(c) A relation between the variables (d) None of these

Q12. . Let $A = \begin{bmatrix} 1 & \sin\theta & 1 \\ -\sin\theta & 1 & \sin\theta \\ -1 & -\sin\theta & 1 \end{bmatrix}$, where 0 δ ⎝ δ 2□. Then:

(a) Det(A) = 0 (b) Det(A)   (2,   )

(c) Det(A)   (2, 4) (d) Det(A)   [2, 4]

Q13. If A is a square matrix such that $A^2 = A$, then $(I + A)^3$ 7A is equal to:

(a) A (b) I A (c) I (d) 3A

Q14 Out of 30 consecutive integers, 2 are chosen at random. The probability that their sum is odd, is:

(a) $\frac{14}{29}$ (b) $\frac{16}{29}$ (c) $\frac{15}{29}$ (d) $\frac{10}{29}$

Q15. The degree of the differential equation $\left(\frac{d^2y}{dx^2}\right)^2 - \left(\frac{dy}{dx}\right) = y^3$, is:

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

Q16. The value of a for which the function f(x) = $\begin{cases} 5x-4, & \text{if } 0<x\le 1 \\ 4x^2+3ax, & \text{if } 1<x<2 \end{cases}$ is continuous at every point of its domain, is:

(a) $\frac{13}{3}$ (b) 1 (c) 0 (d) 1

Q17. A unit vector perpendicular to both $\hat{i}+\hat{j}$ and $\hat{j}+\hat{k}$ is:

(a) $\hat{i}-\hat{j}+\hat{k}$ (b) $\hat{i}+\hat{j}+\hat{k}$ (c) $\frac{\hat{i}+\hat{j}+\hat{k}}{\sqrt{3}}$ (d) $\frac{\hat{i}-\hat{j}+\hat{k}}{\sqrt{3}}$

Q18 The angle between the straight lines $\frac{x+1}{2}=\frac{y-2}{5}=\frac{z+3}{4}$ and $\frac{x-1}{1}=\frac{y+2}{2}=\frac{z-3}{-3}$ is:

(a) 45° (b) 30° (c) 60° (d) 90°

ASSERTION-REASON BASED QUESTIONS

In the following questions, a statement of assertion (A) is followed by a statement of Reason (R). Choose the correct answer out of the following choices.

(a) Both A and R are true and R is the correct explanation of A.

(b) Both A and R are true but R is not the correct explanation of A.

(c) A is true but R is false.

(d) A is false but R is true.

Q19. Assertion: $\sin^{-1}(8/17) + \sin^{-1}(3/5) = \sin^{-1}(77/85)$

Reason: $\tan^{-1} x + \tan^{-1} y = \tan^{-1}(x + y/1 - xy)$

Q20.

Assertion (A): The points with position vectors a,b,c are collinear if $2\bar{a}-7\bar{b}+5\bar{c}=0$.

Reason (R): The points with position vectors a,b,c are collinear if $l\bar{a}+m\bar{b}+n\bar{c}=0$.

<u>SECTION B</u>

<u>This section comprises of very short answer type-questions (VSA) of 2 marks each</u>

Q21. Prove that : $2\sin^{-1}\frac{3}{5} = \tan^{-1}\frac{24}{7}$

OR

Check whether the relation R defined in the set

{1, 2, 3, 4, 5, 6} as R = {(a, b) : b = a + 1}

is reflexive, symmetric or transitive.

Q22. Find the intervals in which the function f given by $f(x) = 2x^2 \quad 3x$ is: Strictly increasing and Strictly decreasing

Q23. Find the Cartesian equation of the line which passes through the point $(-2, 4, -5)$ and parallel to the line given by $\frac{x+3}{3} = \frac{y-4}{5} = \frac{z+8}{6}$.

<u>OR</u>

Find the values of p so that the lines $\frac{1-x}{3} = \frac{7y-14}{2p} = \frac{z-3}{2}$ and $\frac{7-7x}{3p} = \frac{y-5}{1} = \frac{6-z}{5}$ are cut each other at right angles.

Q24. If $y = 5\cos x \quad 3\sin x$, prove that $\frac{d^2y}{dx^2} + y = 0$.

Q25. For given vectors $\vec{a} = 2\hat{i} - \hat{j} + 2\hat{k}$ and $\vec{b} = -\hat{i} + \hat{j} - \hat{k}$, find the unit vector in the direction of $\vec{a} + \vec{b}$.

SECTION C

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

Q26. Integrate the rational function w.r.t x : $\int \frac{x}{(x^2+1)(x-1)}$ dx

Q27. In a hostel, 60% of the students read Hindi news paper, 40% read English news paper and 20% read both Hindi and English news papers. A student is selected at random:

(i) Find the probability that she reads neither Hindi nor English news papers.

(ii) If she reads Hindi news paper, find the probability that she reads English news paper.

(iii) If she reads English news paper, find the probability that she reads Hindi news paper.

OR

There are three coins. One is a two headed coin (having head on both faces), another is a biased coin that comes up heads 75% of the time and third is an unbiased coin. One of the three coins is chosen at random and tossed, it shows heads, what is the probability that it was the two headed coin?

Q28. Integrate w.r.t x : $\int \cos^4 2x \, dx$

OR

Integrate the following functions .

$$\frac{6x+7}{\sqrt{(x-5)(x-4)}}$$

Q29. Solve the differential equation to find the general solution : $x\,dy - y\,dx = \sqrt{x^2+y^2}\,dx$

OR

For of the differential equations find the particular solution satisfying the given condition **:** $\left[x\sin^2\left(\frac{y}{x}\right) - y\right]dx + x\,dy = 0;\ y = \frac{\pi}{4}$ when x=1

Q30**.** Maximize **Z** = $5x+3y$ subject to $3x+5y \le 15,\ 5x+2y \le 10,\ x \ge 0,\ y \ge 0.$

Q31. **By using the properties of definite integrals, evaluate the integral :**

$$\int_0^{\frac{\pi}{2}} \left(2\log \sin x - \log \sin 2x\right)\, dx$$

<u>SECTION D</u>

<u>(This section comprises of long answer-type questions (LA) of 5 marks each)</u>

Q32. Find the area of the region in the first quadrant enclosed by X- axis, line $x = \sqrt{3}y$ and the circle $x^2 + y^2 = 4$.

Q33. Show that the relation R in the set **Z** of integers given by R = {(a, b) : 2 divides a b} is an equivalence relation.

OR

Let A and B be sets. Show that f : A · B □ B · A such that f(a, b) = (b, a) is bijective function.

Q34. 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 $\frac{x-15}{3} = \frac{y-29}{8} = \frac{z-5}{-5}$.

OR

Find the shortest distance between the lines whose vector equations are

$\vec{r} = (1-t)\hat{i} + (t-2)\hat{j} + (3-2t)\hat{k}$ and $\vec{r} = (s+1)\hat{i} + (2s-1)\hat{j} - (2s+1)\hat{k}$ ..

Q35. If $A = \begin{bmatrix} 2 & -3 & 5 \\ 3 & 2 & -4 \\ 1 & 1 & -2 \end{bmatrix}$, find A^{1}. Using A^{1} solve the system of equations:

2x 3y + 5z = 11, 3x + 2y 4z = 5 and x + y 2z = 3

<u>SECTION E</u>

The case study based questions are compulsory. Attempt any 3 sub parts from each questions. Each questions carries 1 mark.

Q36. An architect design a tank with rectangular sides and rectangular base , open at the top so that its depth is 2m and volume is 8 cubic meters.

(i) If x is the length and y is breadth of the tank then what is the relation between x and y

(ii) What is the area of four walls and If building of tank cost Rs 45 per m^2 for sides , then what will be the total cost for the sides of the tank

(iii) If the building of the tank costs Rs 70 per m^2 for the base , then what will the total cost for the base of the tank

OR

What is the cost of least expensive tank

Q37. $P(x) = -5x^2 + 125x + 37500$ is the total profit function of a company, where x is the production of the company.

(i) What will be the production when the profit is maximum and What will be the maximum profit?

(ii) Find the interval in which the profit is strictly increasing .
(iii) When the production is 2units what will be the profit of the company

Or

What will be production of the company when the profit is Rs 38250?

Q 38. A factory production line is manufacturing bolts using three machines A,B and C. Of the total output, machine A is responsible for 25%, machine B for 35% and machine C for rest. It is known from previous experience with machine that 5% of the output from A, 4% from B and 2% from C are defective. A bolt is chosen at random from the production line and found to be defective .

(i) What is the probability that Machine A produces a defective bolt?

(ii) Total Probability of defective bolt is

(iii)What is the probability that the defective bolt is from machine A

OR

What is the probability that the defective bolt is from machine B

KENDRIYA VIDYALAYA SANGATHAN, JAMMU REGION
SAMPLE PAPER SET -5

CLASS : XII **SUBJECT: MATHEMATICS**

TIME: 3 hrs **M.M: 80**

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 type (VSA) – type questions of 2 marks each.
4. Section C has 6 Short Answer (SA) – type questions of 3 mark each.
5. Section D has 4 Long Answer (LA) – type questions of 5 mark each.
6. Section E has 3 source based / case based / passage based / integrated units of assessment (4 marks each) with sub parts.

	Section – A	
1.	If S= $\begin{bmatrix} a & b \\ c & d \end{bmatrix}$ then adjA is equal to : (a)$\begin{bmatrix} d & b \\ c & a \end{bmatrix}$ (b)$\begin{bmatrix} d & -b \\ -c & a \end{bmatrix}$ (c) $\begin{bmatrix} c & d \\ a & b \end{bmatrix}$ (d) $\begin{bmatrix} -a & b \\ c & -d \end{bmatrix}$	1
2.	Let A(adjA) is equal to : (a)0 (b)|A|I (c)I (d)None of these	1
3.	If $\vec{a}\ and\ \vec{b}$ are two collinear vectors then which of the following if incorrect : $(a)\vec{b} = k\vec{a}$, k is a scalar (b)$\vec{a} = \pm\vec{b}$ (c)Respective components of $\overrightarrow{a}$ and $\vec{b}$ are proportional. (d) $\overrightarrow{a}.\vec{b}$	1
4.	If the function f(x) = $\begin{cases} \frac{kcos2x}{\pi-4x} & , \quad if\ x \neq \frac{\pi}{4} \\ 5 & , \quad if\ x = \frac{\pi}{4} \end{cases}$ is continuous at x= $\frac{\pi}{4}$ then the value of k is : (a) 9 (b) 5 (c) -5 (d) 10	1
5.	The value of the integral $\int_{-\frac{\pi}{2}}^{\frac{\pi}{2}} sin^7 x\ dx$ is : (a)1 (b) 0 (c)$\frac{3\pi}{2}$ (d)None of these.	1
6.	The integrating factor of the differential equation $(xlogx)\frac{dy}{dx} + y = 2\ logx$ is : (a)x (b)e^x (c) log x (d)log(log x)	1
7.	The optimal value of the objective function is attained at the points : a) Given by the intersection of the inequations with axes only.	1

	b) Given by the intersection of the inequations with x-axis only. c) At the corner point of the feasible region. d) None of these	
8.	If $\lvert\vec{a}\rvert = \sqrt{3}, \lvert\vec{b}\rvert = 2$, $\vec{a}.\vec{b} = \sqrt{6}$ then the angle between the vectors $\vec{a}$ *and* $\vec{b}$ is : a) 0 b) $\frac{\pi}{2}$ c) $\frac{\pi}{4}$ d) π	1
9.	If I=$\int \sqrt{e^x - 1}dx$,then I is equals to: a) $2\sqrt{e^x - 1} - 2\tan^{-1}\sqrt{e^x - 1} + c$ b) $\sqrt{e^x - 1} + c$ c) $\frac{2}{3}(e^x - 1)^{\frac{3}{2}} + c$ d) $none\ of\ these$	1
10.	If A = $\begin{bmatrix} a & 0 & 0 \\ 0 & a & 0 \\ 0 & 0 & a \end{bmatrix}$ then det(adjA) is : a) a^{27} b) a^9 c) a^6 d) a^2	1
11.	The LPP is as follows : Minimize Z = 30x + 50y subject to the constraints: 3x + 5y ≥ 15 , $2x + 3y \leq 18$ *and* $x, y \geq 0$. In the feasible region minimum value of Z occurs at : a) A unique point b) No point c) Infinitely many points d) Two points	1
12.	If A = $\begin{bmatrix} 0 & 3 \\ 2 & 4 \end{bmatrix}$ $and\ kA = \begin{bmatrix} 0 & 3a \\ 2b & 24 \end{bmatrix}$ $then\ the\ values\ of\ k\ , a\ and\ b\ are$: a) -6 ,-12 ,-18 b) -6 , -4 ,-9 c) -6 , 4 ,9 d) -6 , 12 , 18	1
13.	If A is a square matrix such that $A^2 = A\ then\ (I + A)^2 - 7A\ is\ equal\ to$: a) A b) I+A c) I-A d) I	1

14.	P(A) = 0.3 , P(B)= 0.6 ,P(B/A) = 0.5 then P(AUB) will be : a) 0.24 b) 0.45 c) 0.75 d) None of these	1
15.	The order and degree of the differential equation $\sqrt{1+\left(\frac{dy}{dx}\right)^2} = \sqrt[3]{c\frac{d^2y}{dx^2}}$ are : a) Degree=2 , order=2 b) Degree= 3 , order = 3 c) Degree = 1, order = 2 d) None of these	1
16.	If x = a sec$\theta, y = btan\theta, then\ \frac{d^2y}{dx^2}$ at $\theta = \frac{\pi}{6}\ is$: a) $\frac{-3\sqrt{3}b}{a^2}$ b) $\frac{-2\sqrt{3}b}{a}$ c) $\frac{-3\sqrt{3}b}{a}$ d) $\frac{-b}{3\sqrt{3}a^2}$	1
17.	The value of scalar p so that the vectors $\vec{a} = 2\hat{\imath} + p\hat{\jmath} + \hat{k}\ \ and\ \vec{b} = \hat{\imath} - 2\hat{\jmath} + 3\hat{k}$ are perpendicular to each other is : a) $\frac{1}{2}$ b) 5/2 c) 3/2 d) 3	1
18.	If the lines are given as: $\frac{x-1}{-3} = \frac{y-2}{2p} = \frac{z-3}{2}\ and \qquad \frac{x-1}{3p} = \frac{y-1}{1} = \frac{z-6}{-5}$ $are\ perpendicular\ to\ each\ other\ then\ the\ value\ of\ p$ is : (a)-5 (b)5 (c) -10/7 (d) -7/10	1
	Assertion Reasoning Based Questions	

19.	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 and R is not the correct explanation of A (c) A is true but R is false (d) A is false but R is true Assertion (A) : The principal value of $2\cos^{-1}\left\{cos\frac{2\pi}{3}\right\} + \sin^{-1}\left\{sin\frac{2\pi}{3}\right\}$ is π. Reason (R): The range of $\cos^{-1} x\ is\ [0,\pi] and\ range\ of\ \sin^{-1} x\ is\ [\frac{-\pi}{2}, \frac{\pi}{2}]$	1
20.	Assertion (A) : Equation of a line passing through the point (5 , 2 , -4) parallel to a line $\frac{x-1}{3} = \frac{y-4}{2} = \frac{z-3}{-2}$ is $\frac{x-5}{3} = \frac{y-4}{2} = \frac{z+4}{-2}$. Reasoning (R): The direction ratio of two parallel lines is proportional.	1
	SECTION B	
21.	Evaluate : $\tan^{-1}\left[2\cos\left(2\sin^{-1}\frac{1}{2}\right)\right]$ Or Show that the function : $R - \left\{\frac{3}{5}\right\} \rightarrow R - \left\{\frac{3}{5}\right\}$, defined by f(x) = $\frac{3x+2}{5x-3}$ is one-one function.	2
22.	Solve : $cos^2x\frac{dy}{dx} + y = tanx$	2
23.	Find the equation of the line passing through the point (2 , -1,3) and parallel to the line $\vec{r} = (\hat{\imath} - 2\hat{\jmath} + \hat{k}) + \lambda\,(2\hat{\imath} - 3\hat{\jmath} - 5\hat{k})$. OR Find a vector of magnitude 49, which is perpendicular to both the vectors $2\hat{\imath} + 3\hat{\jmath} + 6\hat{k}$ and $3\hat{\imath} - 6\hat{\jmath} + 2\hat{k}$.	2
24.	Differentiate $\log_9 x + \log_x 9 + \log_x x + \log_9 9$ with respect to x .	2
25.	Find $\lambda\ and\ \mu\ if$: $(2\hat{\imath} + 6\hat{\jmath} + 27\hat{k})\ X\ (\hat{\imath} + \lambda\hat{\jmath} + \mu\hat{k}) = \vec{0}$.	2
	SECTION C	
26.	Integrate : $\int \frac{x}{(x^2-a^2)(x^2-b^2)}dx$	3
27.	One bag contains 4 white and 5 black balls. Another bag contains 6 white and 7 black balls. A ball is transferred from first bag to second bag and then a ball is drawn from the second bag. The ball so drawn is found to be red. Find the probability that the ball transferred is white. OR Assume that each born child is likely to be a boy or a girl. If a family has two children, what is the conditional probability that both are girls given that:	3

	(i) at least one is a girl child (ii) younger child is a girl	
28.	Evaluate : $\int \frac{cosx}{sin^2x+4sinx+13}dx$ OR Evaluate: $\int_0^{\frac{\pi}{6}} sin^4xcos^3xdx$	3
29.	Find the particular solution of the differential equation: $\frac{dy}{dx} = 1 + x^2 + y^2 + x^2y^2$ given that y=1 when x=0. Or Solve the differential equation : $(x^2 - 1)\frac{dy}{dx} + 2xy = \frac{2}{x^2-1}$	3
30.	Find graphically , the Maximum value of $Z = 2x + 5y, subject\ to\ the\ constraints\ given$ below : $2x + 4y \leq 8\ , 3x + y \leq 6\ ,\quad x + y \leq 4\ , x \geq 0\ , y \geq 0$.	3
31.	Evaluate the definite integral : $\int_0^{\pi} \frac{e^{cosx}}{e^{cosx}+e^{-cosx}} dx$	3
	SECTION D	
32.	Find the area enclosed by the curve x= 3 cost,y = 2sint .	5
33.	Let A is the set of all positive integers and R is a relation on AXA, defined by R= {(a, b) R(c, d): ad = bc, for all (a, b), (c, d) $\in AXA.$} Show that the relation R is an equivalence relation. Or Show that the function f: $Q - \{3\} \rightarrow Q\ defined\ as\ f(x) = \frac{2x+3}{x-3}$ is not a bijective function.	5
34.	Find the distance between the lines $\vec{r} = 4\hat{\imath} - \hat{\jmath} + 2\hat{k} + \lambda(\hat{\imath} + 2\hat{\jmath} - 3\hat{k})$ $and\ \vec{r} = 2\hat{\imath} + \hat{\jmath} - \hat{k} + \mu(3\hat{\imath} + 2\hat{\jmath} - 4\hat{k})$ Or Find the equation of a line passing through (2,-1,3) and perpendicular to the lines $\vec{r} = \hat{\imath} + \hat{\jmath} - \hat{k} + \lambda(2\hat{\imath} - 2\hat{\jmath} + \hat{k})$ and $\vec{r} = 2\hat{\imath} - \hat{\jmath} - 3\hat{k} + \mu(\hat{\imath} + 2\hat{\jmath} + 2\hat{k})$. Obtain the equation in cartesian form.	5
35.	If A= $\begin{bmatrix} 1 & 0 & -2 \\ -2 & -1 & 2 \\ 3 & 4 & 1 \end{bmatrix}$,then show that the matrix is a non-singular matrix and $Hence\ find\ A^{-1}$	5
	<u>SECTION E</u> <u>CASE STUDY BASED QUESTIONS</u>	
36.	Read the text carefully and answer the following questions : For the function $(x) = \frac{4sinx-2x-xcosx}{2+cosx}$, $0 \leq x \leq 2\pi$ answer the following questions: (a)Find $f'(x)$ (b)Find the interval in which f(x) is increasing.	1,1,2

	(c)Find the interval in which the function f(x) is decreasing	
37.	Karan a student of class 12^{th} wants to make a box to store some important daily usable stationary items in it. He has a squared sheet of tin of side 24 cm and want to convert it to a box open from the top by cutting square from each corner of the sheet and folding up of the flaps. Answer the questions given below: (a)If x cm is the side of each square cut from the corner then find the total surface area of the box in term of x. (b)What should be the value of x show that the volume of the box is maximum. (c)Find the maximum volume of the box.	1,1,2
38.	Rahul is studying in class 12^{th}. She wants to do graduation in chemical engineering. Her main subjects are mathematics, physics and chemistry. In the examination, her probability of getting grade A in these subjects is 0.2, 0.3 and 0.5 respectively. (a)Find the probability that she gets grade A in all subjects. (b)Find the probability that she gets grade A in no subjects.	2,2

KENDRIYA VIDYALAYA SANGATHAN, JAMMU REGION
SAMPLE PAPER SET -6

CLASS : XII **SUBJECT: MATHEMATICS**
TIME: 3 hrs **M.M: 80**

General Instructions :

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

SECTION A
(Multiple Choice Questions) Each question carries 1 mark

Q1. If A is a square matrix such that $A^2 = A$, then $(I + A)^3 - 7A$ is

(a) I (b) 2A (c) 3I (d) A

Q2. If $A = \begin{bmatrix} 3 & -2 \\ 4 & -2 \end{bmatrix}$, then the value of k if, $A^2 = kA - 2I$ is
(a) 0 (b) 8 (c) -7 (d) 1

Q3. If A is a square matrix of order 3×3,such that $|A| = 12$, then the value of $|A.\,adj\ A|$ is
(a) 12 (b) 144 (c) 1728 (d) 72

Q4. The function $f(x) = \frac{x+1}{1+\sqrt{1+x}}$ is continuous at x=0 if $f(0)$ is

(a) -1 (b) $\frac{1}{2}$ (c) 0 (d) 1

Q5. If $f(x) = 9^{x^2+2x}$, then $f'(-1)$ is

(a) 0 (b) 2 (c) 4 (d) -2

Q6. The corner points of the feasible region for a Linear Programming Problem are A(20,40), B(50,100), C(0,200) and D(0,50). The maximum value of the objective function $Z = x + 2y$ is at the point

(a) A (b) B (c) C (d) –D

Q7. Integrating factor for the solution of differential equation $(x - y^3)dy + y\,dx = 0$ is
(a) $\frac{1}{y}$ (b) $\log y$ (c) y (d) y^2

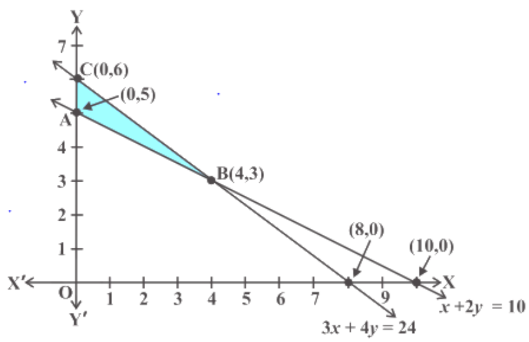
Q8. If $\bar{p}$ is a unit vector and $(\bar{x} - \bar{p})(\bar{x} + \bar{p}) = 80$, then the value of $|\bar{x}|$ is

(a) 4 (b) 6 (c) 8 (d) 9

Q9. The value of $\int_{-2}^{2} x \cos \pi x \ dx$ is

(a) 0 (b) $\frac{4}{\pi}$ (c) $\frac{2}{\pi}$ (d) $\frac{1}{\pi}$

Q10. The feasible region for a LPP is shown in figure. Let $Z = 200\,x + 500y$ be the objective function.



Minimum value of Z occurs at

(a) (8,0) (b) (0,5) (c) ((4,3) (d) (0,6)

Q11. If A and B are invertible matrices then which of the following is not correct

(a) $AdjA = |A|A^{-1}$ (b) $\det(A^{-1}) = (\det A)^{-1}$ (c) $(AB)^{-1} = B^{-1}A^{-1}$ (d) $(A+B)^{-1} = A^{-1}+B^{-1}$

Q12. If A is an invertible matrix of order 2, then $\det(A^{-1})$ is equal to

(a) det(A) (b) $\frac{1}{\det(A)}$ (c) 1 (d) 0

Q13. If $A = \begin{bmatrix} 1 & 3 \\ 2 & 1 \end{bmatrix}$, then $|A^2 - 2A| =$

(a) 15 (b) 20 (c) 25 (d) -15

Q14. If P(A) = 0.4, P(B) = 0.8 and P(B|A) = 0.6, then $P(A \cup B)$ is equal to

(a) 0.24 (b) 0.3 (c) 0.48 (d) 0.96

Q15. The solution of differential equation $(2y-1)dx - (2x+3)dy = 0$ is

(a) $\frac{2x-1}{2y+3} = k$ (b) $\frac{2y+1}{2x-3} = k$

(c) $\frac{2x+3}{2y-1} = k$ (d) $\frac{2x-1}{2y-1} = k$

Q16. At $x = \frac{5\pi}{6}$, $f(x) = 2\sin 3x + 3\cos 3x$ is

(a) maximum (b) minimum

(c) zero (d) neither maximum nor minimum

Q17. If $\vec{a}$ = 10, $\vec{b}$ = 2 and $\vec{a}.\vec{b} = 12$, then the value of $|\vec{a} \times \vec{b}|$ is

(a) 5 (b) 10 (c) 14 (d) 16

Q18. If the direction cosines of a line are k, k and k, then

(a) $k > 0$ (b) $0 < k < 1$ (c) k = 1 (d) $k = \frac{1}{\sqrt{3}}$ or $\frac{-1}{\sqrt{3}}$

ASSERTION-REASON BASED QUESTIONS

In the following questions, a statement of assertion (A) is followed by a statement ofReason (R). Choose the correct answer out of the following choices.

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

Q19. **Assertion (A)**: $\sin^{-1}(\sin\frac{2\pi}{3}) = \frac{\pi}{3}$

. **Reason (R)**: $\sin^{-1}(\sin x) = x.\ x \epsilon \left[-\frac{\pi}{2},\ \frac{\pi}{2}\right]$

Q20. **Assertion (A)**: If $\vec{a}, \vec{b}$ and $\vec{c}$ are mutually perpendicular vectors of equal magnitude then $\vec{a} + \vec{b} + \vec{c}$ is equally inclined to $\vec{a}, \vec{b}\ and\ \vec{c}$.

Reason (R): Vectors of equal magnitude have same direction ratios.

SECTION B

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

Q21. Find the value of $\boldsymbol{tan^{-1}\left(tan\frac{7\pi}{6}\right)}$.

OR

Check if the relation R on the set $\boldsymbol{A = \{1, 2, 3, 4, 5, 6\}}$ defined as $\boldsymbol{R = \{(x, y): y\ is\ divisible\ by\ x\}}$ is

(i) symmetric

(ii) transitive

Q22. A particle moves along the curve $\boldsymbol{x^2 = 2y}$. At what point, ordinate increases at the same rate as abscissa increases?

Q23. Give an example of two non-zero vectors $\boldsymbol{\vec{a}\ and\ \vec{b}}$ such that $\boldsymbol{\vec{a} \times \vec{b} = 0}$

OR

Show that the points A (2,3,-4) , B (1,-2,3) and C (3,8,-11) are collinear.

Q24. If $\boldsymbol{y = 500e^{7x} + 600e^{-7x}}$, then show that $\boldsymbol{\frac{d^2y}{dx^2} = 49y}$.

Q25. Find the projection of the vector $\boldsymbol{\hat{\imath} + 3\hat{\jmath} + 7\hat{k}}$ on the vector $\boldsymbol{7\hat{\imath} - \hat{\jmath} + 8\hat{k}}$.

SECTION C

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

Q26. Find: $\int \frac{x^2+x+1}{(x+2)(x^2+1)} dx$

Q27. Suppose a girl throws a die. If she gets 1 or 2, she tosses a coin three times and notes the number of tails. If she gets 3,4,5 or 6, she tosses a coin once and notes whether a 'head' or 'tail' is obtained. If she obtained exactly one 'tail', what is the probability that she threw 3,4,5 or 6 with the die?

OR

Three rotten apples are mixed with seven fresh apples. Find the probability distribution of the number of rotten apples, if three apples are drawn one by one with replacement.

Q28. Evaluate: $\boldsymbol{\int_0^{\pi} \frac{x \sin x}{1+\cos^2 x} dx}$

OR

Prove that $\boldsymbol{\int_1^3 \frac{dx}{x^2(x+1)} = \frac{2}{3} + \log\frac{2}{3}}$

Q29. Solve the differential equation:

$$\boldsymbol{x \sin\left(\frac{y}{x}\right)\frac{dy}{dx} + x - y \sin\left(\frac{y}{x}\right) = 0}$$

Given that x = 1 when y = $\boldsymbol{\frac{\pi}{2}}$.

OR

Find the equation of a curve passing through the origin and whose differential equation is $\boldsymbol{y' = e^x \sin x}$.

Q30. Solve the following L.P.P. graphically:

Maximize Z = 4x+y

s. t. $\boldsymbol{x + y \leq 50}$

$\boldsymbol{3x + y \leq 90}$
$\boldsymbol{x \geq 10}$
$\boldsymbol{x, y \geq 10}$

Q31. $\int \frac{\boldsymbol{x+2}}{\sqrt{\boldsymbol{x^2-1}}} \boldsymbol{dx}$

SECTION D
(This section comprises of Long answer type questions (LA) of 5 marks each)

Q32. Find the area of the region $\{(x, y): 0 \leq y \leq x^2, 0 \leq y \leq x, 0 \leq x \leq 2\}$

Q33. Let $A = \{1,2,3,4,5,6,7,8,9\}$ and R is a relation in $A \times A$ defined by $(a, b)R(c, d)$ if $a + d = b + c$ for (a,b), (c,d) in $A \times A$. Prove that R is an equivalence relation and also obtain equivalence class [(2,5)].

OR

Show that the function $\boldsymbol{f}: \mathbb{R} \to \{\boldsymbol{x} \in \mathbb{R}: \boldsymbol{-1 < x < 1}\}$ defined by $\boldsymbol{f(x) = \frac{x}{1+|x|}}$, $\boldsymbol{x} \in \mathbb{R}$ is one-one and onto function.

Q34. Find the foot of perpendicular from the point (2, 3, -8) to the line $\boldsymbol{\frac{4-x}{2} = \frac{y}{6} = \frac{1-z}{3}}$. Also, find the perpendicular distance from the given point to the line.

OR

Find the shortest distance between the lines $\boldsymbol{\vec{r} = (\hat{\imath} + 2\hat{\jmath} + 3\hat{k}) + \lambda(\hat{\imath} - 3\hat{\jmath} + 2\hat{k})}$ and $\boldsymbol{\vec{r} = (4\hat{\imath} + 5\hat{\jmath} + 6\hat{k}) + \mu(2\hat{\imath} + 3\hat{\jmath} + \hat{k})}$.

Q35. If $\boldsymbol{A = \begin{bmatrix} 2 & -3 & 5 \\ 3 & 2 & -4 \\ 1 & 1 & -2 \end{bmatrix}}$, find $\boldsymbol{A^{-1}}$. Use it to solve the system of equations

$$\boldsymbol{2x - 3y + 5z = 11}$$
$$\boldsymbol{3x + 2y - 4z = -5}$$
$$\boldsymbol{x + y - 2z = -3}$$

SECTION E
(This section comprises of 3 case-study/passage-based questions of 4 marks each with two sub-parts. First two case study questions have three sub-parts (i), (ii),

(iii) of marks 1, 1, 2 respectively. The third case study question has two sub-parts of 2 marks each.)

Q36. **Case-Study 1:** Read the following passage and answer the questions given below:

A tent is in the shape of a cone as shown in figure. Surface area of the cone is S(given), radius of base is r, height is h and slant height is l (which all are variables).

i. If α be the semi vertical angle of the cone, then find the value of $\tan\alpha$.

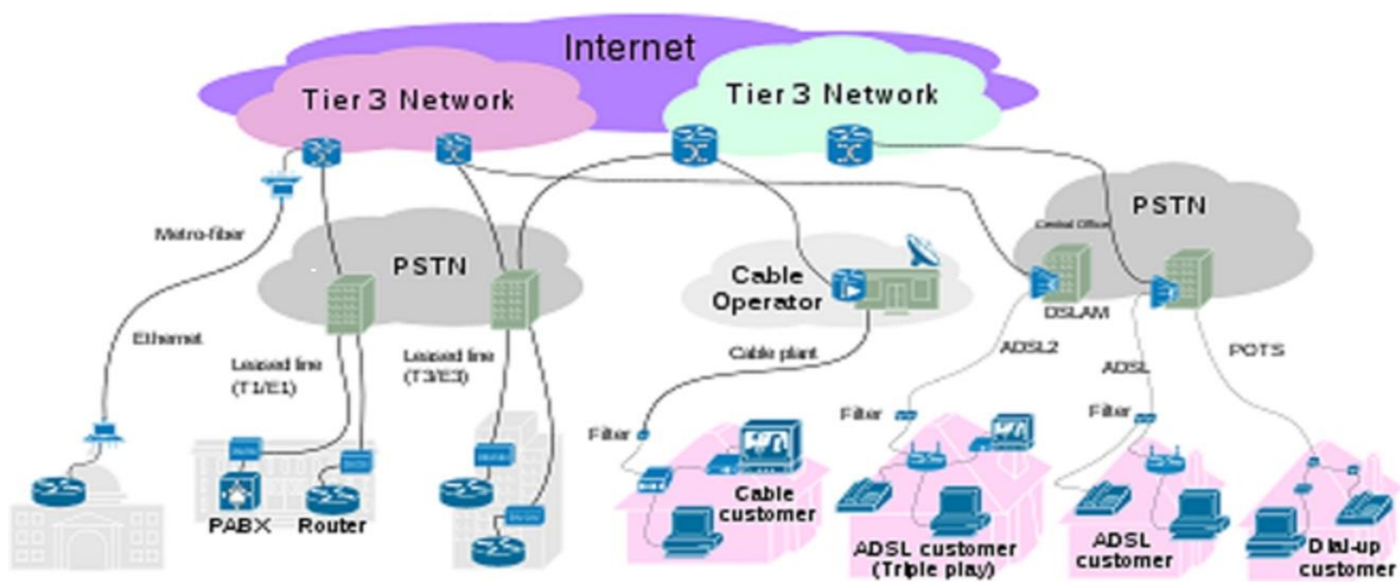
ii. If $Z = V^2$, then find the value of $\frac{dZ}{dr}$.

iii. Find the value of $\frac{d^2Z}{dr^2}$.

OR

Find the value of r for which Z is maximum.

Q37. **Case-Study** 2: Read the following passage and answer the questions given below:



An internet service provider has a subscriber base of 600 and charges Rs. 500 per month. With the increase of Rs. 10 per month, equal number of subscribers discontinue the service. Based on above information if Rs. X are increased per month, then

i. Find the number of subscribers when Rs. x are increased.

ii. What is the value of total revenue received?

iii. For what value of x, revenue is maximum?

OR

Write the value of maximum revenue (in Rs.).

Q38. **3**: Read the following Case-Study passage and answer the questions given below.

A shopkeeper sells three types of flower seeds A_1, A_2 and A_3. They are sold as a mixture where the proportion are 4:4:2 respectively. The germination rates of the three types of seeds are 45%, 60% and 35% respectively. Calculate the probability of a randomly chosen seed

i. that it will germinate.
ii. that it will not germinate given that the seed is of type A_3.

KENDRIYA VIDYALAYA SANGATHAN, JAMMU REGION
SAMPLE PAPER SET -7

CLASS : XII **SUBJECT: MATHEMATICS**

TIME: 3 HRS **M.M: 80**

General Instructions :

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

SECTION A
(Multiple Choice Questions) Each question carries 1 mark

Q1. If $A = \begin{bmatrix} 1 & 3 \\ 2 & 1 \end{bmatrix}$, then $|A^2 - 2A|$=

(a) 15 (b) 20 (c) 25 (d) -15

Q2. If matrix $A = [a_{ij}]_{2\times2}$, where $a_{ij} = \begin{cases} 1, if\ i \neq j \\ 0, if\ i = j \end{cases}$, then A^2 is equal to

(a) I (b) A (c) 0 (d) None of these.

Q3. For matrices X,Y and Z, if $X_{m\times3}Y_{p\times4} = Z_{2\times b}$, then values of m, p and b are respectively

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

Q4. The function $f(x) = \frac{4-x^2}{4x-x^3}$ is

(a) discontinuous at only one point (b) discontinuous at exactly two points
(c) discontinuous at exactly three points (d) None of these

Q5. The derivative of $\cos^{-1}(2x^2 - 1)$ w.r.t. $\cos^{-1} x$ is

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

Q6. The corner points of the feasible region for a Linear Programming Problem are A(20,80), B(40,160) and C(20,180). The maximum value of the objective function $Z = 1000x + 600y$ is at the point

(a) A (b) B (c) C (d) None of these

Q7. The degree of the differential equation $\frac{d^2y}{dx^2} + 3\left(\frac{dy}{dx}\right)^2 = x^2 \log\left(\frac{d^2y}{dx^2}\right)$ is

(a) 1 (b) 2 (c) 3 (d) Not defined

Q8. The cosine of the angle which vector $\sqrt{2}\hat{\imath} + \hat{\jmath} + \hat{k}$ makes with y- axis is

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

Q9. The value of $\int_{-2}^{2} Sin^5 x \, dx$ is

(a) 0 (b) 1 (c) 2 (d) 4

Q10. The corner points of the feasible region determined by the system of linear constraints are (0,10), (5,5), (15,15), (0,20). Let $Z = px + qy$ where $p, q > 0$. The 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) $q = 3p$

Q11. If C_{ij} denotes the cofactor of the element p_{ij} of the matrix $P = \begin{bmatrix} 1 & -1 & 2 \\ 0 & 2 & -3 \\ 3 & 2 & 4 \end{bmatrix}$, then the value of $C_{31}.C_{23}$ is

(a) 5 (b) 24 (c) -24 (d) -5

Q12. If $\begin{vmatrix} 2 & 3 & 2 \\ x & x & x \\ 4 & 9 & 1 \end{vmatrix} + 3 = 0$, then value of x is

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

Q13. If A is a given square matrix , then $A + A'$ is

(a) scalar matrix (b) diagonal matrix
(c) symmetric matrix (d) skew-symmetric matrix

Q14. If the probability of happening of atleast one of the two events A or B is p and probability of their simultaneous happening is q, then the value of $P(\bar{A}) + P(\bar{B})$ is

(a) p+q-2 (b) 2-p-q (c) 2-p+q (d) 2+p-q

Q15. The integrating factor for the differential equation $\frac{dy}{dx} + y \tan x - \sec x = 0$ is

(a) $\tan x$ (b) $sec^2 x$
(c) $\sec x$ (d) $\frac{tan^2 x}{2}$

Q16. If $x = t^2$ and $y = t^3$, then $\frac{d^2y}{dx^2}$ is equal to

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

Q17. The area of a parallelogram whose diagonals are $2\hat{i}$ and $-3\hat{k}$ is

(a) 6 sq.units (b) 2 sq. units (c) 12 sq. units (d) 3 sq. units

Q18. If $\vec{x}$ is a unit vector such that $\vec{x} \times \hat{i} = \hat{k}$, then $\hat{x}.\hat{j}$ is

(a) -1 (b) 0 (c) 1 (d) not defined.

ASSERTION-REASON BASED QUESTIONS

In the following questions, a statement of assertion (A) is followed by a statement ofReason (R). Choose the correct answer out of the following choices.

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

Q19. **Assertion (A)**: $\sin^{-1}\left(\frac{-1}{2}\right) = \frac{-\pi}{6}$
Reason (R): Principal value branch of sin^{-1} function is $[\frac{-\pi}{2}, \frac{\pi}{2}]$ and $\sin\left({}^{-\pi}/_{2}\right) = \frac{-1}{2}$.

Q20. **Assertion (A)**: The angle between the lines $\frac{x+1}{2} = \frac{y-2}{5} = \frac{z+3}{-4}$ and $\frac{x-1}{1} = \frac{y+2}{2} = \frac{z-3}{-3}$ is 90°.

Reason (R): Skew lines are lines in different planes which are parallel and intersecting.

SECTION B

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

Q21. Simplify: $\boldsymbol{tan^{-1}\left(\frac{9\pi}{8}\right)}$,

OR

Show that the relation R in the set ℝ of real numbers, defined as

R = $\{(a, b): a \leq b^2\}$ is neither reflexive nor symmetric nor transitive.

Q22. Find the local maxima and local minima, if any of the function f given by

$$\boldsymbol{f(x) = \sin x + \cos x, \quad 0 < x < \frac{\pi}{2}}.$$

Q23. If vectors $\vec{a} = 2\hat{i} + 2\hat{j} + 3\hat{k}$, $\vec{b} = -\hat{i} + 2\hat{j} + \hat{k}$ and $\vec{c} = 3\hat{i} + \hat{j}$ are such that $\vec{a} + \lambda\vec{b}$ is perpendicular to $\vec{c}$, then find the value of λ.

OR

If a line has direction ratios -18, 12, -4, then find direction cosines.

Q24. If $\boldsymbol{x = a(2\theta - sin2\theta)}$ and $\boldsymbol{y = a(1 - cos\, 2\theta)}$, find $\frac{dy}{dx}$ when $\boldsymbol{\theta = \frac{\pi}{3}}$.

Q25. Find the value of *p* so that the lines

$$\frac{1-x}{3} = \frac{7y-14}{2p} = \frac{z-3}{1} \ \textbf{and}\ \frac{7-7x}{3p} = \frac{5-y}{1} = \frac{11-z}{7}$$

are at right angles.

SECTION C

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

Q26. Evaluate $\int \sqrt{x^2 - 4x + 1}\, dx$.

Q27. Bag A contains 3 red and 2 black balls, while bag B contains 2 red and 3 black balls. A ball drawn at random from bag A is transferred to bag B and then one ball is drawn at random from bag B. If this ball was found to be a red ball, find the probability that the ball drawn from bag A was red.

OR

From a lot of 30 bulbs which includes 6 defectives, a sample of 4 bulbs is drawn at random one by one with replacement. Find the probability distribution of the number of defective bulbs. Hence find the mean of the distributions.

Q28. ***Evaluate:*** $\int_0^{\pi} \frac{x \tan x}{\sec x \,\mathrm{cosec}\, x} dx$

OR

Prove that $\int_1^3 \frac{dx}{x^2(x+1)} = \frac{2}{3} + \log\frac{2}{3}$

Q29. Find the particular solution of the differential equation:

$\frac{dy}{dx} = \frac{xy}{x^2+y^2}$, given that y= 1 when x = 0.

OR

Find the particular solution of the differential equation:

$$\frac{dy}{dx} + y\cot x = 2x + x^2 \cot x, \qquad x \neq 0$$

Given that y=0 when $x = \frac{\pi}{2}$.

Q30. Minimize: $Z = x + 2\,y$, subject to the constraints:

$$2x + y \geq 3$$
$$x + 2y \geq 6$$
$$x\,, y \geq 0$$

Solve the above LPP graphically

Q31. $\int \frac{\mathbf{1}}{(\boldsymbol{x}+\mathbf{2}).\sqrt{\mathbf{3}\boldsymbol{x}+\mathbf{4}}}\, \boldsymbol{dx}$

SECTION D

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

Q32. Find the area of the region bounded by the parabola $y = x^2$ and $y = |x|$.

Q33. Prove that the relation R in the set $A = \{1,2,3,4,5\}$ given by $R = \{(a, b): |a - b|\ is\ even\}$, is an equivalence relation. Show that all the elements of {1,3,5} are related to each other and all the element of {2,4} are related to each other. But no element of {1,3,5} is elated to any element of {2,4}.

OR

Give an example of real valued function which is

a. One-one and onto both.
b. One-one but not onto.
c. Onto but not one-one.

Justify your answer.

Q34. Find the distance of a point (2,4,-1) from the line $\frac{\boldsymbol{x}+\mathbf{5}}{\mathbf{1}} = \frac{\boldsymbol{y}+\mathbf{3}}{\mathbf{4}} = \frac{\boldsymbol{z}-\mathbf{6}}{-\mathbf{9}}$.

OR

Find the shortest distance between the lines whose vector equations are

$\vec{\boldsymbol{r}} = (\mathbf{1} - \boldsymbol{t})\hat{\boldsymbol{\imath}} + (\boldsymbol{t} - \mathbf{2})\hat{\boldsymbol{\jmath}} + (\mathbf{3} - \mathbf{2}\boldsymbol{t})\widehat{\boldsymbol{k}}$ and $\vec{\boldsymbol{r}} = (\boldsymbol{s} + \mathbf{1})\hat{\boldsymbol{\imath}} + (\mathbf{2}\boldsymbol{s} - \mathbf{1})\hat{\boldsymbol{\jmath}} - (\mathbf{2}\boldsymbol{s} + \mathbf{1})\widehat{\boldsymbol{k}}$

Q35. 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 the system of equations:

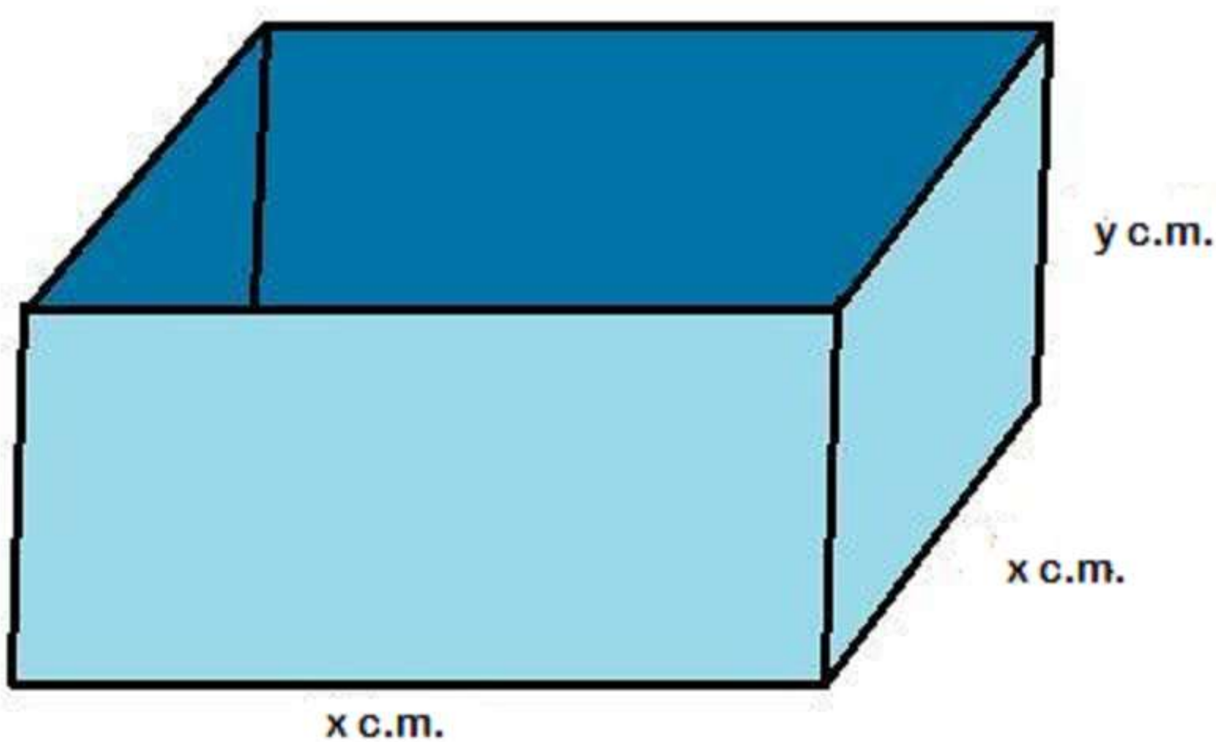
$$x - y + 2z = 1$$
$$2y - 3z = 1$$
$$3x - 2y + 4z = 2$$

SECTION E

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

Q36. **Case-Study 1:** Read the following passage and answer the questions given below:

A given quantity of metal sheet is to be cast into an open tank with a square base of x c.m. and vertical sides of y c.m. as shown in the figure.



Based on above information, answer the following:

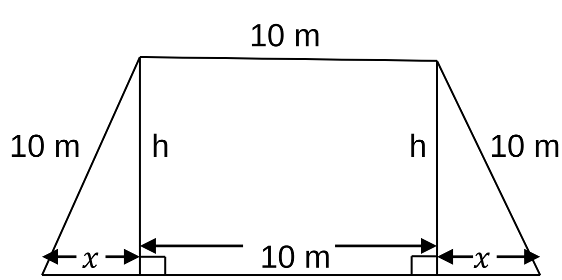
a. If V represents the volume of tank, then find relation between V, x and y.
b. Find x, when total surface area of the tank is minimum.
c. Represent the relation in y and x so that the area is minimum.

OR

If volume of tank is1024 cm^3. The material for bottom costs 5Rs. per cm^2 and material for sides cost Rs. 2.50 per cm^2, then find the value of x so that cost is minimum.

Q37. **Case-Study** 2: Read the following passage and answer the questions given below:

The front gate of a building is in the shape of a trapezium as shown below. Its three sides other than base are of 10 m each. The height of the gate is h meter. On the basis of above figure, answer the following questions:



i. Express the Area (A) of the gate as a function of x

ii. Find the value of x when A is maximum.

iii. Find the maximum value of A.

OR

Find the value of $\frac{dA}{dx}$.

Q38. **3**: Given three identical boxes $1^{st,}$ 2^{nd} and 3^{rd} each containing two coins. In 1^{st} box both coins are gold coins, in 2^{nd} box both are silver coins and in 3^{rd} box there is one gold and one silver coin. A person chooses a box at random and takes out a coin.

On the basis of above information, answer the following questions:

a) Find the probability of choosing 3^{rd} box and getting silver coin .

b) If drawn coin is of gold then find the probability that other coin in the box is also of gold.

KENDRIYA VIDYALAYA SANGATHAN, JAMMU REGION
SAMPLE PAPER SET -8

CLASS : XII **SUBJECT: MATHEMATICS**

TIME: 3 hrs **M.M: 80**

General Instructions:

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

SECTION A
(Multiple Choice Questions)
Each question carries 1 mark

1. Value of k, for which A=$\begin{bmatrix} k & 8 \\ 4 & 2k \end{bmatrix}$ is a singular matrix is.

(A) 4 (B) -4 (C) ± 4 (D) 0

2. Which of the given values of x and y make the following pair of matrices equal?
$\begin{bmatrix} 3x+7 & 5 \\ y+1 & 2-3x \end{bmatrix}=\begin{bmatrix} 0 & y-2 \\ 8 & 4 \end{bmatrix}$

(A) x =$\frac{-1}{3}$, y= 7 (B) Not possible (C) y= 7 , x = $\frac{-2}{3}$ (D) x = $\frac{-1}{3}$ y = $\frac{-2}{3}$

3. What is the magnitude of vector, v = $1/\sqrt{3}\hat{\imath} + 1/\sqrt{3}\hat{\jmath} + 1/\sqrt{3}\hat{k}$?

(A) 0 (B) 1 (C) 2 (D) 3

4. The function f(x) = $e^{|x|}$ is

(A) Continuous everywhere but not differentiable at x = 0
(B) continuous and differentiable everywhere. (C) Not continuous at x = 0
(D) none of these.

5. $\int \frac{dx}{e^x+e^{-x}}$ =

(A) $\tan^{-1} e^x$ + C (B) -$\tan^{-1} e^x$ + C (C) $\tan^{-1} e^{-x}$ + C (D) $-\tan^{-1} e^{-x}$ + C

6. The sum of the order and degree of the differential is. $1 + \left(\frac{dy}{dx}\right)^4 = \left(\frac{d^2y}{dx^2}\right)^3$

(A) 2 (B) 3 (C) 4 (D) 5

7. 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 .the minimum value of F occurs at;

(A) (0,2) only (B) (3,0) only
(C) the midpoint of the line segment joining the points the points (0,2) and (3,0) only
(D) any point on the line segment joining the points (0,2) and (3,0)

8. If $\left|\vec{a}\times\vec{b}\right|^2 + \left|\vec{a}.\vec{b}\right|^2 = 144$ and $|\vec{a}| = 4$, then $\left|\vec{b}\right|$ =………

(A) 1 (B) 2 (C) 3 (D) 4

9. The value of $\int \frac{dx}{sin^2xcos^2x}$ is;

(A) tanx-cotx +C (B) tanx+cotx + C
(C) tanx-cotx -C (D) None of these.

10. The maximum value of $\Delta = \begin{vmatrix} 1 & 1 & 1 \\ 1 & 1+\sin x & 1 \\ 1+\cos x & 1 & 1 \end{vmatrix}$ is (θ $is\ a\ real\ number$)

(A) $\frac{1}{2}$ (B) $\frac{\sqrt{3}}{2}$ (C) $\sqrt{2}$ (D) $\frac{2\sqrt{3}}{4}$

11. A LLP is as follows:

Minimise Z = x+y

Subject to constraints x≥3,x≤ $9, y \geq 0$

x-y$x - y \geq 0, x + y \leq 14$ the feasible region has :

(A) 5 corner points including (0,0) and (9,5) (B) 5 corner points including (7,7) and (3,3)
(C) 5 corner points including (14,0) and (9,0) (D) 5 corner points including 3,6) and (9,5)

12. If A and B are symmetric matrices of same order, AB-BA is a:

(A) Skew- symmetric matrix (B) Symmetric matrix
(C) Zero matrix (D) Identity matrix

13. If C_{ij} denotes the cofactors of elements P_{ij} of the matrix P = $\begin{bmatrix} 1 & -1 & 2 \\ 0 & 2 & -3 \\ 3 & 2 & 4 \end{bmatrix}$, then the value of $C_{31}C_{23}$ is :

(A) 5 (B) 35 (C) -24 (D) -5

14. If A and B are to events such that P (B) = 0.6, P (A/B) = 0.1, then P (A∩B) =

(A) 0.02 (B) 0.04 (C) 0.06 (D) 0.08

15. The radius of a circle is increasing at the rate of 0.4 cm/ s. The rate of increasing of its circumference is

(A) 0.4 π cm/s (B) 0.8 π cm/s (C) 0.8 cm/s (D) none of these

16. If y = $\log\left(\frac{1-x^2}{1+x^2}\right)$, then $\frac{dy}{dx}$ is equal to

(A) $\frac{4x^3}{1+x^4}$ (B) $\frac{-4x}{1-x^4}$ (C) $\frac{1}{4-x^4}$ (D) $\frac{4x}{1-x^4}$

17. If $\vec{a} = 3\hat{\imath} - 2\hat{\jmath} + \hat{k}$ and $\vec{b} = 2\hat{\imath} + \hat{\jmath}$, then the value of $\vec{a}.\vec{b}$ =

(A) 2 (B) 3 (C) 4 (D) 0

18. The area of the rectangle having vertices A, B, C and D with position vector;

$-\hat{\imath} + \frac{1}{2}\hat{\jmath} + 4\hat{k}$, $\hat{\imath} + \frac{1}{2}\hat{\jmath} + 4\hat{k}$, $\hat{\imath} - \frac{1}{2}\hat{\jmath} + 4\hat{k}$ and $-\hat{\imath} - \frac{1}{2}\hat{\jmath} + 4\hat{k}$ respectively is:

(A) 1 sq. unit (B) 2 sq. unit (C) 3 sq. unit (D) 4 sq. unit

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. **Assertion (A)**: $\cos^{-1}\left(\frac{-\sqrt{3}}{2}\right) = -\frac{\pi}{3}$

Reason (R): Principal value branch of arc cosine function is $[0, \pi]$

20. **Assertion**: The area of parallelogram with diagonals $\vec{a}$ and $\vec{b}$ is $\frac{1}{2}$ $|\vec{a} \times \vec{b}|$.

Reason: If $\vec{a}$ and $\vec{b}$ represents adjacent sides of a tringle, then area of triangle can be obtained by $|\vec{a} \times \vec{b}|$.

SECTION B

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

21. Let R be the relation in the set Z of integers given by R = {(a, b): 2 divides a – b}.Show that the relation R transitive? Write the equivalence class [0].

OR

If $\sin^{-1} x + \sin^{-1} y = \frac{2\pi}{3}$ then find the value of $\cos^{-1} x + \cos^{-1} y$

22. Show that the function f(x) = $x^3 - 3x^2 + 6x - 100$ is increasing on R.

23. If $\vec{a}$ and $\vec{b}$ are perpendicular vectors, $|\vec{a} + \vec{b}|$ = 13 and $|\vec{a}|$ =5, find the value of $|\vec{b}|$

OR

What are the direction cosines of a line which makes equal angles with the coordinate axes?

24. Determine the value of the constant 'k' so that the function

$$f(x)=\begin{cases}\dfrac{kx}{|x|}, & \text{if } x<0\\ 3, & \text{if } x\geq 0\end{cases}$$

Is continuous at x = 0.

25. Find the unit vector in the direction of the sum of the vectors

$$\vec{a} = 2\hat{\imath} - \hat{\jmath} + 2\hat{k}$$

$$\vec{b} = -1\hat{\imath} + 1\hat{\jmath} + 3\hat{k}$$

SECTION C

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

26. Find the value of $\int \sin x \cdot \log \cos x \, dx$

27. The probability of solving the specific problem independently by the persons' A and B are 1/2 and 1/3 respectively. In case, if both the persons try to solve the problem independently, then calculate the probability that the problem is solved.

OR

5 cards are drawn successively from a well-shuffled pack of 52 cards with replacement. Determine the probability that (i) all the five cards should be spades? (ii) Only 3 cards should be spades? (iii) None of the cards is a spade?

28. Evaluate: $\int_0^{\frac{\pi}{2}} e^{x}(\sin x - \cos x)dx$

OR

Evaluate: $\int_0^4 |x-1| \, dx$

29. Solve the following differentia equation:

$\frac{dy}{dx} + y = \cos x - \sin x$

OR

Find the particular solution of the differential equation $(1 + x^2)\frac{dy}{dx} + 2xy = \frac{1}{1+x^2}$, given that y = 0 when x = 1.

30. Solve the following LPP graphically:

Minimise Z = 5x + 10y subject to the constraints

$x + 2y \leq 120$

$x + y \geq 60$,

$x - 2y > 0$ and $x, y \geq 0$

31. Determine $\int \tan^8 x \sec^4 x \, dx$.

SECTION D

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

32. Find the area enclosed by the ellipse. $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$.

33. Show that the relation R on R defined as R = {(a, b): a ≤ b}, is reflexive and transitive but not symmetric.

OR

Show that R = {(a, b): a, b ∈ A; |a – b| is divisible by 4} is an equivalence relation. Find the set of all elements related to 1. Also write the equivalence class [2].

34. Find the shortest distance between the lines l_1 and l_2 whose vector equations are

$$\vec{r} = \hat{\imath} + 2\hat{\jmath} - 4\hat{k} + \lambda(2\hat{\imath} + 3\hat{\jmath} + 6\hat{k})$$

$$\vec{r} = 3\hat{\imath} + 3\hat{\jmath} - 5\hat{k} + \mu(2\hat{\imath} + 3\hat{\jmath} + 6\hat{k})$$

OR

If the lines $\frac{x-1}{-3} = \frac{y-2}{2\lambda} = \frac{z-3}{2}$ and $\frac{x-1}{3\lambda} = \frac{y-1}{2} = \frac{z-6}{-5}$ are perpendicular, find the value of λ. Hence find whether the lines are intersecting or not

35. If A = $\begin{bmatrix} 2 & -3 & 5 \\ 3 & 2 & -4 \\ 1 & 1 & -2 \end{bmatrix}$, then find A^{-1} ,

Using A^{-1}, solve the following system of equations;

2x-3y+5z = 11

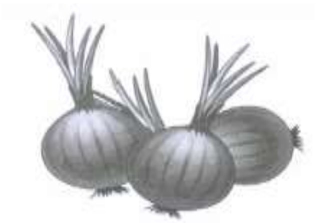
3x+2y-4z = -5

x+y-2z = -3

SECTION E

(This section comprises 3 case-study/passage-based questions of 4 marks each with two sub-parts. 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. The Government declare that farmers can get Rs.300 per quintal for their onions on 1st July and after that, the price will be dropped by Rs.3 per quintal per extra day. Shyams father has 80 quintal of onions in the field on 1st July and he estimates that crop is increasing at the rate of 1 quintal per day.



Based on the above information, answer the following questions.

(i) If x is the number of days after 1st July, then price and quantity of onion respectively can be expressed as

(ii) Revenue R as a function of x can be represented as

(iii) Megha is interested in maximising the volume of the box. So, what should be the side of the square to be cut off so that the volume of the box is maximum?
OR

(iv) What will be the Maximum revenue?

37. Shobhit's father wants to construct a rectangular garden using a brick wall on one side of the garden and wire fencing for the other three sides as shown in' figure. He has 200 ft of wire fencing.

Based on the above information, answer the following questions.

(i) To construct a garden using 200 ft of fencing, we need to maximise its

(ii) If x denote the length of side of garden perpendicular to brick wall and y denote the length, of side parallel to brick wall, then find the relation representing total amount of fencing wire.

(iii) Area of the garden as a function of x, say A(x), can be represented as
OR

(iv) What will be the Maximum value of A(x)?

38. A doctor is to visit a patient. From the past experience, it is known that the probabilities that he will come by cab, metro, bike or by other means of transport are respectively 0.3, 0.2, 0.1 and 0.4. The probabilities that he will be late are 0.25, 0.3, 0.35 and 0.1 if he comes by cab, metro, bike and other means of transport respectively.

Based on the above information, answer the following questions.
(i) When the doctor arrives late, what is the probability that he comes by metro?
(ii) When the doctor arrives late, what is the probability that he comes by cab?
(iii) When the doctor arrives late, what is the probability that he comes by bike?

OR

What is the probability that the doctor is late by any means?

KENDRIYA VIDYALAYA SANGATHAN, JAMMU REGION
SAMPLE PAPER SET -9
CLASS : XII **SUBJECT: MATHEMATICS**

TIME: 3 hrs **M.M: 80**

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

SECTION A
(Multiple Choice Questions)
Each question carries 1 mark

Q1) If A is the square matrix of order 3. |A´| = -3 then |AA´| =
(a) 9 (b) -9 (c) -3 (d) -3

Q2) If A =[a_{ij}] is a skew-symmetric matrix of order n, then
(a) $a_{ij} = \frac{1}{a_{ji}}$ for all i,j (b) $a_{ij} \neq 0$ for all i,j (c) $a_{ij} = 0$ where i=j
(d) $a_{ij} \neq 0$ where i=j

Q3) The direction Ratios of line given by $\frac{3x-15}{3} = \frac{4-2y}{8} = \frac{z-5}{-5}$
(a) <1,-4,-5> (b) <1,4,-5> (c) <-1,4,5> (d) <1,4,5>

Q4)The value of 'k' for which the function $f(x) = \begin{cases} \frac{1-cos4x}{8x^2}, & x \neq 0 \\ k, & x = 0 \end{cases}$ is continuous at x = 0 is
(a) 0 (b) -1 (c) 1. (d) 2

Q5) If f´(x) = x + $\frac{1}{x}$, then f(x) is
(a) $x^2 + log|x|$ +C (b) $\frac{x^2}{2} + log|x|$ +C (c) $\frac{x}{2} + log|x|$ +C (d) $\frac{x}{2} - log|x|$ +C

Q6) The order and degree (if exists) of differential equation
Y = x $\frac{dy}{dx} + \sqrt{1 + (\frac{dy}{dx})^2}$
(a) Order 1 degree 1
(b) Order 1 degree 2
(c) Order 2 degree 1
(d) Order 2 degree 2

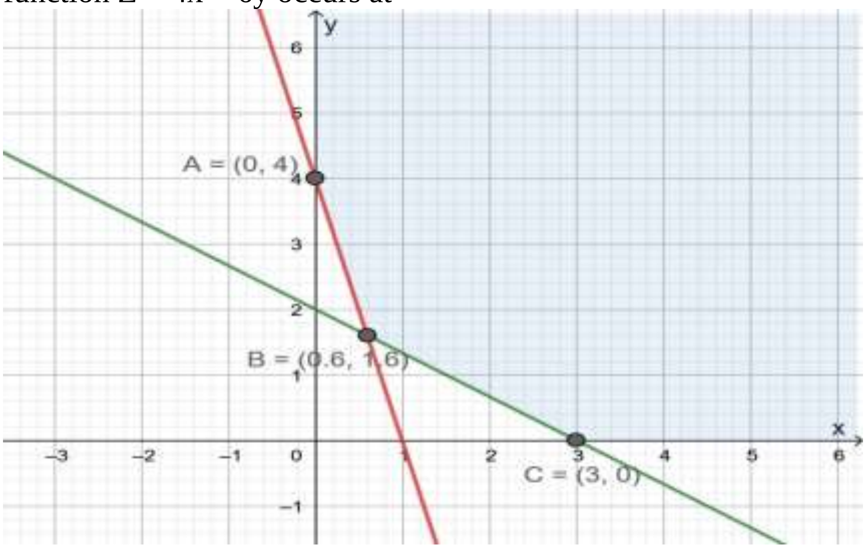
Q7) How many solutions the Linear Programming Problem ,
Minimize Z= 3x+2y
Subject to constraints x+y≥8, 3x+5y≤15, x≥0 and y≥ 0 has?
(a) 2 (b) 3 (c) No Feasible region (d) 3

Q8) If $\vec{a}.\vec{a}$ = 0 and $\vec{a}.\vec{b}$ = 0 then what can be concluded about the vector $\vec{b}$?
(a) $\vec{b}$ can be any vector (b) $\vec{b}$ = 0 (c) $\vec{b}$ is a unit vector

Q9) The value of $\int_2^3 \frac{x}{x^2+1}$ dx is
(a) log 4 (b) log $\frac{3}{2}$ (c) $\frac{1}{2}$ log 2 (d) log $\frac{9}{4}$

Q10) If a matrix has 24 elements, which of the following cannot be the possible orders it can have
(a) (1,24) (b) (2,12) (c) (4,12) (d) (8,3)

Q11) The corner points of the shaded unbounded feasible region of an LPP are (0, 4), (0.6, 1.6) and (3, 0) as shown in the figure. The minimum value of the objective function Z = 4x + 6y occurs at



(a) (0.6, 1.6) only (b) (3,0) only (c) (0.6, 1.6) and (3, 0) only
(d) at every point of the line-segment joining the points (0.6, 1.6) and (3, 0)

Q12) If A is a symmetric matrix, then what can be said about B^TAB?
(a)Symmetric (b) Skew- Symmetric (c) Both (d) Can't Say

Q13)If A= $[a_{ij}]$ is a matrix of order 2×2, such that |A| = -15 and $[c_{ij}]$ represents the cofactor of a_{ij} ,then $a_{21}C_{21}$ + $a_{22}C_{22}$ equals to.
(a)15 (b) $\frac{1}{15}$ (c) -15 (d) None of these

Q14) If P(A)=0.4, P(B)=0.8 and P(B/A)=0.6, Then what is value of P(AUB)?

(a)1 (b) 0.96 (c) 0.80 (d) 0.94

Q15) The general solution of the differential equation ydx- xdy = 0 is
(a)xy=C (b) x=Cy^2 (c) y=Cx (d) y=Cx^2

Q16) If y =Sin^{-1}x, then (1-x^2)y_2 is equal to
(a) xy_1 (b) xy (c) xy_2 (d) x^2

Q17)If two vectors $\underset{a}{\rightarrow}$ and $\underset{b}{\rightarrow}$ are such that |$\underset{a}{\rightarrow}$| = 2 and |$\underset{b}{\rightarrow}$ | =3 and $\underset{a}{\rightarrow}$.$\underset{b}{\rightarrow}$ =4 ,
then |$\vec{a}$ -2 $\vec{b}$| equal to
(a) √2 (b) 2√6 (c) 24 (d) 2√2

Q18) The x-coordinate of a point on the line joining the points P(2,2,1) and Q(5,1,–2) is 4.
Find its z-coordinate.
(a) -1 (b) -2 (c) 1 (d) 2

ASSERTION-REASON BASED QUESTIONS
In the following questions, a statement of assertion (A) is followed by a statement of Reason (R). Choose the correct answer out of the following choices.
(a) Both A and R are true and R is the correct explanation of A.
(b) Both A and R are true but R is not the correct explanation of A.
(c) A is true but R is false.
(d) A is false but R is true.

Q19) **Assertion (A)**: The domain of the function Sec^{-1}2x is (–∞, $\frac{1}{2}$] U [$\frac{1}{2}$, ∞)
Reason (R):Sec^{-1}(-2) = $-\frac{\pi}{4}$

Q20) **Assertion (A)**: The acute angle between the line $\overline{r}$ = $\hat{i}+\hat{j}+2\hat{k}+\lambda(\hat{i}-\hat{j})$

Reason (R): $\overline{r}$ = $x_1\hat{i}+y_1\hat{j}+z_1\hat{k}+\lambda(a_1\hat{i}+b_1\hat{j}+c_1\hat{k})$ and
$\overline{r}$ = $x_2\hat{i}+y_2\hat{j}+z_2\hat{k}+\lambda(a_2\hat{i}+b_2\hat{j}+c_2\hat{k})$ is given by

cosθ = $\frac{|a_1a_2+b_1b_2+c_1c_2|}{\sqrt{a_1^2+b_1^2+c_1^2}\ \sqrt{a_2^2+b_2^2+c_2^2}}$

SECTION B

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

Q21) Find the Value of $\cos^{-1}\frac{1}{2}+2\sin^{-1}\frac{1}{2}$

OR

Prove that the function f is surjective, where f: N→N such that

$$F(n) = f(x) = \begin{cases} \frac{n+1}{2}, & if\ n\ is\ odd \\ \frac{n}{2}, & if\ n\ is\ even \end{cases}$$

Is the function injective? Justify your answer.

Q22) A man 1.6 m tall walks at the rate of 0.3 m/sec away from a street light that is 4 m above the ground. At what rate is the tip of his shadow moving? At what rate is his shadow lengthening?

Q23) Show that the points (2, 3, 4), (−1, −2, 1), (5, 8, 7) are collinear.

OR

If $\vec{a} = \hat{i} - \hat{j} + 7\hat{k}$ and $\vec{b} = 5\hat{i} - \hat{j} + \lambda\hat{k}$ then find the value of λ so that the vectors $\vec{a}+\vec{b}$ and $\vec{a}-\vec{b}$ are orthogonal.

Q24) If cos y = xcos(a+y) find $\frac{dy}{dx}$

Q25) Find $|\vec{x}|$ if $(\vec{x}-\vec{a}).(\vec{x}+\vec{a}) = 12$, where $\vec{a}$ is a unit vector.

Q26) Evaluate $\int_0^{\frac{\pi}{2}} log(tanx)\ dx$

Q27) If A and B are two independent events, then prove that P(A)=P(A∩B)+P(A∩$\overline{B}$).

OR

Find the mean number of defective items in a sample of two items drawn one-by-one without replacement from an urn containing 6 items, which include 2 defective items.

Q28) Evaluate $\int \frac{\sqrt{1+sin2x}}{\sqrt{1+cos2x}} e^x dx$

OR

Evaluate: $\int_0^4 |x-1|\ dx$

Q29) Solve the differential equation: $(1+e^{\frac{x}{y}})dx + e^{\frac{x}{y}}(1-\frac{x}{y})dy = 0$

OR

Solve the differential equation: $x\frac{dy}{dx} + y - x + xy\ cotx = 0$, (x≠0)

Q30) Solve the following Linear Programming Problem graphically:
Maximize Z = 400x + 300y subject to
$x+y\leq 200$, $x\leq 40$, $x\geq 20$, $y\geq 2$

Q31) Evaluate $\int \frac{\cos 2x}{(\cos x+\sin x)^2} dx$

Q32) Find the area bound by Ellipse $\frac{x^2}{4} + \frac{y^2}{9} = 1$

Q33) Define the relation R in the set N×N as follows
For (a,b), (c,d) ∈N×N and (a,b) R (c,d) iff ad=bc. Prove that R is an equivalence Relation in N×N

OR

Given a non-empty set X, define the relation R in P(X) as follows:
For A, B ∈ P(X),(A,B) ∈R iff A⊂ B. Prove that R is Reflexive, transitive and not symmetric.

Q34) Find the coordinates of the points where the line through (5, 1, 6) and (3, 4, 1) crosses the yz-plane.

OR

Find shortest distance between the lines $\overline{r} = \hat{i} + 2\hat{j} - 4\hat{k} + \lambda(2\hat{i} + 3\hat{j} + 6\hat{k})$ and $\overline{r} = 3\hat{i} + 3\hat{j} - 5\hat{k} + t(2\hat{i} + 3\hat{j} + 6\hat{k})$.

Q35) Determine the product of $\begin{bmatrix} -4 & 4 & 4 \\ -7 & 1 & 3 \\ 5 & -3 & -1 \end{bmatrix}\begin{bmatrix} 1 & -1 & 1 \\ 1 & -2 & -2 \\ 2 & 1 & 3 \end{bmatrix}$ and then use to solve the system of equations x-y+z=4, x-2y-2z=9 and 2x+y+3z=1.

Q36) Case-Study 1: The temperature of a person during an illness is given by $f(x) = -0.1x^2+mx+98.6$, $0\leq x\leq 12$, m being a constant where f(x) is the temperature in °F at x days.
A) Is the function differentiable in the interval (0,2)? Justify your answer.
B) If 6 is the critical point of the function, then find the value of constant m
C) Find the intervals in which the function is strictly increasing/strictly decreasing.

OR

Find the points of local maximum/local minimum, if any, in the interval (0, 12) as well as the points of absolute maximum/absolute minimum in the interval [0, 12]. Also, find the corresponding local maximum/local minimum and the absolute maximum/absolute minimum values of the function.

Q37) **Case-Study** 2: Read the following passage and answer the questions given below.

In an elliptical sport field the authority wants to design a rectangular soccer field with the maximum possible area. The sport field is given by the graph of

$\frac{x^2}{a^2}+\frac{y^2}{b^2} = 1$

(i) If the length and the breadth of the rectangular field be 2x and 2y respectively, then find the area function in terms of x.

(ii) Find the critical point of the function.

(iii) Use First derivative Test to find the length 2x and width 2y of the soccer field (in terms of a and b) that maximize its area.

OR

(iii) Use Second Derivative Test to find the length 2x and width 2y of the soccer field (in terms of a and b) that maximize its area.

Q38) A fair die is rolled, if 1 turns up, a ball is picked up at random from a bag A. If 2 or 3 turn up, a ball is drawn from bag B and if 4, 5 or 6 turns up a ball is picked up from bag C. Bag A contains 3 red and 2 white, bag B contains 3 red and 4 white balls and Bag C contains 4 red and 5 white balls. The die is rolled, a bag is picked and a ball is drawn.

Based on the above information, answer the following questions

1. What is the probability of selecting bag A?

2. Find the conditional probability of selecting red ball from bag B.

3. What is the probability of drawing white ball ?

OR

Which of the bags is the most likely outcome in selection of bags?

KENDRIYA VIDYALAYA SANGATHAN, JAMMU REGION
SAMPLE PAPER SET -10

CLASS : XII **SUBJECT: MATHEMATICS**
TIME: 3 hrs **M.M: 80**

General Instructions: This Question paper contains - five sections A, B, C, D and E. Each section is compulsory. However, there are internal choices in some questions.

1. **Section A has 18 MCQ's and 02 Assertion-Reason based questions of 1 mark each.**
2. **Section B has 5 Very Short Answer (VSA)-type questions of 2 marks each.**
3. **Section C has 6 Short Answer (SA)-type questions of 3 marks each.**
4. **Section D has 4 Long Answer (LA)-type questions of 5 marks each.**
5. **Section E has 3 source based/case based/passage based/integrated units of assessment (4 marks each) with sub parts.**

Section A

1. What is a, if $\begin{bmatrix} 1 & 4 \\ 2 & a \end{bmatrix}$ is a singular matrix?

   (a) 5 (b) 6 (c) 7 (d) 8

2. If A is a square matrix of order 3, $|A| = 4$, then $|AA'| =$

   (a) 9 (b) -9 (c) -12 (d) 16

3. The area of a parallelogram with vertices A, B, C and D is given by

   (a) $|\overrightarrow{AB} \times \overrightarrow{CD}|$ (b) $\frac{1}{2}|\overrightarrow{AB} \times \overrightarrow{CD}|$ (c) $|\overrightarrow{AB} \times \overrightarrow{BC}|$ (d) $\frac{1}{2}|\overrightarrow{AB} \times \overrightarrow{BC}|$

4. For which value of k the function f(x) = $\begin{cases} [x], x \neq 2 \\ k, x = 2 \end{cases}$ is continuous?

   (a) 1 (b) 2 (c) 4 (d) for no value of k

5. If $\int \frac{3e^x - 5e^{-x}}{4e^x + 5e^{-x}} dx = ax + b\log|4e^x + 5e^{-x}| + c$, then

   (a) $a = \frac{-1}{8}, b = \frac{7}{8}$ (b) $a = \frac{1}{8}, b = \frac{7}{8}$ (c) $a = \frac{-1}{8}, b = \frac{-7}{8}$ (d) $a = \frac{1}{8}, b = \frac{-7}{8}$

6. The degree of the differential equation $\left(\frac{d^2y}{dx^2}\right)^2 - \left(\frac{dy}{dx}\right) = y^3$, is

   (a) 1 (b) 2 (c) 3 (d) 5

7. The corner points of the feasible region determined by the system of linear constraints are (0, 10), (5, 5), (15, 15), (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

8. The value of λ for which the vectors, $\lambda\hat{\imath} + 2\hat{\jmath} + \hat{k}$ and $4\hat{\imath} - 9\hat{\jmath} + 2\hat{k}$ perpendicular to each other is

   (a) 2 (b) 6 (c) 4 (d) 8

9. If $f(x) = \int_0^x t\sin t dt$ then $f'(x)$ is

   (a) $\cos x + x\sin x$ (b) $x\sin x$ (c) $x\cos x$ (d) $\sin x + x\cos x$

10. The elements of a_{ij} of a 3x3 matrix are given by $a_{ij} = \frac{1}{2}|-3i + j|$ write the value of a_{32}.

(a) $\frac{7}{2}$ (b) $\frac{-7}{2}$ (c) $\frac{11}{2}$ (d) $\frac{-11}{2}$

11. The feasible solution for a LPP is shown in Fig. 12.12. Let Z = 3*x* – 4*y* be the objective function. Minimum of Z occurs at

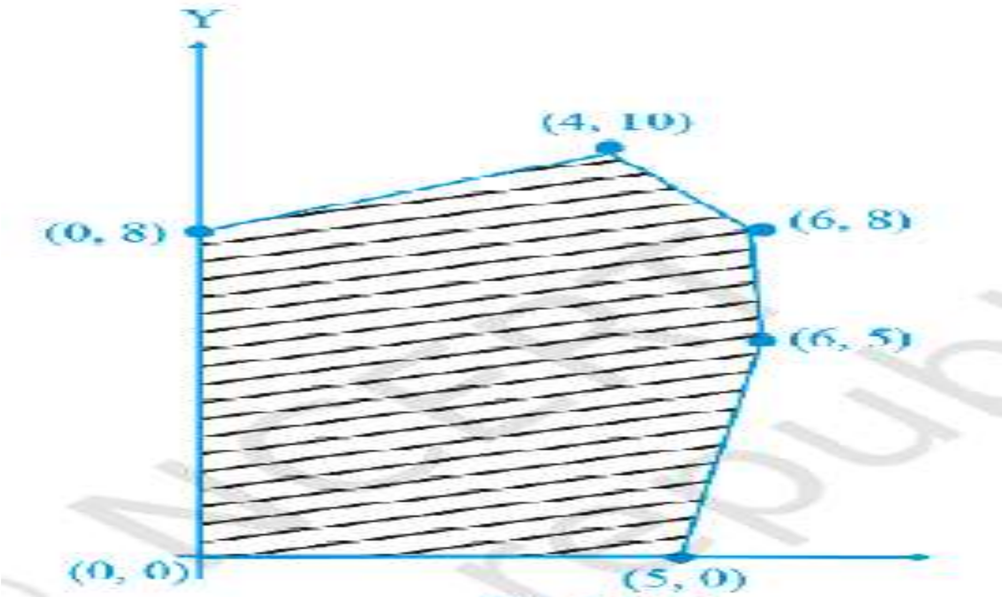


Fig. 12.12

(a) (0,0) (b) (5,0) (c) (0,8) (d) (4,10)

12. If A is a square matrix of order 3 and $|\text{adj.} A|$ = 36, then $|A|$ =

(a) 6 (b) -6 (c) 0 (d) a and b both

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

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

14. The probability that a leap year will have 53 Fridays or 53 Saturdays is

(a) $\frac{2}{7}$ (b) $\frac{1}{7}$ (c) $\frac{3}{7}$ (d) $\frac{4}{7}$

15. The number of arbitrary constants in the general solution of a differential equation of fourth order are:

(a) 0 (b) 2 (c) 3 (d) 4

16. The derivative of tanx with respect secx is

(a) tanx (b) secx (c) cosecx (d) cotx

17. If $|\vec{a}+\vec{b}| = 6$, $|\vec{a}-\vec{b}| = 8$ *and* $|\vec{a}| = 5$, then $|\vec{b}|$ is

(a) 5 (b) 10 (c) 15 (d) 12

18. The line joining the points (0,5,4) and (1,3,6) meets XY – plane at the point

(a) (-2,9,0) (b) (4,-3,0) (c) (1,-2,0) (d) (1,3,0)

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. Assertion (A) : The principal value of $\cos^{-1}(-\frac{1}{2})$ is $\frac{2\pi}{3}$.

Reason (R) : The Principal value of $\cos^{-1}x$ is always lies in $[\pi, 2\pi]$

20. Assertion (A): The pair of lines are $\vec{r} = \vec{\imath} - \vec{\jmath} + t(2\vec{\imath} + \vec{k})$ and $\vec{r} = \overrightarrow{2\imath} - k + s(\vec{\imath} + \vec{\jmath} - \vec{k})$ intersect.

Reason (R) : Two lines intersect each other, if they are not parallel and shortest distance = 0..

SECTION B

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

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

OR

Show that the function f: R→R defined by $f(x)=x^2$ is neither one-one nor onto.

22. A stone is dropped into a quiet lake and waves move in circles at a speed of 4 cm per second. At the instant, when the radius of the circular wave is 10 cm, how fast is the enclosed area increasing?

23. The x-coordinate of a point on the line joining the points P(2,2,1) and Q(5,1,-2) is 4. Find its z-coordinate.

OR

Find the vector equation of the line which passes through the origin and is parallel to the vector $2\hat{i} - 5\hat{j} - 5\hat{k}$. Also write the direction ratio's of x-axis.

24. If $x\sqrt{1+y} + y\sqrt{1+x} = 0$, for , $-1 < x < 1$, prove that $\frac{dy}{dx} = -\frac{1}{(1+x)^2}$.

25. Let $\vec{a} = \vec{\imath} + 4\vec{\jmath} + 2\vec{k}, \vec{b} = 3\vec{\imath} - 2\vec{\jmath} + 7\vec{k}$ and $\vec{c} = \overrightarrow{2\imath} - \vec{\jmath} + 4\vec{k}$. Find a vector $\vec{d}$ which is perpendicular to both $\vec{a}$ and $\vec{b}$ and also $\vec{c} \cdot \vec{d} = 27$.

SECTION - C

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

26. Integrate: $\int \frac{x+3}{\sqrt{5-4x-x^2}} dx$

27. Probabilities of solving a specific problem independently by A and B are $\frac{1}{2}$ and $\frac{1}{3}$ respectively. If both try to solve the problem independently, find the probability that (i) the problem is solved (ii) exactly one of them solves the problem.

OR

5 cards are drawn successively from a well-shuffled pack of 52 cards with replacement. Determine the probability that (i) all the five cards should be spades? (ii) Only 3 cards should be spades? (iii) None of the cards is a spade?

28. Evaluate :$\int_0^{\pi} \frac{x \tan x}{\sec x + \tan x} dx$

OR

Evaluate: $\int \frac{3x+1}{(x+1)^2(x+3)} dx$

29. Solve the differential equation $(1+x^2)\frac{dy}{dx} + y = e^{tan^{-1}x}$.

OR

Solve the differential equation $\frac{dy}{dx} = \frac{2y-x}{2y+x}$

30. Solve the following Linear Programming Problem graphically:

Maximum z = 5x + 6y subjected to constraints

$5x + 8y \leq 200$, $10x + 8y \leq 240$, $x \geq 0$, $y \geq 0$

31. Evaluate: $\int_0^{\frac{\pi}{2}} \log \sin x \, dx$

SECTION - D

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

32. Find the area of the region included between the parabola $y^2 = x$ and the line $x + y = 2$.

33. Let f: W → W be defined by: $f(n) = \begin{cases} n-1, \text{if n is odd} \\ n+1, \text{if n is even} \end{cases}$. Show that 'f' is one-one and onto .

OR

Show that the relation in the set A={1,2,3,4,5,6,7,8} given by R = { (a,b) :$|a-b|$ is divisible by 4} is an equivalence relation.

34. Find the image of the point (1,6,3) in the line $\frac{x}{1} = \frac{y-1}{2} = \frac{z-2}{3}$

OR

Find the shortest distance between the lines whose vector equations are

$\vec{r} = (1-t)\vec{\imath} + (t-2)\vec{\jmath} + (3-2t)\vec{k}$ and $\vec{r} = (s+1)\vec{\imath} + (2s-1)\vec{\jmath} + (2s+1)\vec{k}$

35. Use the product $\begin{bmatrix} -4 & 4 & 4 \\ -7 & 1 & 3 \\ 5 & -3 & -1 \end{bmatrix} = \begin{bmatrix} 1 & -1 & 1 \\ 1 & -2 & -2 \\ 2 & 1 & 3 \end{bmatrix}$ to solve the following system of equations

x-y+z = 4, x-2y-2z = 9, 2x+y+3z = 1

SECTION - E

(This section comprises of 3 case- study based questions of 4 marks each with two sub-parts. 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. Shashi want to make a metal box. She has a metal sheet by which she can make box whose capacity is 1024 cm^3. She thinks that the box has a square base and vertical sides. The material for the top and bottom costs Rs 5/cm^2 and the material for the sides costs Rs 2.50/cm^2 .

Based on the above information answer the following:

(i) What is the sides of the base if cost of box is minimum?

(ii) What is the surface area of the box without top?

(iii) Find the least cost of the box.

OR

Mohan would like to construct a window in his house. He thought about the shape of window. At last he concluded that window has the shape of a rectangle surmounted by an equilateral triangle. If the perimeter of the window is 12 m. He would like to paint the window at cost of10/- per metre square.

Based on the above information answer the following:

(i) Find the dimensions of the rectangle that will produce the largest area of the window.

(ii) Find the largest area of the window.

(iii) Find the cost of painting of equilateral triangular part of window.

37. A person wants to plant some trees in his community park. The local nursery charges the cost of planting trees by the following formula:$C(x) = x^3 - 45x^2 + 600x$, where x is the number of trees and C(x) is the cost of planting x trees in rupees.

The owner of local nursery has imposed a restriction that it can plant 10 to 20 trees in one community park for a fair distribution.

Keeping the above discussion in mind, answer the following:

(i) What are the possible number of trees if C'(x)=0?

(ii) For how many trees should the person place the order so that he has to spend the least amount?

(iii)What is the value of C(x) in rupees, when 10 trees are planted?

OR

Let f(x) be a polynomial function which is defined as $f(x) = x^4 - 8x^3 + 22x^2 - 24x + 21$.

Based on the above function, answer the following:

(i) Determine the critical points of f(x).

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

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

38. There are three categories of students in a class of 60 students :

A : Very hard working students
B : Regular but not so hard working
C : Careless and irregular.
It's known that 10 students are in category A, 30 in category B and rest in category C.
It is also found that probability of students of category A, unable to get good marks in the final year examination is, 0.002, of category B it is 0.02 and of category C, this probability is 0.20.

Based on the above information answer the following:

(i) If a student selected at random was found to be the one who could not get good marks in the examination, then what is the probability that this student is of category C?

(ii) What is the probability that the student is unable to get good marks in the examination?

(iii) A student selected at random was found to be the one who could not get good marks in the examination. Find the probability that this student is **NOT** of category A.

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SAMPLE PAPER SET -11

CLASS : XII | **SUBJECT: MATHEMATICS**

TIME: 3 hrs | **M.M: 80**

General Instructions :

1. This Question paper contains – **five sections** A, B, C, D and E. Each section is compulsory. However, there are internal choices in some questions.
2. **SECTION A** has **18 MCQ's** and **02 Assertion-Reason** based questions of **1 mark each**.
3. **SECTION B** has **05 Very Short Answer (VSA)**-type questions of **2 mark each**.
4. **SECTION C** has **06 Short Answer (SA)**-type questions of **3 mark each**.
5. **SECTION D** has **04 Long Answer (LA)**-type questions of **5 mark each**.
6. **SECTION E** has **03 source based/case based/passage based/integrated units of assessment (4 mark each)** with sub parts.

SECTION A

1. If $A = \begin{bmatrix} \cos\alpha & -\sin\alpha \\ \sin\alpha & \cos\alpha \end{bmatrix}$, then the value of '∝' for which A is an identity matrix:

a) 0   b) $\frac{\pi}{2}$

c) $\frac{-\pi}{2}$ d) π

2. The element a_{23} of a 3×3 matrix $A = (a_{ij})$ whose elements a_{ij} are given by $a_{ij} = \frac{|i-j|}{2}$ is:

a) $\frac{1}{2}$ b) 0

c) $\frac{-1}{2}$ d) 1

3. If A = $\begin{bmatrix} 0 & a & -3 \\ 2 & 0 & -1 \\ b & 1 & 0 \end{bmatrix}$ is skew-symmetric, then:

a) a = – 2, b = 3   b) a = 2, b = – 3

c) a = 2, b = 3   d) a = – 2, b = – 3

4. For what values of 'a' and 'b', the function 'f' defined as

$$f(x) = \begin{cases} 3ax + b & if \quad x < 1 \\ 11 & if \quad x = 1 \\ 5ax - 2b & if \quad x > 1 \end{cases}$$

a) 3, 2 b) 2, 3

c) 2, 2 d) 3, 3

5. If $y = 500\, e^{7x} + 600\, e^{7x}$, then $\dfrac{d^2 y}{d x^2}$ equals:

a) 47y b) 49y

c) 48y d) 46y

6. $\int \log x \;\; dx$ is:

a) $x \log x + x + c$ b) $x \log x - x + c$

c) $\log x + x + c$ d) $\log x - x + c$

7. $\int_0^{\pi/2} \dfrac{\sin x}{\sin x + \cos x} dx$ is:

a) $\dfrac{\pi}{2}$ b) $\dfrac{\pi}{4}$

c) $\dfrac{\pi}{3}$ d) $\dfrac{\pi}{6}$

8. Value of $\begin{vmatrix} \cos 15^0 & \sin 15^0 \\ \sin 75^0 & \cos 75^0 \end{vmatrix}$ is:

a) 0 b) 1

c) $\dfrac{1}{2}$ d) $\dfrac{1}{\sqrt{2}}$

9. If A is a square matrix of order 3, with $|A| = 9$, then $|2 \text{ adj } A|$ is:

a) 538 b) 548

c) 648 d) 638

10. The degree of the differentiate equation $\left(\dfrac{d^2 y}{d x^2}\right)^2 + \left(\dfrac{d y}{d x}\right)^3 + \cos\left(\dfrac{d y}{d x}\right) - 1 = 0$ is:

a) 2 b) 3

c) 1 d) Not defined

11. Integrating factor of the differential equation $x\dfrac{dy}{dx} + y = 2x^2$ is:

a) e^x b) e^{-y}

c) $\dfrac{1}{x}$ d) x

12. Two vectors $\hat{j}+\hat{k}$ and $3\hat{i}-\hat{j}+4\hat{k}$ represent the two sides AB and AC respectively of a Δ ABC. Then length of median through A is:

a) $\sqrt{34}$ units
b) $\frac{1}{2}\sqrt{34}$ units
c) $\frac{1}{3}\sqrt{34}$ units
d) $\frac{1}{4}\sqrt{34}$ units

13. The value of λ when the projection of $\vec{a}=\lambda\hat{i}+\hat{j}+4\hat{k}$ on $\vec{b}=2\hat{i}+6\hat{j}+3\hat{k}$ is 4 units:

a) 4
b) 5
c) 3
d) 6

14. Find $|\vec{a}-\vec{b}|$, if $|\vec{a}|=2$, $|\vec{b}|=3$ and $\vec{a}-\vec{b}=4$:

a) $\sqrt{3}$
b) $\sqrt{2}$
c) $\sqrt{5}$
d) $\sqrt{7}$

15. The point which does not lie in the half plane $2x+3y-12=0$ is:

a) (1, 12)
b) (2, 1)
c) (2, 3)
d) (– 3, 2)

16. The corner points of the feasible region for a linear programming problem are P (0, 5), Q (1, 5), R (4, 2) and S (12, 0). The minimum value of the objective fun. $Z = 2x + 5y$ is at the point:

a) P
b) Q
c) R
d) S

17. Let A and B be two events. If $P(A) = 0.2$, $P(B) = 0.4$, $P(A \cup B) = 0.6$, then $P(A / B)$ is equal to:

a) 0.8
b) 0.5
c) 0.3
d) 0

18. Direction-cosines of x-axis are:

a) (0, 1, 0)
b) (1, 0, 0)
c) (0, 0, 1)
d) (1, 1, 1)

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. Assertion (A): If $\tan^{-1} x + \tan^{-1} y = \frac{\pi}{4}$, $xy < 1$, then the values of $x + y + xy$ is 1.

Reason (R): $\tan^{-1} x + \tan^{-1} y = \tan^{-1} \frac{x+y}{1-xy}$

20. Assertion (A): Shortest distance between two skew lines:

$$\frac{x+3}{-4} = \frac{y-6}{3} = \frac{z}{2} \text{ and } \frac{x+2}{-4} = \frac{y}{1} = \frac{z-7}{1} \text{ is 9}$$

Reason (R): Two lines are skew if there exists no plane passing through them.

SECTION B

21. Find the principal value of:

$$\cos^{-1}\left(\cos\frac{2\pi}{3}\right) + \sin^{-1}\left(\sin\frac{2\pi}{3}\right)$$

OR

Show that the function $f : R \to R$ defined by $f(x) = \frac{x}{x^2+1}$, $\forall\ x \in R$ is neither one-one nor onto.

22. A stone is dropped into a quiet lake and waves move in circles at a speed of 4cm per second. At the instant when the radius of circular wave is 10cm, how fast is the enclosed area increasing?

23. If $\hat{a}$ and $\hat{b}$ are unit vectors, then prove that $\frac{|\hat{a}+\hat{b}|}{2} = \cos\frac{\theta}{2}$, where ‘θ’ is the angle between them.

OR

Find the value of ‘K’ so that the lines:

$x = -y = Kz$ and $x - 2 = 2y + 1 = -z + 1$ are perpendicular to each other.

24. If $(x^2 + y^2)^2 = xy$, find $\frac{dy}{dx}$.

25. If $\vec{a}$ and $\vec{b}$ are perpendicular vectors $|\vec{a} + \vec{b}| = 13$ and $|\vec{a}| = 5$, find the value of $|\vec{b}|$.

.

SECTION C

26. Find $\int \frac{2x}{(x^2+1)(x^2+2)} dx$

27. A speaks truth in 80% cases and B speaks truth in 90% cases. In what percentage of cases are they likely to agree with each other in stating the same fact?

OR

An urn contains 5 red, 2 white and 3 black balls. Three ball are drawn one by one, at random without replacement. Find the probability distribution of the number of white balls.

28. Evaluate: $\int_0^{\pi/2} \frac{1}{1+(\tan x)^{2/3}} \, dx$

OR

Evaluate: $\int_1^3 \frac{\sqrt{x}}{\sqrt{x}+\sqrt{4-x}} \, dx$

29. Solve the differential equation:

$$(1+e^{y/x})\, dy + e^{y/x}\left(1-\frac{y}{x}\right) dx = 0 \qquad (x \neq 0)$$

OR

Find the general solution of the differential equation:

$$x\frac{dy}{dx} - y = x^2 \,.\, e^x \text{, given } y\,(1) = 0$$

30. Solve the following linear programming problems graphically.

Maximise $Z = 2x + 3y$, subject to constraints $x + 2y \leq 10$, $2x + y \leq 14$ and $x \geq 0$, $y \geq 0$.

31. Find: $\int \sec^3 x \, dx$

SECTION D

32. Using integration, find the area of the region enclosed by the parabola $y = 3x^2$ and the line $3x - y + 6 = 0$.

33. Show that the relation R on the set Z of all integers defined by $(x, y) \in R \Leftrightarrow (x - y)$ is divisible by 3 is an equivalence relation.

OR

Check whether the relation R in the set R of real numbers, defined by:

$R = \{(a, b) : 1 + ab > 0\}$ is reflexive symmetric or transitive.

34. Find the coordinates of the foot of perpendicular drawn from the point A (1, 8, 4) to the line joining B (0, – 1, 3) and C (2, – 3, – 1).

OR

Find the shortest distance between the lines:

$\vec{r} = 3\hat{i} + 2\hat{j} - 4\hat{k} + \lambda\left(\hat{i} + 2\hat{j} + 2\hat{k}\right)$ and

$\vec{r} = 5\hat{i} - 2\hat{j} + \mu\left(3\hat{i} + 2\hat{j} + 6\hat{k}\right)$

If the lines intersect, find their point of intersection.

35. If A = $\begin{bmatrix} 5 & -1 & 4 \\ 2 & 3 & 5 \\ 5 & -2 & 6 \end{bmatrix}$, find A^{-1} and use it to solve the following system of equations

$5x - y + 4z = 5,\ \ 2x + 3y + 5z = 2,\ \ 5x - 2y + 6z = -1$

SECTION-E

36. A manufacturer makes two types of machines, deluxe sells for ₹ 12,000 and standard sells for ₹ 8000. It costs ₹ 9000 to produce a deluxe and ₹ 6000 to produce a standard. In one week manufacturer can produce 40 to 60 deluxe machines and 30 to 50 standard machines, but not more than 90 machines.

MCQ:

(i) Maximum profit is:

(a) ₹ 240,000 (b) ₹ 20,000

(b) ₹ 220,000 (d) ₹ 250,000

(ii) Minimum profit is:

(a) ₹ 200,000 (b) ₹ 180,000

(c) ₹ 220,000 (d) ₹ 210,000

(iii) Maximum profit is received when the following machines are sold:

(a) 50 Deluxe and 40 Standard machines.

(b) 60 Deluxe and 30 Standard machines.

(c) 40 Deluxe and 50 Standard machines.

(d) 40 Deluxe and 60 Standard machines.

(iv) Minimum profit is received when the following machines are sold:

(a) 40 Deluxe and 30 Standard machines.

(b) 30 Deluxe and 40 Standard machines.

(c) 40 Deluxe and 50 Standard machines.

(d) 50 Deluxe and 40 Standard machines.

37. A coach is training 3 players. He observes that the player *A* can hit a target 4 times in 5 shots, player *B* can hit 3 times in 4 shots and the player *C* can hits 2 times in 3 shots.

Based on the above information, answer the following:

(i) What is the probability that all A, B and C will hit the target?

(ii) What is the probability that B, C will hit but A will not?

(iii) What is the probability that none of them will hit the target?

OR

What is the probability that at least one of A, B or C will hit the target?

38. A village Panchayat wants to dug out a square base tank for preparing fertilizers and wants capacity to be 250 cu metres. On calculations it was found that cost of the land is INR50per square metre and cost of digging increases with depth and cost of the whole tank is INR400. Tank is shown as

Based on the above information, answer the following:

(i) If the side of the square base is x metres and the height of the tank is h metre, then establish relation between x and h.

(ii) Find the Cost for digging the tank in terms of h only.

(iii) Find cost in terms of h only.

OR

Find the cost of h for which c is minimum.

KENDRIYA VIDYALAYA SANGATHAN, JAMMU REGION
SAMPLE PAPER SET -12

CLASS : XII **SUBJECT: MATHEMATICS**

TIME: 3 hrs **M.M: 80**

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

SECTION A
(Multiple Choice Questions)
Each question carries 1 mark

1. If A and B are symmetric matrices of same order, then AB-BA is a
   a)symmetric matrix b)skew-symmetric matrix c)zero matrix d)identity matrix
2. If A is a square matrix of order 3 such that $A(adj\ A) = \begin{bmatrix} -3 & 0 & 0 \\ 0 & -3 & 0 \\ 0 & 0 & -3 \end{bmatrix}$, then |A| is equal to
   a)9 b)-3 c)-6 d)3
3. The projection of the vector $\vec{a} = 2\hat{\imath} - \hat{\jmath} + \hat{k}$ along the vector $\vec{b} = \hat{\imath} + 2\hat{\jmath} + 2\hat{k}$ is
   a)2 b)$\sqrt{6}$ c)$\frac{2}{3}$ d)$\frac{1}{3}$
4. If $f(x) = \begin{cases} \frac{1-\cos px}{x \sin x}, & x \neq 0 \\ \frac{1}{2}, & x = 0 \end{cases}$ is continuous at x=0, then p is equal to
   a)2 b)-2 c)1,-1 d)none of these
5. If $\int xe^{kx^2}\, dx = \frac{1}{4}e^{2x^2} + C$, then the value of k is
   a)4 b)-2 c)2 d)1
6. The order and degree of the differential equation $\frac{d^2y}{dx^2} + \left(\frac{dy}{dx}\right)^3 + 6y^5 = 0$, respectively, are
   a)2,3 b)2,1 c)3,1 d)2,5
7. If the objective function for a LPP is Z=5x+7y and the corner points of the bounded feasible region are (0,0), (7,0) ,(3,4) and (0,2), then the maximum value of Z occurs at
   a)(0,0) b)(7,0) c)(3,4) d)(0,2)
8. If $|\vec{a}| = 3\ and\ |\vec{b}| = 4$, then the value of λ for which $\vec{a} + \lambda\vec{b}\ and\ \vec{a} - \lambda\vec{b}$ are perpendicular is
   a)$\frac{9}{16}$ b)$\frac{3}{4}$ c)$\frac{3}{2}$ d)$\frac{4}{3}$
9. The value of $\int_0^1 \frac{\tan^{-1} x}{1+x^2}\, dx$ is
   a)$\frac{\pi}{4}$ b)$\frac{\pi^2}{32}$ c)1 d) $\frac{\pi^2}{16}$

10. If $A^2 - A + I = O$, then A^{-1} is equal to

a) $A + I$ b) $A - I$ c) $A + 2I$ d) $I - A$

11. The corner points of the feasible region for an LPP are (0,10), (5,5), (15,15) and (0,20). If the objective function is Z=px+qy, p,q>0, then the condition on p and q so that the maximum of Z occurs at (15,15) and (0,20) is

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

12. If $A = \begin{bmatrix} 2x & 0 \\ x & x \end{bmatrix}$ $and\ A^{-1} = \begin{bmatrix} 1 & 0 \\ -1 & 2 \end{bmatrix}$, then the value of x is

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

13. If A is a square matrix of order 3 and |A| = 5, then $|adjA|$ =

a)5 b)25 c)125 d) $\frac{1}{5}$

14. If $P(A) = \frac{4}{5}$ $and\ P(A \cap B) = \frac{7}{10}, then\ P(B|A)$ is equal to

a) $\frac{1}{10}$ b) $\frac{1}{8}$ c) $\frac{7}{8}$ d) $\frac{17}{20}$

15. The general solution of the differential equation $\frac{dy}{dx} + y\tan x = \sec x$ is

a) $y\sec x = \tan x + C$ b) $y\tan x = \sec x + C$ c) $x\sec x = \tan y + C$ d) None of these

16. If $f(x) = x\ \tan^{-1} x\ , then\ f'(1)$ is equal to

a) $\frac{\pi}{4} + \frac{1}{2}$ b) $\frac{\pi}{4} - \frac{1}{2}$ c) $\frac{1}{2} - \frac{\pi}{4}$ d)none of these

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

a)1 b) $\frac{3}{2}$ c) $-\frac{3}{2}$ d)none of these

18. If a line is equally inclined with the coordinate axes, then its direction cosines are

a) $\pm < 1,1,1 >$ b) $\pm < \frac{1}{3}, \frac{1}{3}, \frac{1}{3} >$ c) $\pm < \frac{1}{\sqrt{3}}, \frac{1}{\sqrt{3}}, \frac{1}{\sqrt{3}} >$ d) $\pm < \frac{1}{\sqrt{3}}, \frac{-1}{\sqrt{3}}, \frac{-1}{\sqrt{3}} >$

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. **Assertion(A):** The domain of the function $\sec^{-1} 2x$ is $\left(-\infty, -\frac{1}{2}\right] \cup \left[\frac{1}{2}, \infty\right)$.

Reason(R): $\sec^{-1}(-2) = -\frac{\pi}{4}$

20. **Assertion(A):** The direction cosines of the vector $2\hat{i} + 3\hat{j} - 5\hat{k}$ are $< \frac{2}{\sqrt{38}}, \frac{3}{\sqrt{38}}, -\frac{5}{\sqrt{38}} >$.

Reason(R): If < a, b, c> are direction ratios then direction cosines are $< \frac{a}{D}, \frac{b}{D}, \frac{c}{D} >$, where D = $\sqrt{a^2 + b^2 + c^2}$.

SECTION B

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

21. a) Find the value of $\tan^{-1}\left(\tan\frac{5\pi}{6}\right)+\cos^{-1}\left(\cos\frac{13\pi}{6}\right)$

OR

b) Show that the function $f: R_0 \to R_0, defined\ by\ f(x)=\frac{1}{x}$, is one-one onto, where R_0 is the set of all non-zero real numbers. Is the result true, if the domain R_0 is replaced by N with co-domain being same as R_0?

22. If the area of a circle increases at a uniform rate, then prove that the perimeter varies inversely as the radius.

23. a) If $\vec{a}=3\hat{\imath}+2\hat{\jmath}+2\hat{k}\ and\ \vec{b}=\hat{\imath}+2\hat{\jmath}-2\hat{k}$, then find a unit vector which is perpendicular to both the vectors $\left(\vec{a}+\vec{b}\right)\ and\ \left(\vec{a}-\vec{b}\right)$.

OR

b) Find the vector and cartesian equations of the line which passes through the point (-2,4,-5) and is parallel to the line given by $\frac{x+3}{3}=\frac{y-4}{5}=\frac{z+8}{6}$.

24. If $y=\frac{\cos x+\sin x}{\cos x-\sin x}$ $, prove\ that\ \frac{dy}{dx}=sec^2\left(\frac{\pi}{4}+x\right)$

25. The vectors $\vec{a}=3\hat{\imath}+x\hat{\jmath}\ and\ \vec{b}=2\hat{\imath}+\hat{\jmath}+y\hat{k}$ are mutually perpendicular. Given that $|\vec{a}|=|\vec{b}|$, find the values of x and y.

SECTION C

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

26. Evaluate: $\int \frac{dx}{\sqrt{3x^2+6x+12}}$

27. Four bad oranges are accidently mixed with 16 good ones. Find the probability distribution of the number of bad oranges when two oranges are drawn at random from this lot. Find the mean of the distribution.

OR

Consider the experiment of tossing a coin. If the coin shows head, toss it again but if it shows tail, then throw a die. Find the conditional probability of the event that 'the die shows a number greater than 4' given that 'there is at least one tail'.

28. a) Evaluate: $\int_{-1}^{2} f(x)\ dx, where\ f(x)=|x+1|+|x|+|x-1|$

OR

b) Evaluate: $\int_0^{\pi}\frac{x\tan x}{\sec x+\tan x}\ dx$

29. a) Solve the differential equation: $x\cos\left(\frac{y}{x}\right)dy=\left(y\cos\left(\frac{y}{x}\right)+x\right)dx$

OR

b) Solve the differential equation: $x\frac{dy}{dx}-y-2x^3=0.$

30. Solve the following Linear Programming Problem graphically:

$Maximize\ Z=5x+10y, subject\ to\ x+2y\le 120, x+y\ge 60, x-2y\ge 0, x\ge 0, y\ge 0.$

31. Find $\int\frac{2x-1}{(x-1)(x-2)(x-3)}\ dx$

SECTION D

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

32. Using integration, find the area of the region included between the curve $4y = 3x^2$ *and the line* $2y = 3x + 12$.

33. a) Let N be the set of all natural numbers and R be the relation on $N \times N$ defined by $(a, b)R(c, d)\ iff\ ad(b + c) = bc(a + d) for\ all\ a, b, c, d \in N$. Show that R is an equivalence relation.

OR

b) Show that the relation R defined by $(a, b)R(c, d)\ iff\ a + d = b + c$ on the set $N \times N$ is an equivalence relation. Also find the equivalence class of (3,7).

34. a) Find the shortest distance between the lines $\vec{r} = 3\hat{\imath} + 2\hat{\jmath} - 4\hat{k} + \lambda(\hat{\imath} + 2\hat{\jmath} + 2\hat{k})$ *and* $\vec{r} = 5\hat{\imath} - 2\hat{\jmath} + \mu(3\hat{\imath} + 2\hat{\jmath} + 6\hat{k})$. If the lines intersect find their point of intersection.

OR

b) Find the value of λ for which the following lines are perpendicular to each other:

$\frac{x-5}{5\lambda+2} = \frac{2-y}{5} = \frac{1-z}{-1}$; $\frac{x}{1} = \frac{y+\frac{1}{2}}{2\lambda} = \frac{z-1}{3}$. Hence, find whether the lines intersect or not.

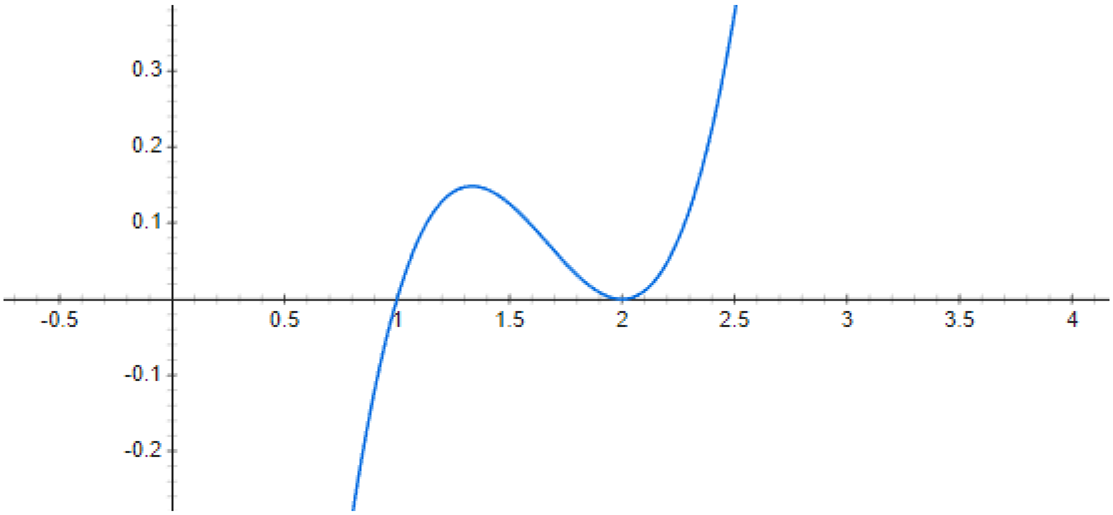
35. If $A = \begin{bmatrix} 4 & 2 & 3 \\ 1 & 1 & 1 \\ 3 & 1 & -2 \end{bmatrix}$, *find* A^{-1}. Using A^{-1}, solve the following system of linear equations:

$4x + 2y + 3z = 2, x + y + z = 1,\ 3x + y - 2z = 5$

SECTION E

(This section comprises of 3 case study/passage-based questions of 4 marks each with two sub-parts. First two case-study questions have three sub-parts (a),(b),(c) of marks 1,1,2 respectively. The third case-study question has two sub-parts of 2 marks each.)

36. **Case-Study 1:** A particle is moving along the curve represented by the polynomial $f(x) = (x-1)(x-2)^2$, as shown in the figure given below:



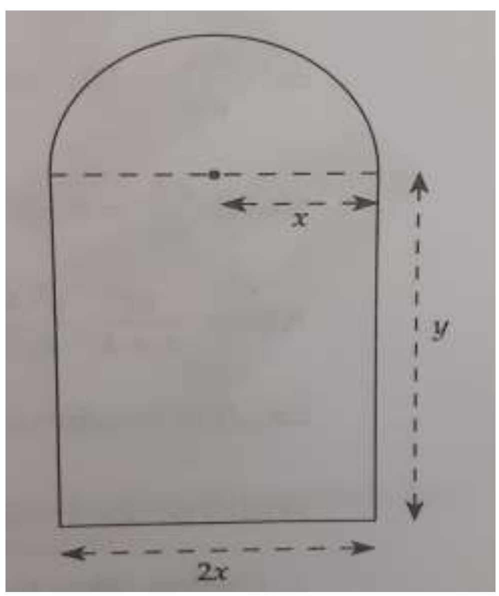
Based on the above information, answer the following questions:

a) Find the critical points of the polynomial f(x).

b) Find the interval in which f(x) is strictly increasing.

c) What is the local minimum value of $f(x) = (x-1)(x-2)^2$

37. **Case-Study 2:** Mr. Dhar is an architect. He designed a building and provided an entry door in the shape of a rectangle surmounted by a semicircular opening as shown in the given figure. The perimeter of the door is 10 m.



Based on the above information, answer the following questions:

a) If 2x metres and y metres be the breadth and the height of the rectangular part of the door, then find the area of the door in terms of x.

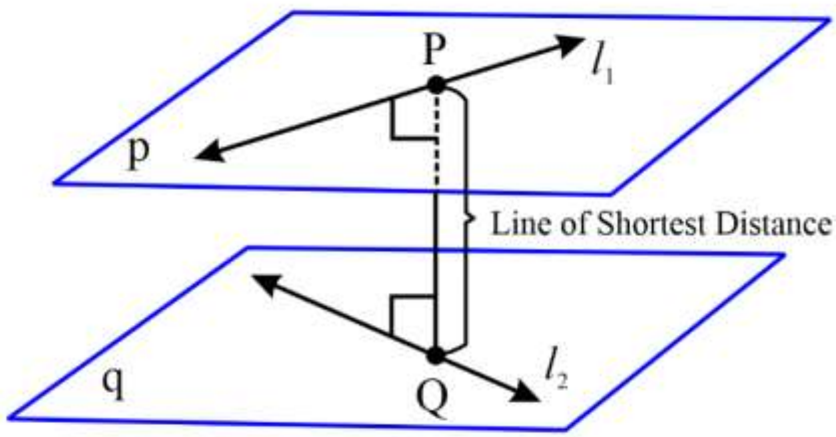
b) What will be the width of the door so as to allow maximum airflow inside the building?

OR

What will be the height of the door so as to allow maximum airflow inside the building?

c) Find the area of the door which permits the maximum airflow inside the building.

38. **Case-Study 3:** Observe the diagram given below in which two lines l_1 and l_2 are shown in space and PQ is the only line which is perpendicular to both l_1 and l_2.



Based on the above information, answer the following questions:

a) If the equations of l_1 and l_2 are respectively $\frac{x-1}{2}=\frac{y-2}{3}=\frac{z-3}{4}$ and $\frac{x-2}{3}=\frac{y-4}{4}=\frac{z-5}{5}$, then find a vector which is perpendicular to both the lines l_1 and l_2.

b) Find the direction ratios of the vector $\overrightarrow{PQ}$.

KENDRIYA VIDYALAYA SANGATHAN, JAMMU REGION
SAMPLE PAPER SET -13

CLASS : XII **SUBJECT: MATHEMATICS**

TIME: 3 hrs **M.M: 80**

General Instructions:

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

Section-A

(Each question carries 1 marks)

Q1:If a matrix has 18 elements, then number of possible orders of the matrix can be:

(a) 3 (b) 4 (c) 6 (d) 5

Q2: If $\begin{vmatrix} 2x & -1 \\ 4 & 2 \end{vmatrix} = \begin{vmatrix} 3 & 0 \\ 2 & 1 \end{vmatrix}$, then x is

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

Q3: For what value of p, is $(\hat{\imath} + \widehat{\jmath + \hat{k}})$p a unit vector.

(a) $1/\sqrt{3}$ (b) $-1/\sqrt{3}$ (c) $\pm 1/\sqrt{3}$ (d) 3

Q4: The value of k, for which the function f(x) $\begin{cases} kx^2, x \geq 1 \\ 4, \ \ x < 1 \end{cases}$ is continuous at x=1.

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

Q5: The value of $\int tan^2x \, dx$:

(a) secx +c (b) secx tanx +c (c) tanx – x +c (d) x – tanx +c

Q6:The sum of order and degree of D.E. $d^2y/dx^2 + (dy/dx)^3 + x^4 = 0$ is

(a) 5 (b) 4 (c) 3 (d) 7

Q7: Feasible region is the set of points which satisfy

(a) the objective function (b)some of given constraints (c)all of given constraints (d) none of these

Q8: The value of $\hat{\imath}.\hat{\imath} - \hat{\jmath}.\hat{\jmath} + \hat{k}.\hat{k}$

(a) 3 (b) 0 (c) 1 (d) 2

Q9: $\int logx \, dx =$

(a) x +c (b) 1/x +c (c) xlox-1 +c (d) x(logx-1) +c

Q10: Find the value of x , such that the points (0,2), (1,x), and (3,1) are collinear.

(a) 1 (b) 3/5 (c) 5/3 (d) 0

Q11:The maximum value of L.P.P., Maximize z= 3x + 4y, subject to $x+y \leq 4$, $x \geq 0$ and $y \geq 0$, is

(a) 12 (b) 16 (c) 18 (d) 28

Q12:If the determinant of matrix A of order 3 x 3 is of value 4, then find the value of |3A|

(a) 36 (b) 108 (c) 112 (d) 12

Q13:If A=$\begin{vmatrix} 3-2x & x+1 \\ 2 & 4 \end{vmatrix}$ is a singular matrix, then the value of x is:

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

Q14: If P(A)=1/2, P(B)=0, then P(A/B) is

(a) 0 (b) 1/2 (c) not defined (d) 1

Q15: Integrating factor of differential equation $\frac{dy}{dx} + ycotx = 2cosx,$ is:

(a) tanx (b) secx (c) sinx (d) logsinx

Q16: The derivative of logx with respect to x^2 is

(a) $2x^2$ (b) 2x (c) $1/2x^2$ (d) none of these

Q17: If (x$\hat{\imath} + 2\hat{\jmath} - z\hat{k}$) and ($3\hat{\imath} - y\hat{\jmath} + \hat{k}$) are two equal vectors, then the value of (x+y+z) is

(a) 6 (b) 0 (c) 4 (d) 5

Q18: $\frac{x-1}{-2} = \frac{y-4}{3p} = \frac{z-3}{4}$ and $\frac{x-2}{4p} = \frac{y-5}{2} = \frac{z-1}{-7}$ are perpendicular to each other, then the value of p is

(a) 28 (b) 14 (c) -14 (d) 2

ASSERTION-REASON BASED QUESTIONS

In the following questions, a statement of assertion (A) is followed by a statement of Reason (R). Choose the correct answer out of the following choices. (a) Both A and R are true and R is the correct explanation of A.
(b) Both A and R are true but R is not the correct explanation of A.
(c) A is true but R is false. (d) A is false but R is true.

Q19. Assertion (A): $\sin^{-1}\left(sin\frac{2\pi}{3}\right) = \frac{\pi}{3}$

Reason (R): $\sin^{-1}(sin\theta) = \theta$ when $\theta \in \left[\frac{-\pi}{2}, \frac{\pi}{2}\right]$

Q20. Assertion (A): Vector equation of line $\frac{x-5}{3} = \frac{y+4}{7} = \frac{6-z}{2}$ is $(5\hat{\imath} - 4\hat{\jmath} + 6\hat{k}) + \mu\,(3\hat{\imath} + 7\hat{\jmath} - 2\hat{k})$

Reason (R): Vector equation of line passing through points (x_1, y_1, z_1) is $\frac{x-x_1}{a} = \frac{y-y_1}{b} = \frac{z-z_1}{c}$.

SECTION B

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

Q21: Let A=R-{3}, B=R-{1}. Let f: A→B be defined by f(x) = $\frac{x-2}{x-3}$ ∀ x∈ A. Then show that the function f is bijective.

(OR)

Evaluate: sin $[\frac{\pi}{3} - sin^{-1}(\frac{-1}{2})]$

Q22: Find the intervals in which function f(x) = sin x + cos x, 0≤x≤2 π, increasing.

Q23: Find the angle between the vectors$(\hat{\imath} - \hat{\jmath})$ and $(\hat{\jmath} - \hat{k})$.

(OR)

The x-coordinate of a point on the line joining the points P(2,2,1) and Q(5,1,-2) is 4.Find its z-coordinate.

Q24: If $xy = e^{(x-y)}, then\ show\ that\ \frac{dy}{dx} = \frac{y(x-1)}{x(y+1)}$

Q25: Find λ, when the projection of $\vec{a}=\lambda\hat{\imath} + \hat{\jmath} + 4\hat{k}$, $\vec{b}= 2\hat{\imath} + 6\hat{\jmath} + 3\hat{k}$ is 4 uint.

Section-C(Each question carries 3 marks)

Q26: Find: $\int e^x[secx + \log(secx + tanx)]\, dx$

Q27: 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 obtained is red". Find if A and B are independent events.

(OR)

If P(A)=2/5, P(B)=1/3, P(A∩B)=1/5, then find P($\bar{A}/\bar{B}$).

Q28 : Evaluate: $\int_0^1 x(\tan^{-1}x)\, dx$

(OR)

Evaluate: $\int_0^{\frac{\pi}{4}} \frac{sinx+cosx}{9+16sin2x} dx$

Q29:Find the particular solution of the differential equation, $\log(\frac{dy}{dx})= 3x + 4y$, given that y=0, when x=0

(OR)

Solve the differential equation, $x \log x \frac{dy}{dx} + y = \frac{2}{x}\log x$

Q30:Solve the following L.P.P. graphically:

Maximize z: 8000x + 12000y

Subject to the constraints: $3x + 4y \leq 60$, $x + 3y \leq 30$, $x\geq0$, $y\geq0$

Q31: Evaluate:$\int \frac{xdx}{(x-1)^2(x+2)}$

Section-D(Each question carries 5 marks)

Q32: Find the area of the region in the first quadrant enclosed by the y-axis, the line y = x and the circle $x^2 + y^2 = 32$, using integration.

Q33: Let A = { 1, 2, 3 ,.......,9} and R be the relation in A x A defined by (a, b) R (c, d) if a + d = b + c for (a, b) , (c, d) in A x A Prove that R is an equivalence relation. Also obtain the equivalence class [(2, 5)].

(OR)

Let N denote the set of all natural numbers and R be the relation on N x N defined by (a, b) R(c, d) if ad(b + c) = bc(a + d). Show that R is an equivalence relation.

Q34: By computing the shortest distance between the following pair of lines, determine whether they intersect or not.

$\vec{r} = (\hat{\imath} - \hat{\jmath}) + \lambda(2\hat{\imath} - \hat{k})$

and $\vec{r} =(2\hat{\imath} - \hat{\jmath}) + \mu(\hat{\imath} - \hat{\jmath} - \hat{k})$.

(OR)

Find the equation of the perpendicular drawn from the point P(2, 4, - 1) to the line

$$\frac{x + 5}{1} = \frac{y+3}{4} = \frac{z-6}{-9}$$

. Also write down the co-ordinates of the foot of the perpendicular from P to the line.

Q35:Determine the product $\begin{bmatrix} -4 & 4 & 4 \\ -7 & 1 & 3 \\ 5 & -3 & -1 \end{bmatrix} = \begin{bmatrix} 1 & -1 & 1 \\ 1 & -2 & -2 \\ 2 & 1 & 3 \end{bmatrix}$, and use it to solve the system of equations:

$x - y + z = 4, \quad x - 2y - 2z = 9, \quad 2x + y + 3z = 1.$

Section-E(Each question carries 4 marks)   CASE STUDY

Q36: Megha wants to prepare a handmade gift box for her friend's birthday at home. For making lower part of box, she takes a square piece of cardboard of side 20 cm.

Based on the above information, answer the following questions.

(i) Write the Volume of the open box formed by folding up the cutting corner.
(ii) Find the values of x for which $\frac{dy}{dx} = 0$.
(iv) Megha is interested in maximising the volume of the box. So, what should be side of the square to be cut off so that the volume of the box is maximum?

Q37: An architecture design a auditorium for a school for its cultural activities. The floor of the auditorium is rectangular in shape and has a fixed perimeter P.

Based on the above information, answer the following questions.

(i) If x and y represents the length and breadth of the rectangular region, then relation between the variable is
(a) $x + y = P$ (b) $x^2 + y^2 = P^2$ (c) $2(x + y) = P$ (d) $x + 2y = P$

(ii) The area (A) of the rectangular region, as a function of x, can be expressed as

(a) $A = Px + x/2$ (b) $A = (Px + x^2)/2$ (c) $A = (Px - 2x^2)/2$ (d) $A = (x^2 + 2Px^2)/2$

(iii) School's manager is interested in maximising the area of floor 'A' for this to be happen, the value of x should be

(a) P (b) P/2 (c) P/3 (d) P/4

OR

(iv)The value of y, for which the area of floor is maximum is

(a) P/2 (b) P/3 (c)P/4 (d) P/16

Q38: In a test, you either guesses or copies or knows the answer to a multiple choice question with four choice.

The probability that you make a guess is 1/3, you copies the answer is 1/6. The probability that your answer is correct, given that you guess it, is 1/8 And also the probability that your answer is correct, given that you copied it is 1/4.

On the basis of above information, answer the following questions.

(i) The probability that you knows the answer is

(a) 0 (b) 1 (c) 1/2 (d) 1/4

(ii) The probability that your answer is correct given that you guess it, is

(a) 1/2 (b)1/8 (c) 1/4 (d)1/6

(iii) The probability that your answer is correct given that you knows the answer is
(a) 1/7 (b)1 (c) 1/9 (d)1/10

(iv) The probability that you knows the answer given that you correctly answered it, is (a) 4/7 6/7
(b) 5/7 (c) 6/7 (d) None of these

KENDRIYA VIDYALAYA SANGATHAN, JAMMU REGION
SAMPLE PAPER SET -14

CLASS : XII **SUBJECT: MATHEMATICS**

TIME: 3 hrs **M.M: 80**

General Instructions:

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

SECTION A

(Multiple Choice Questions)

Each question carries 1 mark

Q1. Let A be non- singular square matrix of order 3 x 3. Then | AdjA| is equal to:

(a) |A| (b) $|A|^2$ (c) $|A|^3$ (d) 3|A|

Q2 If A = $\begin{bmatrix} \cos\alpha & -\sin\beta \\ \sin\beta & \cos\alpha \end{bmatrix}$ then $\mathbf{A} + \mathbf{A'} = \mathbf{I}$ If the value of α is :

(a) $\frac{\pi}{6}$ (b) $\frac{\pi}{3}$ (c) π (d) $\frac{3\pi}{2}$

Q3. Position vector of point A and point B are $\vec{a} + \vec{b}$ and $2\vec{a} - \vec{b}$ then $\overrightarrow{AB}$ eual to

(a) $3\vec{a}$ (b) $-\vec{a} + 2\vec{b}$ (c) $\vec{a} - 2\vec{b}$ (d) none of these.

Q4 The function f(x) = $\begin{cases} \frac{\sin x}{x} + \cos x & if\ x \neq 0 \\ k & if\ x = 0 \end{cases}$ continuous at x=0 then value of k is:

(a) 3 (b) 2 (c) -1 (d) 1.5

Q5 $\int \frac{log 2x}{x}$ dx is equal to

(a) x logx (b) $\frac{1}{2}\log x.\log 2x$ (c) $\frac{(\log 2x)^2}{2}$ (d) $\log 2x$

Q6 The sum of order and degree differential equation $\frac{d}{dx}\left[\frac{dy}{dx}\right]$=5

(a) 2 (b) 3 (c) 4 (d) 5

Q7The graph of the inequality 2x+ 3x > 6 is

(a) Half plain that contain the origin

(b) half plane that neither contain the origin nor the point of the line 2x +3y = 6

(c) whole XOY –plane excluding the point on the line 2x+3y = 6

(d)entire XOY-Plane

Q8 If θ is the angel between any two vector $\vec{a}$ and $\vec{b}$ then $\vec{a} \times \vec{b}$ then $|\vec{a}.\vec{b}| = |\vec{a} \times \vec{b}|$ when θ is equal to

(a) 0 (b) $\frac{\pi}{4}$ (c) $\frac{\pi}{2}$ (d) π

Q9The value of $\int_0^1 \frac{\tan^{-1} x}{1+X^2}$ **dx**

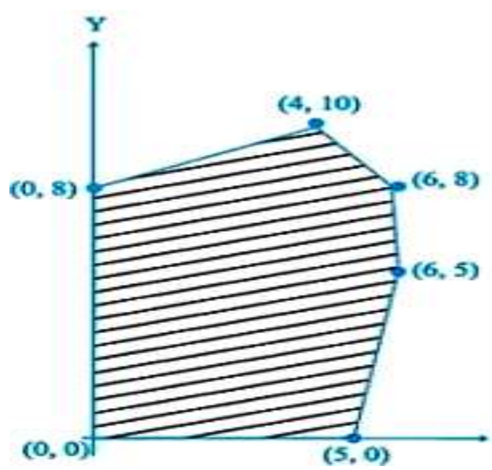
(a) $\frac{\pi^2}{4}$ (b) $\frac{\pi^2}{8}$ (c) $\frac{\pi^2}{32}$ (d) $\frac{\pi^2}{2}$

Q10 A square matrix A is said to be non - singular matrix, if

(a) $|A| = 0$ (b) $|A| \neq 0$ $(c)|A| = -1$ (d) $|A| = 1$

Q11 In the given graph, the feasible region for a LLP is shaded .The objective function Z=2x-3y will be minimum at

(a) (4,10) (b) (6,8) (c) (0,8) (d) (6,5)



Q12 Fine the value of x if $\begin{vmatrix} 2 & 4 \\ 5 & 1 \end{vmatrix} = \begin{vmatrix} 2x & 4 \\ 6 & x \end{vmatrix}$ is

(a) -3 (b) 3 (c) $\pm\sqrt{3}$ (d) $\sqrt{3}$

Q13 For what value of α, the matrix $\begin{bmatrix} 1 & \alpha & 0 \\ 3 & -1 & 2 \\ 4 & 1 & 5 \end{bmatrix}$ is singular ?

(a) $\alpha = 1$ (b) $\alpha = -2$ (c) $\alpha = 2$ (d) $\alpha = -1$

Q14 Given that E and F are event such that P(E)= 0.6 P(F) = 0.3 and P(E/F) = $\frac{2}{3}$ find $P(E \cap F)$

(a) 0.3 (b) 0.4 (c) 0.3 (d) 0.2

Q15 The integrating factor of differential equation $\cos x \frac{dy}{dx} + y \sin x = 1$ is

(a) $\cos x$ (b) $\tan x$ (c) $\sec x$ (d) $\sin x$

Q16 If x = a $\log t$ and y = b $\sin t$ then $\frac{dy}{dx}$

(a) $\frac{b}{a}\ t \cos t$ (b) $\frac{b}{a} t \sin t$ (c) $t \sin t$ (d) $t \cos t$

Q17 The angle between the vector $\hat{\imath}$ - $\hat{\jmath}$ and $\hat{\jmath}$ - $\hat{k}$ is

(a) $\frac{\pi}{3}$ (b) $-\frac{\pi}{3}$ (c) $\frac{2\pi}{3}$ (d) $\frac{\pi}{6}$

Q18 P is point on the line segment joining the point (3,2,-1) and (6,2,-2) .If x-coordinate of P is 5,then its y-coordinate is

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

ASSERTION-REASON BASED QUESTIONS

In the following questions, a statement of assertion (A) is followed by a statement of Reason (R). Choose the correct answer out of the following choices.

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

Q19 Assertion (A) If $0 < x < \frac{\pi}{2}$ then $\sin^{-1}(\cos x) + \cos^{-1}(\sin x) = \pi - 2\pi$

Reason(R) $\cos^{-1} x = \frac{\pi}{2} - \sin^{-1} x \ \ \forall\, x \in [0,1]$

Q20 The angle between the pair of line given by

$\vec{r} = 3\vec{\imath}+2\vec{\jmath}- 4\vec{k} + \alpha(\vec{\imath} + 2\vec{\jmath}+ 2\vec{k})$ and $\vec{r} = 5\vec{\imath}-2\vec{\jmath}+ \beta(3\vec{\imath} + 2\vec{\jmath}+ 6\vec{k})$ is θ $=\cos^{-1}\left[\frac{19}{21}\right]$

Reason (R) The acute angle θ between the lines

$\vec{r} = x_1\vec{\imath}+y_1\vec{\jmath}+ z_1\vec{k} + \alpha(a_1\vec{\imath} + b_1\vec{\jmath}+c_1\vec{k})$ and

$\vec{r} = x_2\vec{\imath}+y_2\vec{\jmath}+ z_2\vec{k} + \beta(a_2\vec{\imath} + b_2\vec{\jmath}+c_2\vec{k})$ is $\cos\theta = \left|\frac{a_1a_2+b_1b_2+c_1c_2}{\sqrt{a_1^2+b_1^2+c_1^2}\ \sqrt{a_1^2+b_2^2+c_2^2}}\right|$

SECTION B

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

Q21 Find the value of $\sin^{-1}\left(\frac{-\sqrt{3}}{2}\right)+\cos^{-1}\left(\frac{7\pi}{6}\right)$

OR

Given a function define by f(x) = $\sqrt{4-x^2}$ $0\leq x \leq 2, 0 \leq f(x) \leq 2$. Show that f is bijective function.

Q22 The volume of a sphere is increasing at the rate of 3 cubic centimetre per second. Find the rate of increasing of its surface area, when the radius is 2cm.

Q23 If $\vec{a} = 2\hat{\imath} + 2\hat{\jmath} + 3\hat{k}$, $\vec{b} = -\hat{\imath} + 2\hat{\jmath} + \hat{k}$ and $\vec{c} = 3\hat{\imath} + \hat{\jmath}$ then find the value of λ such that $\vec{a} + \lambda\vec{b}$ is perpendicular to $\vec{c}$.

OR

Find the cartesian and vector equation for line passing through the point A(-1,1,2) and B (2,4,5).

Q24 If y= $\sin^{-1} x$ show that $(1 - \boldsymbol{x^2})\, \boldsymbol{\frac{d^2y}{dx^2}} - \mathbf{x}\boldsymbol{\frac{dy}{dx}} = \mathbf{0}$

Q25 Show that $(\vec{a}-\vec{b}) \times (\vec{a}+\vec{b}) = 2(\vec{a}\times\vec{b})$

SECTION C

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

Q26 Find $\int \frac{\mathbf{1}}{\sqrt{\mathbf{8+3}x-x^2}}\, dx$

Q27 A factory has two machines A and B. Past record shows that machine A produced 60% of the items of output and machine B produced 40% of the items. Further, 2% of the items produced by machine A and 1% produced by machine B were defective. All the items are put into one stockpile and then one item is chosen at random from this and is found to be defective. What is the probability that it was produced by machine B?

OR

A bag contains 4 red and 4 black balls, another bag contains 2 red and 6 black balls. One of the two bags is selected at random and a ball is drawn from the bag which is found to be red. Find the probability that the ball is drawn from the first bag.

Q28 Evaluate $\int_0^{\pi} \frac{x}{1+sinx}$ dx

OR

Evaluate $\int_0^1 |5x-3|\ dx$

Q 29 Solve the differential equation (1+e^{2x})dy +e^{x}($1+y^2$) dx = 0. Given that y =1 when x = 0

OR

Solve the differential equation $x^2\ \frac{dy}{dx} = 2xy + y^2$

Q30 Solve the following Linear programming problem by graphically.

Minimise and Maximise Z = $x + 2y$

Subject to $x + 2y \geq 100, 2x - y \leq 0 , 2x + y \leq 200; x, y \geq 0$

Q31 Find $\int \frac{5x}{(x+1)(x^2-1)}\ dx$

SECTION D

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

Q32 Find the area of the smaller part of the circle $x^2 + y^2 = a^2$ cut off by the line $\frac{a}{\sqrt{2}}$

Q33 Check whether the relation R in the set R of real number defined by:

$R = \{(a, b): 1 + ab > 0\}$ is reflexive, symmetric or transitive

OR

If R_1, and R_2 are equivalence relations in a set A, show that $R_1 \cap R_2$ is also an equivalence relation

Q34 Find the shortest distance between lines

$\vec{r} =(\vec{\imath} + \overrightarrow{2\jmath} + \vec{k}) + \rho(\vec{\imath} - \vec{\imath} + \vec{k})$; $\vec{r} =(2\vec{\imath} - \vec{\jmath} - \vec{k}) + \mu(2\vec{\imath} + \vec{\jmath} + 2\vec{k})$

OR

The equations of motion of a rocket are $x = 2t$, $y = -4t$, $z = 4t$, where the time t is given in seconds, and the coordinates of a moving point in km. What is the path of rocket? At what distances will the rocket be from the starting point O (0, 0, 0) and from the following line in 10 seconds? $\vec{r} = 20\vec{\imath} - 10\vec{\jmath} + 40\vec{k} + (10\vec{\imath} - 20\vec{\jmath} + 10\vec{k})$

Q35If $\begin{bmatrix} 1 & -3 & 5 \\ 3 & 2 & -4 \\ 1 & 1 & -2 \end{bmatrix}$ Prove that $A^3 + 6A^3 + 7A + 2I = O$

SECTION E

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

Q36 A square piece of tin of side 18 cm is made into a box without top, by cutting a square form each corner and folding up the flaps to form the box.

(i) Find the volume of the box

(ii) Find $\frac{dv}{dx}$?`

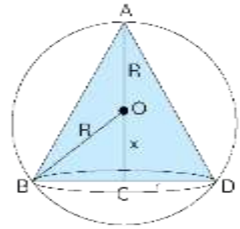
(iii) What should be the side of square to cut off, so that the volume of the box is maximum possible?

OR

Find the maximum volume

Q37 Let a cone is inscribed in sphere of radius R.

The height and radius of cone are h.



Based on the above information, answer the following question

(a)Find the relation between r and R in term of x?

(b) Find x, when $\frac{dV}{dx} = 0$.

(c)Find the volume v of the cone expressed as a function x?

OR

Find the maximum value of volume v and the ratio of volume of cone and volume and volume sphere, when the volume of cone is maximum?

Q38 The reliability of a COVID PCR test is specified as follows:

Of people having COVID, 90% of the test detects the disease but 10% goes undetected. Of people free of COVID, 99% of the test is judged COVID negative but 1% are diagnosed as showing COVID positive. From a large population of which only 0.1% have COVID, oneperson is selected at random, given the COVID PCR test, and the pathologist reports him/her as COVID positive

(i)What is the probability of the 'person to be tested as COVID positive' given that 'he is actually having COVID?

(a)0.001 (b)0.1 (c)0.8 (d)0.9

(ii) What is the probability of the 'person to be tested as COVID positive' given that 'he is actually he is not COVID?

(a)0.01 (b)0.99 (c)0.1 (d)0.001

(iii) What is the probability that the person not having COVID?

(a)0.998 (b)0.999 (c)0.001 (d)0.111

(iv) What is the probability that the person is actually having COVID given that he is tested as COVID positive ?

(a)0.83 (b)0.0803 (c)0.083 (d)0.089

KENDRIYA VIDYALAYA SANGATHAN, JAMMU REGION
SAMPLE PAPER SET -15

CLASS : XII **SUBJECT: MATHEMATICS**

TIME: 3 hrs **M.M: 80**

General Instructions :

1. This Question paper contains - five sections A, B, C, D and E. Each section iscompulsory. 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
(Multiple Choice Questions)Each question carries 1 mark

Q1. If A and B are symmetric matrices of the same order, then (AB′ –BA′) is a:

(a) Skew symmetric matrix (b) Null matrix

(c) Symmetric matrix (d) none of these

Q2. If A is a square matrix of order 3, $|A'| = -3$, then $|AA'|$ =(a) 9 (b) -9 (c) 3 (d) -3

Q3.The scalar product of 5i + j – 3k and 3i – 4j + 7k is:

(a) 15 (b) -15 (c) 10. (d)-10

Q4. If $x = t^2$, $y = t^3$, then d^2y/dx^2 is equals to:

(a) 3/2 (b) 3/4t (c) 3/2t (d) 3t/2

Q5. If $\int \sec^2 (7 - 4x)\, dx = a \tan (7 - 4x) + C$, then value of a is:

(a) -4 (b) -¼ (c) 3 (d)70

Q6. The number of arbitrary constants in the particular solution of a differential equation of third order is:

(a)3 (b)2 (c)1 (d)0

Q7. A set of values of decision variables that satisfies the linear constraints and non-negativityconditions of an L.P.P. is called its:

(a)Unbounded solution (b)Optimum solution(c)Feasible solution (d)None of these

Q8. What is the magnitude of vector -3i + 5j?
(a)$\sqrt{34}$ (b)$\sqrt{32}$ (c)$\sqrt{8}$ (d)$\sqrt{16}$
Q9. $\int \cot^2 x\, dx$ equals to:
(a)cot x – x + C (b) -cot x – x + C (c) cot x + x + C (d)-cot x + x + C

Q10. If A is a square matrix of order 3 and |A| = 5, then the value of |2A′| is:
(a) -10. (b) 10. (c) 15. (d) 4
Q11. The maximum value of Z = 3x + 4y subjected to constraints $x + y \leq 4$, $x \geq 0$ and$y \geq 0$ is:
(a) 12 (b) 14 (c)16 (d)None of the above
Q12 Value of k, for which

$A = \begin{bmatrix} k & 8 \\ 4 & 2k \end{bmatrix}$ –

(a) 4 (b) -4 (c) ±4. (d) 8

Q13 Which of the following is correct?

(a) Determinant is a square matrix.
(b) Determinant is a number associated with a matrix.
(c) Determinant is a number associated with a square matrix
(d) None of these

Q14. If P(A) = 0.4, P(B) = 0.7 and P(B/A) = 0.6. Find P (A ∪ B).
(a) 0.46 (b) 0.86. (c) 0.76. (d). 0.54

Q15. The general solution of the differential equation $ydx - xdy = 0$ is:
(a) $xy = C$ (b) $x = Cy$ (c) $y = Cx$ (d) $y = Cx$

Q16. If $y = sin$ x, then $(1 - x\ )\ y$ is equal to
(a) xy (b) xy (c) xy (d) x

Q17. If two vectors $\vec{a}$ and $\vec{b}$ are such that $|\vec{a}| = 2$, $\vec{b} = 3$ and $\vec{a}.\ \vec{b} = 4$, $then$ $\vec{a} - 2\vec{b}$ is equal to
(a) $\sqrt{2}$ (b) $2\sqrt{6}$ (c) 24 (d) $2\sqrt{2}$

Q18.The vector equation for the line passing through the points (–1, 0, 2) and (3, 4,6) :is:

(a) i+ 2k + λ(4i + 4j + 4k)
(b)i– 2k + λ(4i + 4j + 4k)
(c)-i+2k+ λ(4i + 4j + 4k)
(d)-i+2k+ λ(4i – 4j – 4k)

ASSERTION-REASON BASED QUESTIONS

In the following questions, a statement of assertion (A) is followed by a statement of Reason (R). Choose the correct answer out of the following choices.

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

Q19. Assertion (A) : The principal value of $2\cos^{-1}\left\{cos\frac{2\pi}{3}\right\} + \sin^{-1}\left\{sin\frac{2\pi}{3}\right\}$ is π.
Reason (R): The range of $\cos^{-1}x\ is\ [0,\pi] and\ range\ of\ \sin^{-1}x\ is\ [\frac{-\pi}{2},\frac{\pi}{2}]$

Q20.Assertion (A): P is a point on the line segment joining the points (3, 2, –1) and (6, –4, –2). If x coordinate of P is 5, then its y coordinate is –2.
Reason (R): The two lines x = ay + b, z = cy + d and x = a'y + b', z = c'y + d' will beperpendicular, iff aa' + bb' + cc' = 0.

SECTION B

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

Q21. Find the value of cot ($\tan^{-1}\alpha + \cot^{-1}\alpha$).

OR

Consider f: R –> R given by f (x) = 4x + 3. Show that f is invertible. Find the inverse of f

Q22. A man 1.6 m tall walks at the rate of 0.3 m/sec away from a street light that is 4 mabove the ground. At what rate is the tip of his shadow moving? At what rate is hisshadow lengthening?

Q23. Write the direction ratios of the vector $3\vec{a} + 2\vec{b}$, where $\vec{a} = \hat{i} + \hat{j} - 2\hat{k}$ and $\vec{b} = 2\hat{i} - 4\hat{j} + 5\hat{k}$

OR

Show that the points A (2, 3, – 4), B (1, – 2, 3) and C (3, 8, – 11) are collinear.

Q24 Explain the continuity of the function f = |x| at x = 0.

Q25. Find $|\vec{x}|$ if $(\vec{x} - \vec{a}).(\vec{x} + \vec{a}) = 12$, where $\vec{a}$ is a unit vector.

SECTION C

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

Q26. Find: $\int \frac{dx}{\sqrt{3-2x-x^2}}$

Q27.The probability of solving the specific problem independently by the persons' A and B are ½ and 1/3 respectively. In case, if both the persons try to solve the problem independently, then calculate the probability that the problem is solved

OR

From a lot of 30 bulbs which include 6 defectives, a sample of 4 bulbs is drawn at random with replacement Find the probability distribution of the number of defective bulbs

Q28. Evaluate: $\int_{\pi/6}^{\pi/3} \frac{dx}{1+\sqrt{tanx}}$

OR

Integrate: ∫ sin3 x cos2x dx

Q29 Form the differential equation representing the family of curves y = e^{2x}(a + bx), where 'a' and 'b' are arbitrary constants.

OR

For each of the given differential equation, find a particular solution satisfying the givencondition:

dy/dx = y tan x ; y = 1 when x = 0

Q30. Solve the following Linear Programming Problem graphically: Maximize Z = 400x + 300y subject to $x + y \leq 200$, $x \leq 40$, $x \geq 20$,y≥0

Q31. Find the values of:

$$\int \frac{\cos x}{(1+sinx)(2+\sin x)} dx$$

SECTION D

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

Q32. Make a rough sketch of the region $\{(x, y): 0 \leq y \leq x , 0 \leq y \leq x, 0 \leq x \leq 2\}$ and find the area of the region using integration.

Q33. Define the relation R in the set $N \times N$ as follows:

For (a, b), (c, d) ∈ $N \times N$, (a, b) R (c, d) iff ad = bc. Prove that R is an equivalence relationin $N \times N$.

OR

Given a non-empty set X, define the relation R in P(X) as follows:
For A, B $\in P(X)$, $(A, B) \in R$ iff $A \subset B$. Prove that R is reflexive, transitive and notsymmetric.

Q34. An insect is crawling along the line $\bar{r} = 6\hat{\imath} + 2\hat{\jmath} + 2k + \lambda\ \hat{\imath} - 2\hat{\jmath} + 2k$ and another insect is crawling along the line $\bar{r} = -4\hat{\imath} - k + \mu\ 3\hat{\imath} - 2\hat{\jmath} - 2k$. At what points on the lines should they reach so that the distance between them is the shortest? Find the shortest possible distance between them.

OR

Find the shortest distance between the lines $\vec{r} = (4\hat{\imath} - \hat{\jmath}) + \lambda(\hat{\imath} + 2\hat{\jmath} - 3\hat{k})$ and $\vec{r} = (\hat{\imath} - \hat{\jmath} + 2\hat{k}) + \mu(2\hat{\imath} + 4\hat{\jmath} - 5\hat{k})$.

Q35. Find A. Use A to solve the following system of equations:

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

$2x - 3y + 5z = 11,\ 3x + 2y - 4z = -5,\ x + y - 2z = -3$

SECTION E

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

Q36. Case-Study 1: Read the following passage and answer the questions given below.

The temperature of a person during an intestinal illness is given by
$f(x) = -0.1x + mx + 98.6, 0 \leq x \leq 12$, m being a constant, where f(x) is the temperatur

ein °F at x days.

(i) Is the function differentiable in the interval (0, 12)? Justify your answer.

(ii) If 6 is the critical point of the function, then find the value of the constant m.

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

OR

(iii) Find the points of local maximum/local minimum, if any, in the interval (0, 12)as well as the points of absolute maximum/absolute minimum in the interval [0,12]. Also, find the corresponding local maximum/local minimum and the absolute maximum/absolute minimum values of the function.

Q37. Case-Study 2: Read the following passage and answer the questions given below.

In an elliptical sport field the authority wants to design a rectangular soccerfield with the maximum possible area. The sport field is given by the graph of

$(x^2/a^2 + y^2/b^2) = 1$

If the length and the breadth of the rectangular field be 2x and 2y respectively, then find thearea function in terms of x.

(i) Find the critical point of the function.

(ii) Use First derivative Test to find the length 2x and width 2y of the soccer field (interms of a and b) that maximize its area.

OR

(iii) Use Second Derivative Test to find the length 2x and width 2y of the soccer field(in terms of a and b) that maximize its area.

Q38. Case-Study 3: Read the following passage and answer the questions given below.

There are two antiaircraft guns, named as A and B. The probabilities that the shell fired from them hits an airplane are 0.3 and 0.2 respectively. Both of them fired one shell at an airplane at the same time.

(i) What is the probability that the shell fired from exactly one of them hit the plane?

(ii) If it is known that the shell fired from exactly one of them hit the plane, then what is the probability that it was fired from B?