

Sample Question Paper
CLASS: XII
Session: 2021-22
Mathematics (Code-041)
Term - 1

Time Allowed: 90 minutes

Maximum Marks: 40

General Instructions:

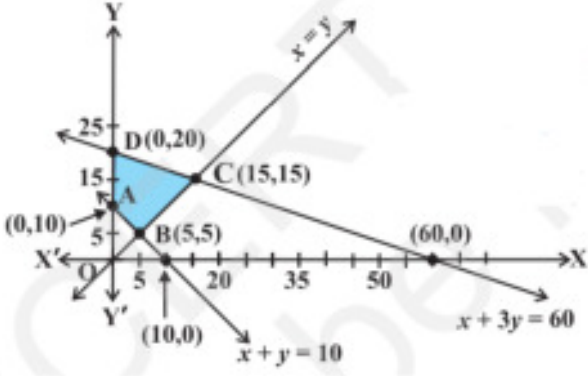
1. This question paper contains three sections – A, B and C. Each part is compulsory.
2. Section - A has 20 MCQs, attempt any 16 out of 20.
3. Section - B has 20 MCQs, attempt any 16 out of 20
4. Section - C has 10 MCQs, attempt any 8 out of 10.
5. All questions carry equal marks.
6. There is no negative marking.

SECTION – A

In this section, attempt any 16 questions out of Questions 1 – 20.
 Each Question is of 1 mark weightage.

1.	$\sin \left[\frac{\pi}{3} - \sin^{-1} \left(-\frac{1}{2} \right) \right]$ is equal to:	1				
	<table border="1" style="width: 100%; border-collapse: collapse;"> <tbody> <tr> <td style="width: 50%; text-align: center;">a) $\frac{1}{2}$</td> <td style="width: 50%; text-align: center;">b) $\frac{1}{3}$</td> </tr> <tr> <td style="width: 50%; text-align: center;">c) -1</td> <td style="width: 50%; text-align: center;">d) 1</td> </tr> </tbody> </table>	a) $\frac{1}{2}$	b) $\frac{1}{3}$	c) -1	d) 1	
a) $\frac{1}{2}$	b) $\frac{1}{3}$					
c) -1	d) 1					
2.	The value of k ($k < 0$) for which the function f defined as $f(x) = \begin{cases} \frac{1 - \cos kx}{x \sin x}, & x \neq 0 \\ \frac{1}{2}, & x = 0 \end{cases}$ is continuous at $x = 0$ is:	1				
	<table border="1" style="width: 100%; border-collapse: collapse;"> <tbody> <tr> <td style="width: 50%; text-align: center;">a) ± 1</td> <td style="width: 50%; text-align: center;">b) -1</td> </tr> <tr> <td style="width: 50%; text-align: center;">c) $\pm \frac{1}{2}$</td> <td style="width: 50%; text-align: center;">d) $\frac{1}{2}$</td> </tr> </tbody> </table>	a) ± 1	b) -1	c) $\pm \frac{1}{2}$	d) $\frac{1}{2}$	
a) ± 1	b) -1					
c) $\pm \frac{1}{2}$	d) $\frac{1}{2}$					
3.	If $A = [a_{ij}]$ is a square matrix of order 2 such that $a_{ij} = \begin{cases} 1, & \text{when } i \neq j \\ 0, & \text{when } i = j \end{cases}$, then A^2 is:	1				
	<table border="1" style="width: 100%; border-collapse: collapse;"> <tbody> <tr> <td style="width: 50%; text-align: center;">a) $\begin{bmatrix} 1 & 0 \\ 1 & 0 \end{bmatrix}$</td> <td style="width: 50%; text-align: center;">b) $\begin{bmatrix} 1 & 1 \\ 0 & 0 \end{bmatrix}$</td> </tr> <tr> <td style="width: 50%; text-align: center;">c) $\begin{bmatrix} 1 & 1 \\ 1 & 0 \end{bmatrix}$</td> <td style="width: 50%; text-align: center;">d) $\begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$</td> </tr> </tbody> </table>	a) $\begin{bmatrix} 1 & 0 \\ 1 & 0 \end{bmatrix}$	b) $\begin{bmatrix} 1 & 1 \\ 0 & 0 \end{bmatrix}$	c) $\begin{bmatrix} 1 & 1 \\ 1 & 0 \end{bmatrix}$	d) $\begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$	
a) $\begin{bmatrix} 1 & 0 \\ 1 & 0 \end{bmatrix}$	b) $\begin{bmatrix} 1 & 1 \\ 0 & 0 \end{bmatrix}$					
c) $\begin{bmatrix} 1 & 1 \\ 1 & 0 \end{bmatrix}$	d) $\begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$					
4.	Value of k , for which $A = \begin{bmatrix} k & 8 \\ 4 & 2k \end{bmatrix}$ is a singular matrix is:	1				
	<table border="1" style="width: 100%; border-collapse: collapse;"> <tbody> <tr> <td style="width: 50%; text-align: center;">a) 4</td> <td style="width: 50%; text-align: center;">b) -4</td> </tr> <tr> <td style="width: 50%; text-align: center;">c) ± 4</td> <td style="width: 50%; text-align: center;">d) 0</td> </tr> </tbody> </table>	a) 4	b) -4	c) ± 4	d) 0	
a) 4	b) -4					
c) ± 4	d) 0					

5.	<p>Find the intervals in which the function f given by $f(x) = x^2 - 4x + 6$ is strictly increasing:</p> <table border="1" data-bbox="252 208 1345 286"> <tbody> <tr> <td>a) $(-\infty, 2) \cup (2, \infty)$</td> <td>b) $(2, \infty)$</td> </tr> <tr> <td>c) $(-\infty, 2)$</td> <td>d) $(-\infty, 2] \cup (2, \infty)$</td> </tr> </tbody> </table>	a) $(-\infty, 2) \cup (2, \infty)$	b) $(2, \infty)$	c) $(-\infty, 2)$	d) $(-\infty, 2] \cup (2, \infty)$	1
a) $(-\infty, 2) \cup (2, \infty)$	b) $(2, \infty)$					
c) $(-\infty, 2)$	d) $(-\infty, 2] \cup (2, \infty)$					
6.	<p>Given that A is a square matrix of order 3 and $A = -4$, then $\text{adj } A$ is equal to:</p> <table border="1" data-bbox="252 477 1345 555"> <tbody> <tr> <td>a) -4</td> <td>b) 4</td> </tr> <tr> <td>c) -16</td> <td>d) 16</td> </tr> </tbody> </table>	a) -4	b) 4	c) -16	d) 16	1
a) -4	b) 4					
c) -16	d) 16					
7.	<p>A relation R in set $A = \{1, 2, 3\}$ is defined as $R = \{(1, 1), (1, 2), (2, 2), (3, 3)\}$. Which of the following ordered pair in R shall be removed to make it an equivalence relation in A?</p> <table border="1" data-bbox="252 790 1169 869"> <tbody> <tr> <td>a) $(1, 1)$</td> <td>b) $(1, 2)$</td> </tr> <tr> <td>c) $(2, 2)$</td> <td>d) $(3, 3)$</td> </tr> </tbody> </table>	a) $(1, 1)$	b) $(1, 2)$	c) $(2, 2)$	d) $(3, 3)$	1
a) $(1, 1)$	b) $(1, 2)$					
c) $(2, 2)$	d) $(3, 3)$					
8.	<p>If $\begin{bmatrix} 2a + b & a - 2b \\ 5c - d & 4c + 3d \end{bmatrix} = \begin{bmatrix} 4 & -3 \\ 11 & 24 \end{bmatrix}$, then value of $a + b - c + 2d$ is:</p> <table border="1" data-bbox="252 969 1169 1048"> <tbody> <tr> <td>a) 8</td> <td>b) 10</td> </tr> <tr> <td>c) 4</td> <td>d) -8</td> </tr> </tbody> </table>	a) 8	b) 10	c) 4	d) -8	1
a) 8	b) 10					
c) 4	d) -8					
9.	<p>The point at which the normal to the curve $y = x + \frac{1}{x}$, $x > 0$ is perpendicular to the line $3x - 4y - 7 = 0$ is:</p> <table border="1" data-bbox="252 1261 1169 1339"> <tbody> <tr> <td>a) $(2, 5/2)$</td> <td>b) $(\pm 2, 5/2)$</td> </tr> <tr> <td>c) $(-1/2, 5/2)$</td> <td>d) $(1/2, 5/2)$</td> </tr> </tbody> </table>	a) $(2, 5/2)$	b) $(\pm 2, 5/2)$	c) $(-1/2, 5/2)$	d) $(1/2, 5/2)$	1
a) $(2, 5/2)$	b) $(\pm 2, 5/2)$					
c) $(-1/2, 5/2)$	d) $(1/2, 5/2)$					
10.	<p>$\sin(\tan^{-1}x)$, where $x < 1$, is equal to:</p> <table border="1" data-bbox="252 1417 1169 1597"> <tbody> <tr> <td>a) $\frac{x}{\sqrt{1-x^2}}$</td> <td>b) $\frac{1}{\sqrt{1-x^2}}$</td> </tr> <tr> <td>c) $\frac{1}{\sqrt{1+x^2}}$</td> <td>d) $\frac{x}{\sqrt{1+x^2}}$</td> </tr> </tbody> </table>	a) $\frac{x}{\sqrt{1-x^2}}$	b) $\frac{1}{\sqrt{1-x^2}}$	c) $\frac{1}{\sqrt{1+x^2}}$	d) $\frac{x}{\sqrt{1+x^2}}$	1
a) $\frac{x}{\sqrt{1-x^2}}$	b) $\frac{1}{\sqrt{1-x^2}}$					
c) $\frac{1}{\sqrt{1+x^2}}$	d) $\frac{x}{\sqrt{1+x^2}}$					
11.	<p>Let the relation R in the set $A = \{x \in \mathbb{Z} : 0 \leq x \leq 12\}$, given by $R = \{(a, b) : a - b \text{ is a multiple of } 4\}$. Then $[1]$, the equivalence class containing 1, is:</p> <table border="1" data-bbox="252 1720 1345 1798"> <tbody> <tr> <td>a) $\{1, 5, 9\}$</td> <td>b) $\{0, 1, 2, 5\}$</td> </tr> <tr> <td>c) ϕ</td> <td>d) A</td> </tr> </tbody> </table>	a) $\{1, 5, 9\}$	b) $\{0, 1, 2, 5\}$	c) ϕ	d) A	1
a) $\{1, 5, 9\}$	b) $\{0, 1, 2, 5\}$					
c) ϕ	d) A					
12.	<p>If $e^x + e^y = e^{x+y}$, then $\frac{dy}{dx}$ is:</p> <table border="1" data-bbox="252 1966 1169 2045"> <tbody> <tr> <td>a) e^{y-x}</td> <td>b) e^{x+y}</td> </tr> <tr> <td>c) $-e^{y-x}$</td> <td>d) $2e^{x-y}$</td> </tr> </tbody> </table>	a) e^{y-x}	b) e^{x+y}	c) $-e^{y-x}$	d) $2e^{x-y}$	1
a) e^{y-x}	b) e^{x+y}					
c) $-e^{y-x}$	d) $2e^{x-y}$					

13.	<p>Given that matrices A and B are of order $3 \times n$ and $m \times 5$ respectively, then the order of matrix $C = 5A + 3B$ is:</p> <table border="1" data-bbox="252 215 1173 293"> <tr> <td>a) 3×5</td> <td>b) 5×3</td> </tr> <tr> <td>c) 3×3</td> <td>d) 5×5</td> </tr> </table>	a) 3×5	b) 5×3	c) 3×3	d) 5×5	1
a) 3×5	b) 5×3					
c) 3×3	d) 5×5					
14.	<p>If $y = 5 \cos x - 3 \sin x$, then $\frac{d^2y}{dx^2}$ is equal to:</p> <table border="1" data-bbox="252 472 1173 551"> <tr> <td>a) $-y$</td> <td>b) y</td> </tr> <tr> <td>c) $25y$</td> <td>d) $9y$</td> </tr> </table>	a) $-y$	b) y	c) $25y$	d) $9y$	1
a) $-y$	b) y					
c) $25y$	d) $9y$					
15.	<p>For matrix $A = \begin{bmatrix} 2 & 5 \\ -11 & 7 \end{bmatrix}$, $(adjA)'$ is equal to:</p> <table border="1" data-bbox="252 689 1173 898"> <tr> <td>a) $\begin{bmatrix} -2 & -5 \\ 11 & -7 \end{bmatrix}$</td> <td>b) $\begin{bmatrix} 7 & 5 \\ 11 & 2 \end{bmatrix}$</td> </tr> <tr> <td>c) $\begin{bmatrix} 7 & 11 \\ -5 & 2 \end{bmatrix}$</td> <td>d) $\begin{bmatrix} 7 & -5 \\ 11 & 2 \end{bmatrix}$</td> </tr> </table>	a) $\begin{bmatrix} -2 & -5 \\ 11 & -7 \end{bmatrix}$	b) $\begin{bmatrix} 7 & 5 \\ 11 & 2 \end{bmatrix}$	c) $\begin{bmatrix} 7 & 11 \\ -5 & 2 \end{bmatrix}$	d) $\begin{bmatrix} 7 & -5 \\ 11 & 2 \end{bmatrix}$	1
a) $\begin{bmatrix} -2 & -5 \\ 11 & -7 \end{bmatrix}$	b) $\begin{bmatrix} 7 & 5 \\ 11 & 2 \end{bmatrix}$					
c) $\begin{bmatrix} 7 & 11 \\ -5 & 2 \end{bmatrix}$	d) $\begin{bmatrix} 7 & -5 \\ 11 & 2 \end{bmatrix}$					
16.	<p>The points on the curve $\frac{x^2}{9} + \frac{y^2}{16} = 1$ at which the tangents are parallel to y-axis are:</p> <table border="1" data-bbox="252 1032 1173 1111"> <tr> <td>a) $(0, \pm 4)$</td> <td>b) $(\pm 4, 0)$</td> </tr> <tr> <td>c) $(\pm 3, 0)$</td> <td>d) $(0, \pm 3)$</td> </tr> </table>	a) $(0, \pm 4)$	b) $(\pm 4, 0)$	c) $(\pm 3, 0)$	d) $(0, \pm 3)$	1
a) $(0, \pm 4)$	b) $(\pm 4, 0)$					
c) $(\pm 3, 0)$	d) $(0, \pm 3)$					
17.	<p>Given that $A = [a_{ij}]$ is a square matrix of order 3×3 and $A = -7$, then the value of $\sum_{i=1}^3 a_{i2}A_{i2}$, where A_{ij} denotes the cofactor of element a_{ij} is:</p> <table border="1" data-bbox="252 1238 1342 1317"> <tr> <td>a) 7</td> <td>b) -7</td> </tr> <tr> <td>c) 0</td> <td>d) 49</td> </tr> </table>	a) 7	b) -7	c) 0	d) 49	1
a) 7	b) -7					
c) 0	d) 49					
18.	<p>If $y = \log(\cos e^x)$, then $\frac{dy}{dx}$ is:</p> <table border="1" data-bbox="252 1373 1342 1451"> <tr> <td>a) $\cos e^{x-1}$</td> <td>b) $e^{-x} \cos e^x$</td> </tr> <tr> <td>c) $e^x \sin e^x$</td> <td>d) $-e^x \tan e^x$</td> </tr> </table>	a) $\cos e^{x-1}$	b) $e^{-x} \cos e^x$	c) $e^x \sin e^x$	d) $-e^x \tan e^x$	1
a) $\cos e^{x-1}$	b) $e^{-x} \cos e^x$					
c) $e^x \sin e^x$	d) $-e^x \tan e^x$					
19.	<p>Based on the given shaded region as the feasible region in the graph, at which point(s) is the objective function $Z = 3x + 9y$ maximum?</p>  <table border="1" data-bbox="252 1951 1342 2065"> <tr> <td>a) Point B</td> <td>b) Point C</td> </tr> <tr> <td>c) Point D</td> <td>d) every point on the line segment CD</td> </tr> </table>	a) Point B	b) Point C	c) Point D	d) every point on the line segment CD	1
a) Point B	b) Point C					
c) Point D	d) every point on the line segment CD					

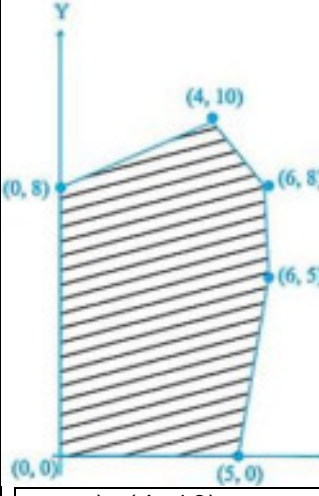
20.	The least value of the function $f(x) = 2\cos x + x$ in the closed interval $[0, \frac{\pi}{2}]$ is:		1
	a) 2	b) $\frac{\pi}{6} + \sqrt{3}$	
	c) $\frac{\pi}{2}$	d) The least value does not exist.	

SECTION – B

**In this section, attempt any 16 questions out of the Questions 21 - 40.
Each Question is of 1 mark weightage.**

21.	The function $f: \mathbb{R} \rightarrow \mathbb{R}$ defined as $f(x) = x^3$ is:		1
	a) One-on but not onto	b) Not one-one but onto	
	c) Neither one-one nor onto	d) One-one and onto	

22.	If $x = a \sec \theta$, $y = b \tan \theta$, then $\frac{d^2y}{dx^2}$ at $\theta = \frac{\pi}{6}$ is:		1
	a) $\frac{-3\sqrt{3}b}{a^2}$	b) $\frac{-2\sqrt{3}b}{a}$	
	c) $\frac{-3\sqrt{3}b}{a}$	d) $\frac{-b}{3\sqrt{3}a^2}$	

23.	 <p>In the given graph, the feasible region for a LPP is shaded. The objective function $Z = 2x - 3y$, will be minimum at:</p>	1		
			a) (4, 10)	b) (6, 8)
			c) (0, 8)	d) (6, 5)

24.	The derivative of $\sin^{-1}(2x\sqrt{1-x^2})$ w.r.t $\sin^{-1}x$, $-\frac{1}{\sqrt{2}} < x < \frac{1}{\sqrt{2}}$, is:		1
	a) 2	b) $\frac{\pi}{2} - 2$	
	c) $\frac{\pi}{2}$	d) -2	

25.	If $A = \begin{bmatrix} 1 & -1 & 0 \\ 2 & 3 & 4 \\ 0 & 1 & 2 \end{bmatrix}$ and $B = \begin{bmatrix} 2 & 2 & -4 \\ -4 & 2 & -4 \\ 2 & -1 & 5 \end{bmatrix}$, then:		1
	a) $A^{-1} = B$	b) $A^{-1} = 6B$	
	c) $B^{-1} = B$	d) $B^{-1} = \frac{1}{6}A$	

26.	<p>The real function $f(x) = 2x^3 - 3x^2 - 36x + 7$ is:</p> <table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td colspan="2" data-bbox="252 174 1350 275">a) Strictly increasing in $(-\infty, -2)$ and strictly decreasing in $(-2, \infty)$</td> </tr> <tr> <td colspan="2" data-bbox="252 275 1350 342">b) Strictly decreasing in $(-2, 3)$</td> </tr> <tr> <td colspan="2" data-bbox="252 342 1350 443">c) Strictly decreasing in $(-\infty, 3)$ and strictly increasing in $(3, \infty)$</td> </tr> <tr> <td colspan="2" data-bbox="252 443 1350 510">d) Strictly decreasing in $(-\infty, -2) \cup (3, \infty)$</td> </tr> </table>	a) Strictly increasing in $(-\infty, -2)$ and strictly decreasing in $(-2, \infty)$		b) Strictly decreasing in $(-2, 3)$		c) Strictly decreasing in $(-\infty, 3)$ and strictly increasing in $(3, \infty)$		d) Strictly decreasing in $(-\infty, -2) \cup (3, \infty)$		1
a) Strictly increasing in $(-\infty, -2)$ and strictly decreasing in $(-2, \infty)$										
b) Strictly decreasing in $(-2, 3)$										
c) Strictly decreasing in $(-\infty, 3)$ and strictly increasing in $(3, \infty)$										
d) Strictly decreasing in $(-\infty, -2) \cup (3, \infty)$										
27.	<p>Simplest form of $\tan^{-1} \left(\frac{\sqrt{1+\cos x} + \sqrt{1-\cos x}}{\sqrt{1+\cos x} - \sqrt{1-\cos x}} \right), \pi < x < \frac{3\pi}{2}$ is:</p> <table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td data-bbox="252 678 794 768">a) $\frac{\pi}{4} - \frac{x}{2}$</td> <td data-bbox="802 678 1350 768">b) $\frac{3\pi}{2} - \frac{x}{2}$</td> </tr> <tr> <td data-bbox="252 768 794 857">c) $-\frac{x}{2}$</td> <td data-bbox="802 768 1350 857">d) $\pi - \frac{x}{2}$</td> </tr> </table>	a) $\frac{\pi}{4} - \frac{x}{2}$	b) $\frac{3\pi}{2} - \frac{x}{2}$	c) $-\frac{x}{2}$	d) $\pi - \frac{x}{2}$	1				
a) $\frac{\pi}{4} - \frac{x}{2}$	b) $\frac{3\pi}{2} - \frac{x}{2}$									
c) $-\frac{x}{2}$	d) $\pi - \frac{x}{2}$									
28.	<p>Given that A is a non-singular matrix of order 3 such that $A^2 = 2A$, then value of $2A$ is:</p> <table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td data-bbox="252 1048 794 1093">a) 4</td> <td data-bbox="802 1048 1350 1093">b) 8</td> </tr> <tr> <td data-bbox="252 1093 794 1126">c) 64</td> <td data-bbox="802 1093 1350 1126">d) 16</td> </tr> </table>	a) 4	b) 8	c) 64	d) 16	1				
a) 4	b) 8									
c) 64	d) 16									
29.	<p>The value of b for which the function $f(x) = x + \cos x + b$ is strictly decreasing over \mathbf{R} is:</p> <table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td data-bbox="252 1305 794 1350">a) $b < 1$</td> <td data-bbox="802 1305 1350 1350">b) No value of b exists</td> </tr> <tr> <td data-bbox="252 1350 794 1384">c) $b \leq 1$</td> <td data-bbox="802 1350 1350 1384">d) $b \geq 1$</td> </tr> </table>	a) $b < 1$	b) No value of b exists	c) $b \leq 1$	d) $b \geq 1$	1				
a) $b < 1$	b) No value of b exists									
c) $b \leq 1$	d) $b \geq 1$									
30.	<p>Let R be the relation in the set N given by $R = \{(a, b) : a = b - 2, b > 6\}$, then:</p> <table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td data-bbox="252 1496 794 1541">a) $(2, 4) \in R$</td> <td data-bbox="802 1496 1350 1541">b) $(3, 8) \in R$</td> </tr> <tr> <td data-bbox="252 1541 794 1574">c) $(6, 8) \in R$</td> <td data-bbox="802 1541 1350 1574">d) $(8, 7) \in R$</td> </tr> </table>	a) $(2, 4) \in R$	b) $(3, 8) \in R$	c) $(6, 8) \in R$	d) $(8, 7) \in R$	1				
a) $(2, 4) \in R$	b) $(3, 8) \in R$									
c) $(6, 8) \in R$	d) $(8, 7) \in R$									
31.	<p>The point(s), at which the function f given by $f(x) = \begin{cases} \frac{x}{ x }, & x < 0 \\ -1, & x \geq 0 \end{cases}$ is continuous, is/are:</p> <table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td data-bbox="252 1821 794 1865">a) $x \in \mathbf{R}$</td> <td data-bbox="802 1821 1350 1865">b) $x = 0$</td> </tr> <tr> <td data-bbox="252 1865 794 1899">c) $x \in \mathbf{R} - \{0\}$</td> <td data-bbox="802 1865 1350 1899">d) $x = -1$ and 1</td> </tr> </table>	a) $x \in \mathbf{R}$	b) $x = 0$	c) $x \in \mathbf{R} - \{0\}$	d) $x = -1$ and 1	1				
a) $x \in \mathbf{R}$	b) $x = 0$									
c) $x \in \mathbf{R} - \{0\}$	d) $x = -1$ and 1									
32.	<p>If $A = \begin{bmatrix} 0 & 2 \\ 3 & -4 \end{bmatrix}$ and $kA = \begin{bmatrix} 0 & 3a \\ 2b & 24 \end{bmatrix}$, then the values of k, a and b respectively are:</p>	1								

	<table border="1"> <tr> <td>a) $-6, -12, -18$</td> <td>b) $-6, -4, -9$</td> </tr> <tr> <td>c) $-6, 4, 9$</td> <td>d) $-6, 12, 18$</td> </tr> </table>	a) $-6, -12, -18$	b) $-6, -4, -9$	c) $-6, 4, 9$	d) $-6, 12, 18$	
a) $-6, -12, -18$	b) $-6, -4, -9$					
c) $-6, 4, 9$	d) $-6, 12, 18$					
33.	<p>A linear programming problem is as follows: <i>Minimize</i> $Z = 30x + 50y$ subject to the constraints,</p> $3x + 5y \geq 15$ $2x + 3y \leq 18$ $x \geq 0, y \geq 0$ <p>In the feasible region, the minimum value of Z occurs at</p> <table border="1"> <tr> <td>a) a unique point</td> <td>b) no point</td> </tr> <tr> <td>c) infinitely many points</td> <td>d) two points only</td> </tr> </table>	a) a unique point	b) no point	c) infinitely many points	d) two points only	1
a) a unique point	b) no point					
c) infinitely many points	d) two points only					
34.	<p>The area of a trapezium is defined by function f and given by $f(x) = (10 + x)\sqrt{100 - x^2}$, then the area when it is maximised is:</p> <table border="1"> <tr> <td>a) 75cm^2</td> <td>b) $7\sqrt{3}\text{cm}^2$</td> </tr> <tr> <td>c) $75\sqrt{3}\text{cm}^2$</td> <td>d) 5cm^2</td> </tr> </table>	a) 75cm^2	b) $7\sqrt{3}\text{cm}^2$	c) $75\sqrt{3}\text{cm}^2$	d) 5cm^2	1
a) 75cm^2	b) $7\sqrt{3}\text{cm}^2$					
c) $75\sqrt{3}\text{cm}^2$	d) 5cm^2					
35.	<p>If A is square matrix such that $A^2 = A$, then $(I + A)^3 - 7A$ is equal to:</p> <table border="1"> <tr> <td>a) A</td> <td>b) $I + A$</td> </tr> <tr> <td>c) $I - A$</td> <td>d) I</td> </tr> </table>	a) A	b) $I + A$	c) $I - A$	d) I	1
a) A	b) $I + A$					
c) $I - A$	d) I					
36.	<p>If $\tan^{-1} x = y$, then:</p> <table border="1"> <tr> <td>a) $-1 < y < 1$</td> <td>b) $\frac{-\pi}{2} \leq y \leq \frac{\pi}{2}$</td> </tr> <tr> <td>c) $\frac{-\pi}{2} < y < \frac{\pi}{2}$</td> <td>d) $y \in \{\frac{-\pi}{2}, \frac{\pi}{2}\}$</td> </tr> </table>	a) $-1 < y < 1$	b) $\frac{-\pi}{2} \leq y \leq \frac{\pi}{2}$	c) $\frac{-\pi}{2} < y < \frac{\pi}{2}$	d) $y \in \{\frac{-\pi}{2}, \frac{\pi}{2}\}$	1
a) $-1 < y < 1$	b) $\frac{-\pi}{2} \leq y \leq \frac{\pi}{2}$					
c) $\frac{-\pi}{2} < y < \frac{\pi}{2}$	d) $y \in \{\frac{-\pi}{2}, \frac{\pi}{2}\}$					
37.	<p>Let $A = \{1, 2, 3\}$, $B = \{4, 5, 6, 7\}$ and let $f = \{(1, 4), (2, 5), (3, 6)\}$ be a function from A to B. Based on the given information, f is best defined as:</p> <table border="1"> <tr> <td>a) Surjective function</td> <td>b) Injective function</td> </tr> <tr> <td>c) Bijective function</td> <td>d) function</td> </tr> </table>	a) Surjective function	b) Injective function	c) Bijective function	d) function	1
a) Surjective function	b) Injective function					
c) Bijective function	d) function					
38.	<p>For $A = \begin{bmatrix} 3 & 1 \\ -1 & 2 \end{bmatrix}$, then $14A^{-1}$ is given by:</p> <table border="1"> <tr> <td>a) $14 \begin{bmatrix} 2 & -1 \\ 1 & 3 \end{bmatrix}$</td> <td>b) $\begin{bmatrix} 4 & -2 \\ 2 & 6 \end{bmatrix}$</td> </tr> <tr> <td>c) $2 \begin{bmatrix} 2 & -1 \\ 1 & -3 \end{bmatrix}$</td> <td>d) $2 \begin{bmatrix} -3 & -1 \\ 1 & -2 \end{bmatrix}$</td> </tr> </table>	a) $14 \begin{bmatrix} 2 & -1 \\ 1 & 3 \end{bmatrix}$	b) $\begin{bmatrix} 4 & -2 \\ 2 & 6 \end{bmatrix}$	c) $2 \begin{bmatrix} 2 & -1 \\ 1 & -3 \end{bmatrix}$	d) $2 \begin{bmatrix} -3 & -1 \\ 1 & -2 \end{bmatrix}$	1
a) $14 \begin{bmatrix} 2 & -1 \\ 1 & 3 \end{bmatrix}$	b) $\begin{bmatrix} 4 & -2 \\ 2 & 6 \end{bmatrix}$					
c) $2 \begin{bmatrix} 2 & -1 \\ 1 & -3 \end{bmatrix}$	d) $2 \begin{bmatrix} -3 & -1 \\ 1 & -2 \end{bmatrix}$					
39.	<p>The point(s) on the curve $y = x^3 - 11x + 5$ at which the tangent is $y = x - 11$ is/are:</p> <table border="1"> <tr> <td>a) $(-2, 19)$</td> <td>b) $(2, -9)$</td> </tr> <tr> <td>c) $(\pm 2, 19)$</td> <td>d) $(-2, 19)$ and $(2, -9)$</td> </tr> </table>	a) $(-2, 19)$	b) $(2, -9)$	c) $(\pm 2, 19)$	d) $(-2, 19)$ and $(2, -9)$	1
a) $(-2, 19)$	b) $(2, -9)$					
c) $(\pm 2, 19)$	d) $(-2, 19)$ and $(2, -9)$					
40.	<p>Given that $A = \begin{bmatrix} \alpha & \beta \\ \gamma & -\alpha \end{bmatrix}$ and $A^2 = 3I$, then:</p>	1				

a) $1 + \alpha^2 + \beta\gamma = 0$

b) $1 - \alpha^2 - \beta\gamma = 0$

c) $3 - \alpha^2 - \beta\gamma = 0$

d) $3 + \alpha^2 + \beta\gamma = 0$

SECTION – C

In this section, attempt any 8 questions.

Each question is of 1-mark weightage.

Questions 46-50 are based on a Case-Study.

41. For an objective function $Z = ax + by$, where $a, b > 0$; the corner points of the feasible region determined by a set of constraints (linear inequalities) are $(0, 20)$, $(10, 10)$, $(30, 30)$ and $(0, 40)$. The condition on a and b such that the maximum Z occurs at both the points $(30, 30)$ and $(0, 40)$ is:

a) $b - 3a = 0$

b) $a = 3b$

c) $a + 2b = 0$

d) $2a - b = 0$

42. For which value of m is the line $y = mx + 1$ a tangent to the curve $y^2 = 4x$?

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

b) 1

c) 2

d) 3

43. The maximum value of $[x(x - 1) + 1]^{\frac{1}{3}}$, $0 \leq x \leq 1$ is:

a) 0

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

c) 1

d) $\sqrt[3]{\frac{1}{3}}$

44. In a linear programming problem, the constraints on the decision variables x and y are $x - 3y \geq 0$, $y \geq 0$, $0 \leq x \leq 3$. The feasible region

a) is not in the first quadrant

b) is bounded in the first quadrant

c) is unbounded in the first quadrant

d) does not exist

45. Let $A = \begin{bmatrix} 1 & \sin\alpha & 1 \\ -\sin\alpha & 1 & \sin\alpha \\ -1 & -\sin\alpha & 1 \end{bmatrix}$, where $0 \leq \alpha \leq 2\pi$, then:

a) $|A|=0$

b) $|A| \in (2, \infty)$

c) $|A| \in (2, 4)$

d) $|A| \in [2, 4]$

CASE STUDY

The fuel cost per hour for running a train is proportional to the square of the speed it generates in km per hour. If the fuel costs ₹ 48 per hour at speed 16 km per hour and the fixed charges to run the train amount to ₹ 1200 per hour.

Assume the speed of the train as v km/h.

Based on the given information, answer the following questions.						
46.	Given that the fuel cost per hour is k times the square of the speed the train generates in km/h, the value of k is:	1				
<table border="1" style="width: 100%;"> <tr> <td style="width: 50%;">a) $\frac{16}{3}$</td> <td style="width: 50%;">b) $\frac{1}{3}$</td> </tr> <tr> <td>c) 3</td> <td>d) $\frac{3}{16}$</td> </tr> </table>			a) $\frac{16}{3}$	b) $\frac{1}{3}$	c) 3	d) $\frac{3}{16}$
a) $\frac{16}{3}$	b) $\frac{1}{3}$					
c) 3	d) $\frac{3}{16}$					
47.	If the train has travelled a distance of 500km, then the total cost of running the train is given by function:	1				
<table border="1" style="width: 100%;"> <tr> <td style="width: 50%;">a) $\frac{15}{16}v + \frac{600000}{v}$</td> <td style="width: 50%;">b) $\frac{375}{4}v + \frac{600000}{v}$</td> </tr> <tr> <td>c) $\frac{5}{16}v^2 + \frac{150000}{v}$</td> <td>d) $\frac{3}{16}v + \frac{6000}{v}$</td> </tr> </table>			a) $\frac{15}{16}v + \frac{600000}{v}$	b) $\frac{375}{4}v + \frac{600000}{v}$	c) $\frac{5}{16}v^2 + \frac{150000}{v}$	d) $\frac{3}{16}v + \frac{6000}{v}$
a) $\frac{15}{16}v + \frac{600000}{v}$	b) $\frac{375}{4}v + \frac{600000}{v}$					
c) $\frac{5}{16}v^2 + \frac{150000}{v}$	d) $\frac{3}{16}v + \frac{6000}{v}$					
48.	The most economical speed to run the train is:	1				
<table border="1" style="width: 100%;"> <tr> <td style="width: 50%;">a) 18km/h</td> <td style="width: 50%;">b) 5km/h</td> </tr> <tr> <td>c) 80km/h</td> <td>d) 40km/h</td> </tr> </table>			a) 18km/h	b) 5km/h	c) 80km/h	d) 40km/h
a) 18km/h	b) 5km/h					
c) 80km/h	d) 40km/h					
49.	The fuel cost for the train to travel 500km at the most economical speed is:	1				
<table border="1" style="width: 100%;"> <tr> <td style="width: 50%;">a) ₹ 3750</td> <td style="width: 50%;">b) ₹ 750</td> </tr> <tr> <td>c) ₹ 7500</td> <td>d) ₹ 75000</td> </tr> </table>			a) ₹ 3750	b) ₹ 750	c) ₹ 7500	d) ₹ 75000
a) ₹ 3750	b) ₹ 750					
c) ₹ 7500	d) ₹ 75000					
50.	The total cost of the train to travel 500km at the most economical speed is:	1				
<table border="1" style="width: 100%;"> <tr> <td style="width: 50%;">a) ₹ 3750</td> <td style="width: 50%;">b) ₹ 75000</td> </tr> <tr> <td>c) ₹ 7500</td> <td>d) ₹ 15000</td> </tr> </table>			a) ₹ 3750	b) ₹ 75000	c) ₹ 7500	d) ₹ 15000
a) ₹ 3750	b) ₹ 75000					
c) ₹ 7500	d) ₹ 15000					
