

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

Time Allowed: 90 minutes

Maximum Marks: 40

**General Instructions:**

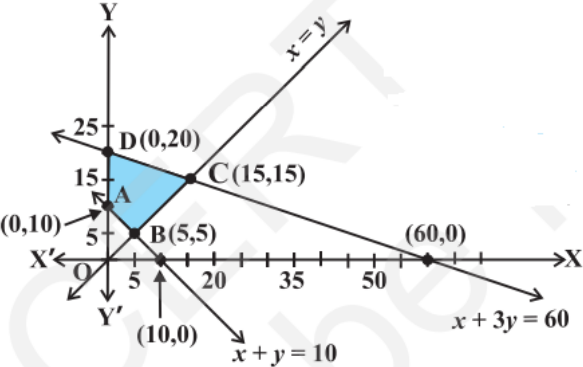
1. This question paper contains three sections – A, B and C. Each part is compulsory.
2. Section - A has 20 MCQs, attempt any 16 out of 20.
3. Section - B has 20 MCQs, attempt any 16 out of 20
4. Section - C has 10 MCQs, attempt any 8 out of 10.
5. All questions carry equal marks.
6. There is no negative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

**SECTION – A**

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

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

5.	<p>Find the intervals in which the function <math>f</math> given by <math>f(x) = x^2 - 4x + 6</math> is strictly increasing:</p> <table border="1" data-bbox="252 208 1345 286"> <tbody> <tr> <td>a) <math>(-\infty, 2) \cup (2, \infty)</math></td> <td>b) <math>(2, \infty)</math></td> </tr> <tr> <td>c) <math>(-\infty, 2)</math></td> <td>d) <math>(-\infty, 2] \cup (2, \infty)</math></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 <math>A</math> is a square matrix of order 3 and <math> A  = -4</math>, then <math> \text{adj } A </math> 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 <math>R</math> in set <math>A = \{1, 2, 3\}</math> is defined as <math>R = \{(1, 1), (1, 2), (2, 2), (3, 3)\}</math>. Which of the following ordered pair in <math>R</math> shall be removed to make it an equivalence relation in <math>A</math>?</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 <math>\begin{bmatrix} 2a + b &amp; a - 2b \\ 5c - d &amp; 4c + 3d \end{bmatrix} = \begin{bmatrix} 4 &amp; -3 \\ 11 &amp; 24 \end{bmatrix}</math>, then value of <math>a + b - c + 2d</math> 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 <math>y = x + \frac{1}{x}</math>, <math>x &gt; 0</math> is perpendicular to the line <math>3x - 4y - 7 = 0</math> is:</p> <table border="1" data-bbox="252 1261 1169 1339"> <tbody> <tr> <td>a) <math>(2, 5/2)</math></td> <td>b) <math>(\pm 2, 5/2)</math></td> </tr> <tr> <td>c) <math>(-1/2, 5/2)</math></td> <td>d) <math>(1/2, 5/2)</math></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><math>\sin(\tan^{-1}x)</math>, where <math> x  &lt; 1</math>, is equal to:</p> <table border="1" data-bbox="252 1417 1169 1597"> <tbody> <tr> <td>a) <math>\frac{x}{\sqrt{1-x^2}}</math></td> <td>b) <math>\frac{1}{\sqrt{1-x^2}}</math></td> </tr> <tr> <td>c) <math>\frac{1}{\sqrt{1+x^2}}</math></td> <td>d) <math>\frac{x}{\sqrt{1+x^2}}</math></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 <math>R</math> in the set <math>A = \{x \in \mathbb{Z} : 0 \leq x \leq 12\}</math>, given by <math>R = \{(a, b) :  a - b  \text{ is a multiple of } 4\}</math>. Then <math>[1]</math>, the equivalence class containing 1, is:</p> <table border="1" data-bbox="252 1720 1345 1798"> <tbody> <tr> <td>a) <math>\{1, 5, 9\}</math></td> <td>b) <math>\{0, 1, 2, 5\}</math></td> </tr> <tr> <td>c) <math>\phi</math></td> <td>d) <math>A</math></td> </tr> </tbody> </table>	a) $\{1, 5, 9\}$	b) $\{0, 1, 2, 5\}$	c) $\phi$	d) $A$	1
a) $\{1, 5, 9\}$	b) $\{0, 1, 2, 5\}$					
c) $\phi$	d) $A$					
12.	<p>If <math>e^x + e^y = e^{x+y}</math>, then <math>\frac{dy}{dx}</math> is:</p> <table border="1" data-bbox="252 1966 1169 2045"> <tbody> <tr> <td>a) <math>e^{y-x}</math></td> <td>b) <math>e^{x+y}</math></td> </tr> <tr> <td>c) <math>-e^{y-x}</math></td> <td>d) <math>2e^{x-y}</math></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 <math>3 \times n</math> and <math>m \times 5</math> respectively, then the order of matrix <math>C = 5A + 3B</math> is:</p> <table border="1" data-bbox="252 215 1171 293"> <tr> <td>a) <math>3 \times 5</math></td> <td>b) <math>5 \times 3</math></td> </tr> <tr> <td>c) <math>3 \times 3</math></td> <td>d) <math>5 \times 5</math></td> </tr> </table>	a) $3 \times 5$	b) $5 \times 3$	c) $3 \times 3$	d) $5 \times 5$	1
a) $3 \times 5$	b) $5 \times 3$					
c) $3 \times 3$	d) $5 \times 5$					
14.	<p>If <math>y = 5 \cos x - 3 \sin x</math>, then <math>\frac{d^2y}{dx^2}</math> is equal to:</p> <table border="1" data-bbox="252 472 1171 551"> <tr> <td>a) <math>-y</math></td> <td>b) <math>y</math></td> </tr> <tr> <td>c) <math>25y</math></td> <td>d) <math>9y</math></td> </tr> </table>	a) $-y$	b) $y$	c) $25y$	d) $9y$	1
a) $-y$	b) $y$					
c) $25y$	d) $9y$					
15.	<p>For matrix <math>A = \begin{bmatrix} 2 &amp; 5 \\ -11 &amp; 7 \end{bmatrix}</math>, <math>(adjA)'</math> is equal to:</p> <table border="1" data-bbox="252 689 1171 898"> <tr> <td>a) <math>\begin{bmatrix} -2 &amp; -5 \\ 11 &amp; -7 \end{bmatrix}</math></td> <td>b) <math>\begin{bmatrix} 7 &amp; 5 \\ 11 &amp; 2 \end{bmatrix}</math></td> </tr> <tr> <td>c) <math>\begin{bmatrix} 7 &amp; 11 \\ -5 &amp; 2 \end{bmatrix}</math></td> <td>d) <math>\begin{bmatrix} 7 &amp; -5 \\ 11 &amp; 2 \end{bmatrix}</math></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 <math>\frac{x^2}{9} + \frac{y^2}{16} = 1</math> at which the tangents are parallel to y-axis are:</p> <table border="1" data-bbox="252 1032 1171 1111"> <tr> <td>a) <math>(0, \pm 4)</math></td> <td>b) <math>(\pm 4, 0)</math></td> </tr> <tr> <td>c) <math>(\pm 3, 0)</math></td> <td>d) <math>(0, \pm 3)</math></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 <math>A = [a_{ij}]</math> is a square matrix of order <math>3 \times 3</math> and <math> A  = -7</math>, then the value of <math>\sum_{i=1}^3 a_{i2}A_{i2}</math>, where <math>A_{ij}</math> denotes the cofactor of element <math>a_{ij}</math> 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 <math>y = \log(\cos e^x)</math>, then <math>\frac{dy}{dx}</math> is:</p> <table border="1" data-bbox="252 1373 1342 1451"> <tr> <td>a) <math>\cos e^{x-1}</math></td> <td>b) <math>e^{-x} \cos e^x</math></td> </tr> <tr> <td>c) <math>e^x \sin e^x</math></td> <td>d) <math>-e^x \tan e^x</math></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 <math>Z = 3x + 9y</math> 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					
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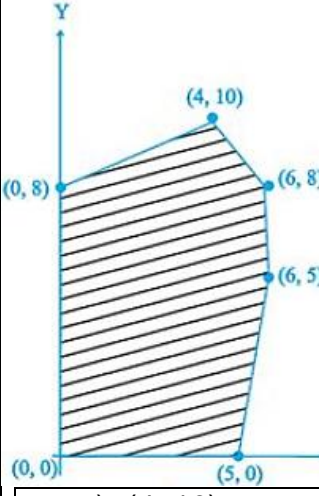
20.	The least value of the function $f(x) = 2\cos x + x$ in the closed interval $[0, \frac{\pi}{2}]$ is:		1
	a) 2	b) $\frac{\pi}{6} + \sqrt{3}$	
	c) $\frac{\pi}{2}$	d) The least value does not exist.	

**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 <math>Z = 2x - 3y</math>, 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 <math>f(x) = 2x^3 - 3x^2 - 36x + 7</math> 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 <math>(-\infty, -2)</math> and strictly decreasing in <math>(-2, \infty)</math></td> </tr> <tr> <td colspan="2" data-bbox="252 275 1350 342">b) Strictly decreasing in <math>(-2, 3)</math></td> </tr> <tr> <td colspan="2" data-bbox="252 342 1350 443">c) Strictly decreasing in <math>(-\infty, 3)</math> and strictly increasing in <math>(3, \infty)</math></td> </tr> <tr> <td colspan="2" data-bbox="252 443 1350 510">d) Strictly decreasing in <math>(-\infty, -2) \cup (3, \infty)</math></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 <math>\tan^{-1} \left( \frac{\sqrt{1+\cos x} + \sqrt{1-\cos x}}{\sqrt{1+\cos x} - \sqrt{1-\cos x}} \right), \pi &lt; x &lt; \frac{3\pi}{2}</math> is:</p> <table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td data-bbox="252 678 794 768">a) <math>\frac{\pi}{4} - \frac{x}{2}</math></td> <td data-bbox="802 678 1350 768">b) <math>\frac{3\pi}{2} - \frac{x}{2}</math></td> </tr> <tr> <td data-bbox="252 768 794 857">c) <math>-\frac{x}{2}</math></td> <td data-bbox="802 768 1350 857">d) <math>\pi - \frac{x}{2}</math></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 <math>A^2 = 2A</math>, then value of <math> 2A </math> 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 <math>b</math> for which the function <math>f(x) = x + \cos x + b</math> is strictly decreasing over <math>\mathbf{R}</math> is:</p> <table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td data-bbox="252 1305 794 1350">a) <math>b &lt; 1</math></td> <td data-bbox="802 1305 1350 1350">b) No value of <math>b</math> exists</td> </tr> <tr> <td data-bbox="252 1350 794 1384">c) <math>b \leq 1</math></td> <td data-bbox="802 1350 1350 1384">d) <math>b \geq 1</math></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 <math>R = \{(a, b) : a = b - 2, b &gt; 6\}</math>, then:</p> <table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td data-bbox="252 1496 794 1541">a) <math>(2, 4) \in R</math></td> <td data-bbox="802 1496 1350 1541">b) <math>(3, 8) \in R</math></td> </tr> <tr> <td data-bbox="252 1541 794 1574">c) <math>(6, 8) \in R</math></td> <td data-bbox="802 1541 1350 1574">d) <math>(8, 7) \in R</math></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 <math>f</math> given by <math>f(x) = \begin{cases} \frac{x}{ x }, &amp; x &lt; 0 \\ -1, &amp; x \geq 0 \end{cases}</math> is continuous, is/are:</p> <table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td data-bbox="252 1821 794 1865">a) <math>x \in \mathbf{R}</math></td> <td data-bbox="802 1821 1350 1865">b) <math>x = 0</math></td> </tr> <tr> <td data-bbox="252 1865 794 1899">c) <math>x \in \mathbf{R} - \{0\}</math></td> <td data-bbox="802 1865 1350 1899">d) <math>x = -1</math> and <math>1</math></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 <math>A = \begin{bmatrix} 0 &amp; 2 \\ 3 &amp; -4 \end{bmatrix}</math> and <math>kA = \begin{bmatrix} 0 &amp; 3a \\ 2b &amp; 24 \end{bmatrix}</math>, then the values of <math>k, a</math> and <math>b</math> respectively are:</p>	1								

	<table border="1"> <tr> <td>a) <math>-6, -12, -18</math></td> <td>b) <math>-6, -4, -9</math></td> </tr> <tr> <td>c) <math>-6, 4, 9</math></td> <td>d) <math>-6, 12, 18</math></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> <math>Z = 30x + 50y</math>  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 <math>f</math> and given by <math>f(x) = (10 + x)\sqrt{100 - x^2}</math>, then the area when it is maximised is:</p> <table border="1"> <tr> <td>a) <math>75cm^2</math></td> <td>b) <math>7\sqrt{3}cm^2</math></td> </tr> <tr> <td>c) <math>75\sqrt{3}cm^2</math></td> <td>d) <math>5cm^2</math></td> </tr> </table>	a) $75cm^2$	b) $7\sqrt{3}cm^2$	c) $75\sqrt{3}cm^2$	d) $5cm^2$	1
a) $75cm^2$	b) $7\sqrt{3}cm^2$					
c) $75\sqrt{3}cm^2$	d) $5cm^2$					
35.	<p>If A is square matrix such that <math>A^2 = A</math>, then <math>(I + A)^3 - 7A</math> is equal to:</p> <table border="1"> <tr> <td>a) A</td> <td>b) <math>I + A</math></td> </tr> <tr> <td>c) <math>I - A</math></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 <math>\tan^{-1} x = y</math>, then:</p> <table border="1"> <tr> <td>a) <math>-1 &lt; y &lt; 1</math></td> <td>b) <math>\frac{-\pi}{2} \leq y \leq \frac{\pi}{2}</math></td> </tr> <tr> <td>c) <math>\frac{-\pi}{2} &lt; y &lt; \frac{\pi}{2}</math></td> <td>d) <math>y \in \{\frac{-\pi}{2}, \frac{\pi}{2}\}</math></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 <math>A = \{1, 2, 3\}</math>, <math>B = \{4, 5, 6, 7\}</math> and let <math>f = \{(1, 4), (2, 5), (3, 6)\}</math> be a function from A to B. Based on the given information, <math>f</math> 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 <math>A = \begin{bmatrix} 3 &amp; 1 \\ -1 &amp; 2 \end{bmatrix}</math>, then <math>14A^{-1}</math> is given by:</p> <table border="1"> <tr> <td>a) <math>14 \begin{bmatrix} 2 &amp; -1 \\ 1 &amp; 3 \end{bmatrix}</math></td> <td>b) <math>\begin{bmatrix} 4 &amp; -2 \\ 2 &amp; 6 \end{bmatrix}</math></td> </tr> <tr> <td>c) <math>2 \begin{bmatrix} 2 &amp; -1 \\ 1 &amp; -3 \end{bmatrix}</math></td> <td>d) <math>2 \begin{bmatrix} -3 &amp; -1 \\ 1 &amp; -2 \end{bmatrix}</math></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 <math>y = x^3 - 11x + 5</math> at which the tangent is <math>y = x - 11</math> is/are:</p> <table border="1"> <tr> <td>a) <math>(-2, 19)</math></td> <td>b) <math>(2, -9)</math></td> </tr> <tr> <td>c) <math>(\pm 2, 19)</math></td> <td>d) <math>(-2, 19)</math> and <math>(2, -9)</math></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 <math>A = \begin{bmatrix} \alpha &amp; \beta \\ \gamma &amp; -\alpha \end{bmatrix}</math> and <math>A^2 = 3I</math>, 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.

	<b>Based on the given information, answer the following questions.</b>					
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"> <tr> <td>a) <math>\frac{16}{3}</math></td> <td>b) <math>\frac{1}{3}</math></td> </tr> <tr> <td>c) 3</td> <td>d) <math>\frac{3}{16}</math></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"> <tr> <td>a) <math>\frac{15}{16}v + \frac{600000}{v}</math></td> <td>b) <math>\frac{375}{4}v + \frac{600000}{v}</math></td> </tr> <tr> <td>c) <math>\frac{5}{16}v^2 + \frac{150000}{v}</math></td> <td>d) <math>\frac{3}{16}v + \frac{6000}{v}</math></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"> <tr> <td>a) 18km/h</td> <td>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"> <tr> <td>a) ₹ 3750</td> <td>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"> <tr> <td>a) ₹ 3750</td> <td>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					

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