





9.	The greatest integer function defined by $f(x) = [x]$ , $1 < x < 3$ is not differentiable at $x =$ (A) 0 (B) 1 (C) 2 (D) $\frac{3}{2}$	
<b>Ans</b>	<b>(C) 2</b>	<b>1</b>
10.	If the radius of a circle is increasing at the rate of 0.5 cm/s, then the rate of increase of its circumference is : (A) $\frac{2\pi}{3}$ cm/s (B) $\pi$ cm/s (C) $\frac{4\pi}{3}$ cm/s (D) $2\pi$ cm/s	
<b>Ans</b>	<b>(B) <math>\pi</math> cm/s</b>	<b>1</b>
11.	$\int_{-\pi/4}^{\pi/4} x^3 \cos^2 x \, dx$ is equal to : (A) 0 (B) -1 (C) 1 (D) 2	
<b>Ans</b>	<b>(A) 0</b>	<b>1</b>
12.	$\int \frac{x-3}{(x-1)^3} e^x \, dx$ is equal to : (A) $\frac{2e^x}{(x-1)^3} + C$ (B) $\frac{-2e^x}{(x-1)^2} + C$ (C) $\frac{e^x}{(x-1)} + C$ (D) $\frac{e^x}{(x-1)^2} + C$	
<b>Ans</b>	<b>(D) <math>\frac{e^x}{(x-1)^2} + C</math></b>	<b>1</b>

13.	The area (in sq. units) of the region bounded by the curve $y = x$ , x-axis, $x = 0$ and $x = 2$ is : (A) $\frac{3}{2}$ (B) $\frac{1}{2} \log 2$ (C) 2 (D) 4	
Ans	(C) 2	1
14.	The number of arbitrary constants in the general solution of the differential equation $\frac{dy}{dx} + y = 0$ is : (A) 0 (B) 1 (C) 2 (D) 3	
Ans	(B) 1	1
15.	What is the value of $\frac{\text{projection of } \vec{a} \text{ on } \vec{b}}{\text{projection of } \vec{b} \text{ on } \vec{a}}$ for vectors $\vec{a} = 2\hat{i} - 3\hat{j} - 6\hat{k}$ and $\vec{b} = 2\hat{i} - 2\hat{j} + \hat{k}$ ? (A) $\frac{3}{7}$ (B) $\frac{7}{3}$ (C) $\frac{4}{3}$ (D) $\frac{4}{7}$	
Ans	(B) $\frac{7}{3}$	1
16.	The direction ratios of the line $\frac{x-1}{3} = \frac{2-y}{1} = \frac{3z}{2}$ are : (A) 3, 1, 2 (B) 4, 3, 2 (C) 9, -3, 2 (D) 9, 3, 2	
Ans	(C) 9, -3, 2	1



20.	<p><i>Assertion (A) :</i> If R and S are two events such that <math>P(R   S) = 1</math> and <math>P(S) &gt; 0</math>, then <math>S \subset R</math>.</p> <p><i>Reason (R) :</i> If two events A and B are such that <math>P(A \cap B) = P(B)</math>, then <math>A \subset B</math>.</p>	
Ans	(C) Assertion (A) is true, but Reason (R) is false.	1
<b>SECTION-B</b> <b>(Question nos. 21 to 25 are very short Answer type questions carrying 2 marks each)</b>		
21.	Find the value of $\cos^{-1}\left(\frac{1}{2}\right) - \tan^{-1}\left(-\frac{1}{\sqrt{3}}\right) + \operatorname{cosec}^{-1}(-2)$ .	
Ans	$\cos^{-1}\left(\frac{1}{2}\right) - \tan^{-1}\left(-\frac{1}{\sqrt{3}}\right) + \operatorname{cosec}^{-1}(-2)$ $= \frac{\pi}{3} + \frac{\pi}{6} - \frac{\pi}{6}$ $= \frac{\pi}{3}$	$1\frac{1}{2}$  $\frac{1}{2}$
22.	<p>(a) If <math>y = (\sin^{-1} x)^2</math>, then find <math>(1 - x^2) \frac{d^2 y}{dx^2} - x \frac{dy}{dx}</math>.</p> <p style="text-align: center;"><b>OR</b></p> <p>(b) If <math>y^x = x^y</math>, then find <math>\frac{dy}{dx}</math>.</p>	
Ans	<p>(a) <math>\frac{dy}{dx} = \frac{2\sin^{-1} x}{\sqrt{1-x^2}} \Rightarrow (1-x^2) \left(\frac{dy}{dx}\right)^2 = 4y</math></p> <p>Differentiating with respect to 'x', we get</p> $(1-x^2) 2 \frac{dy}{dx} \frac{d^2 y}{dx^2} - 2x \left(\frac{dy}{dx}\right)^2 = 4 \frac{dy}{dx}$ $\Rightarrow (1-x^2) \frac{d^2 y}{dx^2} - x \frac{dy}{dx} = 2$ <p style="text-align: center;">Or</p>	1  $\frac{1}{2}$  $\frac{1}{2}$

	<p>(b) <math>y^x = x^y \Rightarrow x \log y = y \log x</math>            Differentiating with respect to 'x',  <math display="block">\frac{x}{y} \frac{dy}{dx} + \log y = \frac{y}{x} + \frac{dy}{dx} \log x</math>  <math display="block">\Rightarrow \frac{dy}{dx} = \frac{y}{x} \left( \frac{y - x \log y}{x - y \log x} \right)</math></p>	$\frac{1}{2}$  1  $\frac{1}{2}$
23.	Given that $f(x) = \frac{\log x}{x}$ , find the point of local maximum of $f(x)$ .	
Ans	$f'(x) = \frac{1 - \log x}{x^2}$ , $\therefore f'(x) = 0 \Rightarrow \log x = 1 \Rightarrow x = e$ $f''(x) = \frac{2x \log x - 3x}{x^4} \Rightarrow f''(e) = -\frac{1}{e^3} < 0$ i.e. $x = e$ is a point of local maximum.	1  1
24.	<p>(a) Find :</p> $\int \frac{x^3 - 1}{x^3 - x} dx$ <p style="text-align: center;"><b>OR</b></p> <p>(b) Evaluate :</p> $\int_{-4}^0  x + 2  dx$	
Ans	<p>(a) <math>\int \frac{x^3 - 1}{x^3 - x} dx = \int \left( 1 + \frac{1}{x} - \frac{1}{x+1} \right) dx</math>  <math>= x + \log x  - \log x+1  + c</math></p> <p style="text-align: center;"><b>Or</b></p> <p>(b) <math>\int_{-4}^0  x+2  dx = \int_{-4}^{-2} -(x+2) dx + \int_{-2}^0 (x+2) dx</math>  <math>= -\left[ \frac{(x+2)^2}{2} \right]_{-4}^{-2} + \left[ \frac{(x+2)^2}{2} \right]_{-2}^0 = 2 + 2 = 4</math></p>	1  1    1  1

25.	<p>Find the angle between the lines</p> $\frac{5-x}{-7} = \frac{y+2}{-5} = \frac{z}{1} \text{ and } \frac{x}{1} = \frac{y}{2} = \frac{z}{3}.$	
Ans	<p>The direction ratios of the two lines are: 7, -5, 1 and 1, 2, 3 respectively.  <math>\therefore</math> The angle between the two lines is given by:</p> $\theta = \cos^{-1} \left( \frac{7(1) - 5(2) + 1(3)}{\sqrt{49 + 25 + 1} \sqrt{1 + 4 + 9}} \right)$ $\Rightarrow \theta = \cos^{-1} 0 = \frac{\pi}{2}$	<p><math>\frac{1}{2}</math></p> <p>1</p> <p><math>\frac{1}{2}</math></p>
<p><b>SECTION-C</b>  <b>(Question nos. 26 to 31 are short Answer type questions carrying 3 marks each)</b></p>		
26.	<p>(a) Find a matrix A such that</p> $A \begin{bmatrix} 4 & 0 \\ -1 & -2 \end{bmatrix} = \begin{bmatrix} 17 & 10 \\ 0 & -16 \end{bmatrix}.$ <p>Also, find <math>A^{-1}</math>.</p> <p style="text-align: center;"><b>OR</b></p> <p>(b) Given a square matrix A of order 3 such that <math>A^2 = \begin{bmatrix} 3 &amp; -4 &amp; 4 \\ 0 &amp; -1 &amp; 0 \\ -2 &amp; 2 &amp; -3 \end{bmatrix}</math>,</p> <p>show that <math>A^3 = A^{-1}</math>.</p>	
Ans	<p>(a) <math>A = \begin{bmatrix} 17 &amp; 10 \\ 0 &amp; -16 \end{bmatrix} \begin{bmatrix} 4 &amp; 0 \\ -1 &amp; -2 \end{bmatrix}^{-1}</math></p> $= -\frac{1}{8} \begin{bmatrix} 17 & 10 \\ 0 & -16 \end{bmatrix} \begin{bmatrix} -2 & 0 \\ 1 & 4 \end{bmatrix}$ $= \begin{bmatrix} 3 & -5 \\ 2 & 8 \end{bmatrix}$ <p>Also, <math>A^{-1} = \frac{1}{34} \begin{bmatrix} 8 &amp; 5 \\ -2 &amp; 3 \end{bmatrix}</math></p>	<p><math>\frac{1}{2}</math></p> <p>1</p> <p><math>\frac{1}{2}</math></p> <p>1</p>

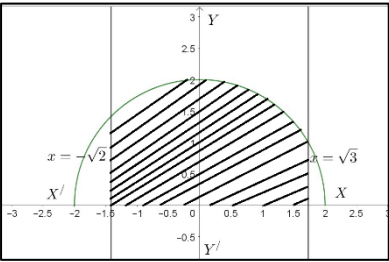


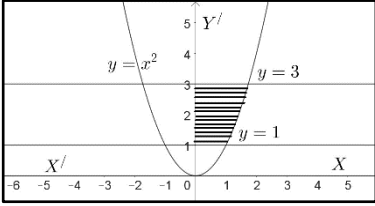
28.	<p>(a) Find :</p> $\int \frac{dx}{\cos x \sqrt{\cos 2x}}$ <p style="text-align: center;">OR</p> <p>(b) Find :</p> $\int \frac{5x-3}{\sqrt{1+4x-2x^2}} dx$	
Ans	<p>(a) <math>\int \frac{dx}{\cos x \sqrt{\cos 2x}} = \int \frac{dx}{\cos x \sqrt{\cos^2 x - \sin^2 x}}</math></p> $= \int \frac{\sec^2 x}{\sqrt{1 - \tan^2 x}} dx$ $= \int \frac{1}{\sqrt{1-t^2}} dt, \text{ using } \tan x = t, \sec^2 x \cdot dx = dt$ $= \sin^{-1} t + c = \sin^{-1}(\tan x) + c$ <p style="text-align: center;">Or</p> <p>(b) <math>\int \frac{5x-3}{\sqrt{1+4x-2x^2}} dx = -\frac{5}{4} \int \frac{-4x+4}{\sqrt{1+4x-2x^2}} dx + \sqrt{2} \int \frac{1}{\sqrt{\left(\left(\frac{\sqrt{3}}{\sqrt{2}}\right)^2 - (x-1)^2\right)}} dx</math></p> $= -\frac{5}{2} \sqrt{1+4x-2x^2} + \sqrt{2} \sin^{-1} \left( \sqrt{\frac{2}{3}} (x-1) \right) + c$	<p><math>\frac{1}{2}</math></p> <p>1</p> <p><math>\frac{1}{2}</math></p> <p>1</p> <p><math>1\frac{1}{2}</math></p> <p><math>1\frac{1}{2}</math></p>
29.	<p>Find the general solution of the differential equation</p> $y dx - x dy + (x \log x) dx = 0.$	
Ans	<p>The given differential equation can be written as, <math>\frac{dy}{dx} - \frac{1}{x}y = \log x</math></p> $\therefore P = -\frac{1}{x}, Q = \log x$ $\text{I.F.} = e^{\int -\frac{1}{x} dx} = e^{-\log x} = e^{\log \frac{1}{x}} = \frac{1}{x}$	<p><math>\frac{1}{2}</math></p> <p><math>\frac{1}{2}</math></p> <p><math>\frac{1}{2}</math></p>

	<p>The solution of the differential equation is:</p> $y \cdot \frac{1}{x} = \int \log x \cdot \frac{1}{x} dx$ $\Rightarrow \frac{y}{x} = \frac{(\log x)^2}{2} + c, \text{ or } y = \frac{1}{2}x \cdot (\log x)^2 + cx$	<p>1</p> <p><math>\frac{1}{2}</math></p>
30.	<p>If the vectors <math>\vec{a}</math>, <math>\vec{b}</math> and <math>\vec{c}</math> represent the three sides of a triangle, then show that <math>\vec{a} \times \vec{b} = \vec{b} \times \vec{c} = \vec{c} \times \vec{a}</math>.</p>	
Ans	$\vec{a} + \vec{b} + \vec{c} = \vec{O}$ $\Rightarrow \vec{a} \times (\vec{a} + \vec{b} + \vec{c}) = \vec{O}$ $\Rightarrow \vec{a} \times \vec{a} + \vec{a} \times \vec{b} + \vec{a} \times \vec{c} = \vec{O}$ $\Rightarrow \vec{a} \times \vec{b} = -\vec{a} \times \vec{c}, \therefore \vec{a} \times \vec{b} = \vec{c} \times \vec{a}$ <p>Similarly, <math>\vec{b} \times \vec{c} = \vec{c} \times \vec{a}, \therefore \vec{a} \times \vec{b} = \vec{b} \times \vec{c} = \vec{c} \times \vec{a}</math></p>	<p>1</p> <p><math>\frac{1}{2}</math></p> <p>1</p> <p><math>\frac{1}{2}</math></p>
31.	<p>It is known that 20% of the students in a school have above 90% attendance and 80% of the students are irregular. Past year results show that 80% of students who have above 90% attendance and 20% of irregular students get 'A' grade in their annual examination. At the end of a year, a student is chosen at random from the school and is found to have an 'A' grade. What is the probability that the student is irregular ?</p>	
Ans	<p>Let B : Student getting 'A' grade</p> <p><math>E_1</math> : Student having above 90% attendance</p> <p><math>E_2</math> : Student being irregular</p> $P(E_1) = \frac{20}{100}; P(E_2) = \frac{80}{100} \quad P(B E_1) = \frac{80}{100}; P(B E_2) = \frac{20}{100}$ $P(E_2 B) = \frac{P(E_2)P(B E_2)}{P(E_1)P(B E_1) + P(E_2)P(B E_2)}$ $= \frac{0.8 \times 0.2}{0.2 \times 0.8 + 0.8 \times 0.2} = \frac{1}{2}$	<p><math>\frac{1}{2}</math></p> <p><math>1\frac{1}{2}</math></p> <p><math>\frac{1}{2} + \frac{1}{2}</math></p>

## SECTION-D

(Question nos. 32 to 35 are Long Answer type questions carrying 5 marks each)

32.	Check whether the relation S in the set of all real numbers ( $\mathbb{R}$ ) defined by $S = \{(a, b) : a \leq b^3\}$ is reflexive, symmetric or transitive.	
Ans	<p><b>Reflexive:</b> Let <math>\frac{1}{2} \not\leq \left(\frac{1}{2}\right)^3</math>, <math>\therefore S</math> is not reflexive.</p> <p><b>Symmetric:</b> <math>1 \leq 2^3 \Rightarrow (1, 2) \in S</math> but <math>2 \not\leq 1^3 \Rightarrow (2, 1) \notin S</math>. <math>\therefore S</math> is not symmetric.</p> <p><b>Transitive:</b> <math>10 \leq 6^3 \Rightarrow (10, 6) \in S</math> &amp; <math>6 \leq 2^3 \Rightarrow (6, 2) \in S</math> but <math>10 \not\leq 2^3 \Rightarrow (10, 2) \notin S</math>  <math>\therefore S</math> is not Transitive.</p>	1 2 2
33.	<p>(a) Using integration, find the area of the region bounded by the curve <math>y = \sqrt{4 - x^2}</math>, the lines <math>x = -\sqrt{2}</math> and <math>x = \sqrt{3}</math> and the x-axis.</p> <p style="text-align: center;"><b>OR</b></p> <p>(b) Using integration, evaluate the area of the region bounded by the curve <math>y = x^2</math>, the lines <math>y = 1</math> and <math>y = 3</math> and the y-axis.</p>	
Ans	<div style="display: flex; align-items: flex-start;"> <div style="flex: 1;">  </div> <div style="flex: 2; padding-left: 20px;"> <p style="text-align: right;"><b>Correct Graph</b></p> <p><b>Area of the region bounded by the curve</b></p> <math display="block">= \int_{-\sqrt{2}}^{\sqrt{3}} \sqrt{4 - x^2} dx</math> <math display="block">= \left[ \frac{x}{2} \sqrt{4 - x^2} + 2 \sin^{-1} \frac{x}{2} \right]_{-\sqrt{2}}^{\sqrt{3}}</math> <math display="block">= \frac{\sqrt{3}}{2} + 2 \cdot \frac{\pi}{3} + 1 + 2 \cdot \frac{\pi}{4} = \frac{\sqrt{3}}{2} + 1 + \frac{7\pi}{6}</math> <p style="text-align: center;"><b>Or</b></p> </div> </div>	1 1 1/2 1 1/2 1

	<div style="text-align: right;"><b>Correct Graph</b></div>  <p style="text-align: center;"><b>Area of the region bounded by the curve</b></p> $= \int_1^3 \sqrt{y} dy$ $= \left[ \frac{2y^{3/2}}{3} \right]_1^3 = \frac{2}{3}(3\sqrt{3}-1)$	<p><b>1</b></p> <p><b>2</b></p> <p><b>2</b></p>
<p><b>34.</b></p>	<p>(a) Find the shortest distance between the lines <math>\frac{x-8}{3} = \frac{y+9}{-16} = \frac{z-10}{7}</math> and <math>\frac{x-15}{3} = \frac{y-29}{8} = \frac{z-5}{-5}</math>.</p> <p style="text-align: center;"><b>OR</b></p> <p>(b) Find the point of intersection of the lines <math>\vec{r} = \hat{i} - \hat{j} + 6\hat{k} + \lambda(3\hat{i} - \hat{k})</math>, and <math>\vec{r} = -3\hat{j} + 3\hat{k} + \mu(\hat{i} + 2\hat{j} - \hat{k})</math>.</p> <p>Also, find the vector equation of the line passing through the point of intersection of the given lines and perpendicular to both the lines.</p>	
<p><b>Ans</b></p>	<p>(a) <math>\vec{r} = (8\hat{i} - 9\hat{j} + 10\hat{k}) + \lambda(3\hat{i} - 16\hat{j} + 7\hat{k})</math>  <math>\vec{r} = (15\hat{i} + 29\hat{j} + 5\hat{k}) + \mu(3\hat{i} + 8\hat{j} - 5\hat{k})</math> }                  We have, <math>\vec{a}_1 = 8\hat{i} - 9\hat{j} + 10\hat{k}</math>, <math>\vec{b}_1 = 3\hat{i} - 16\hat{j} + 7\hat{k}</math>, <math>\vec{a}_2 = 15\hat{i} + 29\hat{j} + 5\hat{k}</math>, <math>\vec{b}_2 = 3\hat{i} + 8\hat{j} - 5\hat{k}</math>  <math>\vec{a}_2 - \vec{a}_1 = 7\hat{i} + 38\hat{j} - 5\hat{k}</math>, <math>\vec{b}_1 \times \vec{b}_2 = \begin{vmatrix} \hat{i} &amp; \hat{j} &amp; \hat{k} \\ 3 &amp; -16 &amp; 7 \\ 3 &amp; 8 &amp; -5 \end{vmatrix} = 24\hat{i} + 36\hat{j} + 72\hat{k}</math>                  Shortest Distance = <math>\frac{(\vec{b}_1 \times \vec{b}_2) \cdot (\vec{a}_2 - \vec{a}_1)}{ \vec{b}_1 \times \vec{b}_2 } = \frac{98}{7} = 14</math></p>	<p><b>2</b></p> <p><math>\frac{1}{2} + 1\frac{1}{2}</math></p> <p><b>1</b></p>

Or

If the given lines intersect then,

$$\hat{i} - \hat{j} + 6\hat{k} + \lambda(3\hat{i} - \hat{k}) = -3\hat{j} + 3\hat{k} + \mu(\hat{i} + 2\hat{j} - \hat{k})$$

Solving the equations,  $1 + 3\lambda = \mu$ ,  $-1 = 2\mu - 3$ , we get  $\lambda = 0$ ,  $\mu = 1$

which do not satisfy the equation,  $6 - \lambda = 3 - \mu$ .

$\therefore$  The lines do not intersect, hence no point of intersection

1

2

1

1

35.

Solve the following linear programming problem graphically :

$$\text{Minimise } Z = 6x + 7y$$

subject to constraints

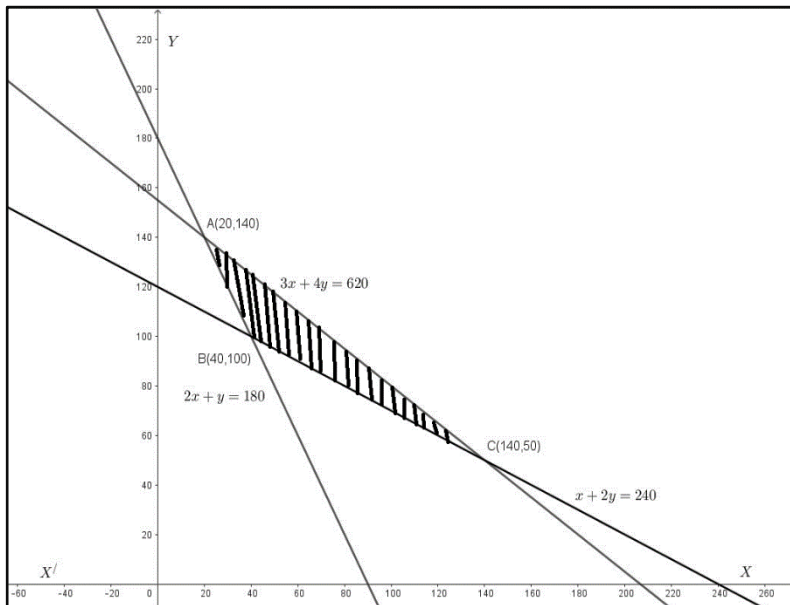
$$x + 2y \geq 240$$

$$3x + 4y \leq 620$$

$$2x + y \geq 180$$

$$x, y \geq 0.$$

Ans



Correct Graph

 $3\frac{1}{2}$ 

Corner Points	Value of $Z = 6x + 7y$
A(20, 140)	$Z = 1100$
B(40, 100)	$Z = 940$
C(140, 50)	$Z = 1190$

$$\text{Min}(Z) = 940 \text{ at } x = 40, y = 100$$

1

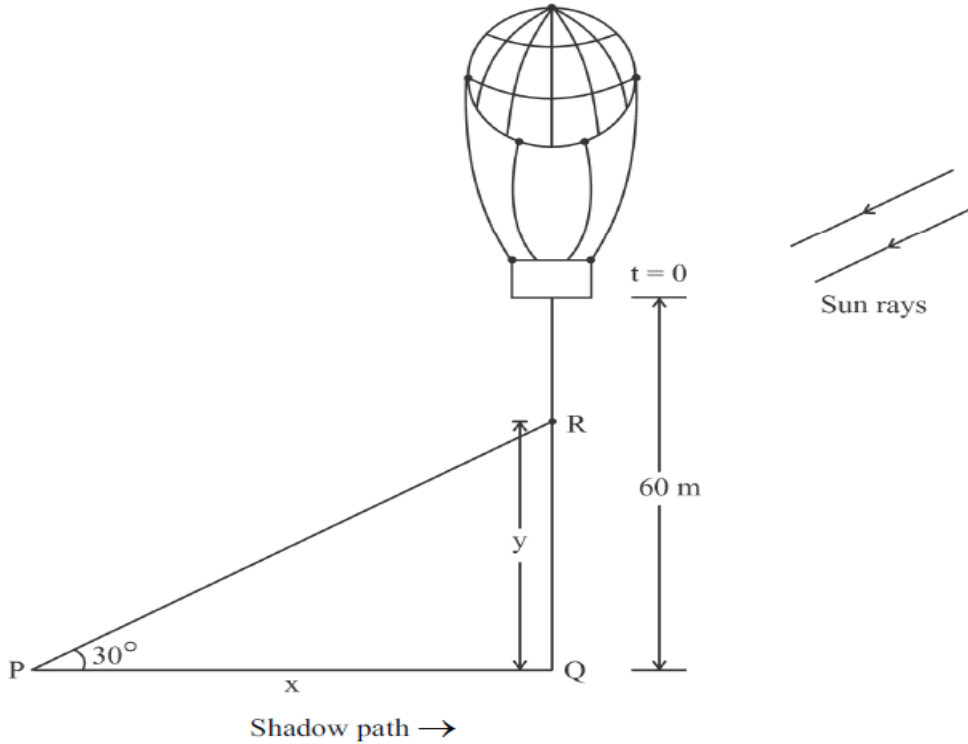
 $\frac{1}{2}$

## SECTION-E

(Question nos. 36 to 38 are source based/case based/passage based/integrated units of assessment questions carrying 4 marks each)

36.

A sandbag is dropped from a balloon at a height of 60 metres.



When the angle of elevation of the sun is  $30^\circ$ , the position of the sandbag is given by the equation  $y = 60 - 4.9t^2$ , where  $y$  is the height of the sandbag above the ground and  $t$  is the time in seconds.

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

- (i) Find the relation between  $x$  and  $y$ , where  $x$  is the distance of the shadow at P from the point Q and  $y$  is the height of the sandbag above the ground.
- (ii) After how much time will the sandbag be 35 metres above the ground ?
- (iii) (a) Find the rate at which the shadow of the sandbag is travelling along the ground when the sandbag is at a height of 35 metres.

**OR**

- (iii) (b) How fast is the height of the sandbag decreasing when 2 seconds have elapsed ?

Ans

(i)  $\frac{y}{x} = \tan 30^\circ \Rightarrow y = \frac{x}{\sqrt{3}}$  or  $x = \sqrt{3}y$

(ii) Using  $y = 35\text{m} \Rightarrow 60 - 4.9t^2 = 35 \Rightarrow 4.9t^2 = 25 \Rightarrow t = \frac{5\sqrt{10}}{7}$  seconds.

(iii) (a)  $x = \sqrt{3}y \Rightarrow x = 60\sqrt{3} - 4.9\sqrt{3}t^2 \Rightarrow \frac{dx}{dt} \Big|_{t=\frac{5\sqrt{10}}{7}} = -4.9\sqrt{3}(2t) \Big|_{t=\frac{5\sqrt{10}}{7}} = -7\sqrt{30}$  m/s

1

1

2

Or

$$(iii) (b) \frac{dy}{dt} = -9.8t = -9.8 \times 2 = -19.6 \text{ m/s}$$

Height of the sandbag is decreasing at the rate of 19.6 m/s

2

37.

A salesman receives a commission for each sale he makes together with a fixed daily income. The number of sales he makes in a day along with their probabilities are given in the table below :


X :	0	1	2	3	4	5
P(X) :	0.42	3k	0.3	0.05	2k	0.03



His daily income  $Y$  (in ₹) is given by :

$$Y = 800X + 50$$

	<p>On the basis of the above information, answer the following questions :</p> <p>(i) Find the value of <math>k</math>.</p> <p>(ii) Evaluate <math>P(X \geq 3)</math>.</p> <p>(iii) (a) Calculate the expected weekly income of the salesman assuming he works five days per week.</p> <p style="text-align: center;"><b>OR</b></p> <p>(iii) (b) Calculate the expected weekly income of the salesman assuming he works only for three days of the week.</p>	
Ans	<p>(i) <math>0.42 + 3k + 0.3 + 0.05 + 2k + 0.03 = 1 \Rightarrow 5k = 0.2 \Rightarrow k = \frac{1}{25} = 0.04</math></p> <p>(ii) <math>P(X \geq 3) = 0.05 + 2k + 0.03 = 2k + 0.08 = 0.08 + 0.08 = 0.16</math></p> <p>(iii) (a) Expected sales per day = <math>\sum x \cdot P(x)</math>  <math>= 3k + 0.6 + 0.15 + 8k + 0.15 = 11k + 0.9 = 1.34</math>  Expected Daily income = <math>Y = 800(1.34) + 50 = ₹ 1122</math>  Expectedly sales income for five days per week = ₹ 5610  Or</p> <p>(iii) (b) Expected sales per day = <math>\sum x \cdot P(x)</math>  <math>= 3k + 0.6 + 0.15 + 8k + 0.15 = 11k + 0.9 = 1.34</math>  Expected Daily income = <math>Y = 800(1.34) + 50 = ₹ 1122</math>  Expectedly sales income for three days of the week = ₹ 3366</p>	<p>1</p> <p>1</p> <p>1</p> <p><math>\frac{1}{2}</math></p> <p><math>\frac{1}{2}</math></p> <p>1</p> <p><math>\frac{1}{2}</math></p> <p><math>\frac{1}{2}</math></p>

38.	<p>An architect is developing a plot of land for a commercial complex. When asked about the dimensions of the plot, he said that if the length is decreased by 25 m and the breadth is increased by 25 m, then its area increases by 625 m<sup>2</sup>. If the length is decreased by 20 m and the breadth is increased by 10 m, then its area decreases by 200 m<sup>2</sup>.</p> <div style="text-align: center;">  <p style="margin-left: 150px;">x</p> <p style="margin-left: 150px;">y</p> </div> <p>On the basis of the above information, answer the following questions :</p> <p>(i) Formulate the linear equations in x and y to represent the given information.</p> <p>(ii) Find the dimensions of the plot of land by matrix method.</p>	
Ans	<p>(i) <math>(x - 25)(y + 25) = xy + 625 \Rightarrow x - y = 50</math>  <math>(x - 20)(y + 10) = xy - 200 \Rightarrow x - 2y = 0</math></p> <p>(ii) The system of linear equations can be written in matrix form as</p> $\begin{bmatrix} 1 & -1 \\ 1 & -2 \end{bmatrix} \begin{bmatrix} x \\ y \end{bmatrix} = \begin{bmatrix} 50 \\ 0 \end{bmatrix}$ $\Rightarrow \begin{bmatrix} x \\ y \end{bmatrix} = \begin{bmatrix} 1 & -1 \\ 1 & -2 \end{bmatrix}^{-1} \begin{bmatrix} 50 \\ 0 \end{bmatrix} = - \begin{bmatrix} -2 & 1 \\ -1 & 1 \end{bmatrix} \begin{bmatrix} 50 \\ 0 \end{bmatrix} = \begin{bmatrix} 100 \\ 50 \end{bmatrix}$ <p style="text-align: center;"><math>x = 100\text{m}, y = 50\text{m}</math></p>	<p>1</p> <p>1</p> <p><math>\frac{1}{2}</math></p> <p>1</p> <p><math>\frac{1}{2}</math></p>