



SUMMER – 17 EXAMINATION

Model Answer

Subject Code: **17301**

Important Instructions to examiners:

- 1) The answers should be examined by key words and not as word-to-word as given in the model answer scheme.
- 2) The model answer and the answer written by candidate may vary but the examiner may try to assess the understanding level of the candidate.
- 3) The language errors such as grammatical, spelling errors should not be given more Importance (Not applicable for subject English and Communication Skills.)
- 4) While assessing figures, examiner may give credit for principal components indicated in the figure. The figures drawn by candidate and model answer may vary. The examiner may give credit for any equivalent figure drawn.
- 5) Credits may be given step wise for numerical problems. In some cases, the assumed constant values may vary and there may be some difference in the candidate's answers and model answer.
- 6) In case of some questions credit may be given by judgement on part of examiner of relevant answer based on candidate's understanding.
- 7) For programming language papers, credit may be given to any other program based on equivalent concept.

Q. No.	Sub Q. N.	Answer	Marking Scheme
1		Attempt any <u>TEN</u> of the following:	20
	a)	Find the point on the curve $y = x^2 - 6x + 8$ where the tangent is parallel to X-axis	02
	Ans	$y = x^2 - 6x + 8$ $\therefore \frac{dy}{dx} = 2x - 6$ \therefore tangent is parallel to X-axis $\therefore \frac{dy}{dx} = 0$ $\therefore 2x - 6 = 0$ $\therefore x = 3$ $y = 3^2 - 6(3) + 8 = -1$ \therefore Point is $(3, -1)$	$\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$
	b)	Find the radius of curvature of the curve $xy = c$ at point (c, c)	02
	Ans	$xy = c$ $x \frac{dy}{dx} + y = 0$	



SUMMER – 17 EXAMINATION

Model Answer

Subject Code: **17301**

Q. No.	Sub Q. N.	Answer	Marking Scheme
1	b)	$\therefore \frac{dy}{dx} = -\frac{y}{x}$ $\frac{d^2y}{dx^2} = -\left(\frac{x\frac{dy}{dx} - y}{x^2}\right)$ <p>at (c, c)</p> $\frac{dy}{dx} = -\frac{c}{c} = -1$ $\frac{d^2y}{dx^2} = -\left(\frac{c(-1) - c}{c^2}\right) = \frac{2}{c}$ $\therefore \text{Radius of curvature} = \frac{\left[1 + \left(\frac{dy}{dx}\right)^2\right]^{\frac{3}{2}}}{\frac{d^2y}{dx^2}} = \frac{\left[1 + (-1)^2\right]^{\frac{3}{2}}}{\frac{2}{c}}$ $= \frac{c}{2}(2\sqrt{2}) = \sqrt{2} c$	<p>½</p> <p>½</p> <p>½</p> <p>½</p>
		<p>c) Evaluate $\int \frac{1}{\sin^{-1} x \sqrt{1-x^2}} dx$</p> <p>Ans $\int \frac{1}{\sin^{-1} x \sqrt{1-x^2}} dx$ put $\sin^{-1} x = t$ $\therefore \frac{1}{\sqrt{1-x^2}} dx = dt$ $= \int \frac{1}{t} dt$ $= \log t + c$ $= \log(\sin^{-1} x) + c$</p>	<p>02</p> <p>½</p> <p>½</p> <p>½</p> <p>½</p>
		<p>d) Evaluate $\int \frac{1}{\sqrt[4]{(2-3x)^3}} dx$</p> <p>Ans $\int \frac{1}{\sqrt[4]{(2-3x)^3}} dx$</p>	<p>02</p>



SUMMER – 17 EXAMINATION

Model Answer

Subject Code: **17301**

Q. No.	Sub Q. N.	Answer	Marking Scheme
1	d)	$= \int \frac{1}{(2-3x)^{\frac{3}{4}}} dx$ $= \int (2-3x)^{-\frac{3}{4}} dx$ $= \frac{(2-3x)^{-\frac{3}{4}+1}}{-\frac{3}{4}+1} \cdot \frac{-1}{3} = \frac{(2-3x)^{\frac{1}{4}}}{\frac{1}{4}} \cdot \frac{-1}{3} + c$ $= -\frac{4}{3}(2-3x)^{\frac{1}{4}} + c$	<p>½</p> <p>1</p> <p>½</p>
	e)	Evaluate $\int \tan^{-1} x dx$	02
	Ans	$\int \tan^{-1} x \cdot 1 dx$ $= \tan^{-1} x \int 1 dx - \int \left(\int 1 dx \cdot \frac{d(\tan^{-1} x)}{dx} \right) dx$ $= \tan^{-1} x \cdot x - \int \frac{x}{1+x^2} dx$ $= x \tan^{-1} x - \frac{1}{2} \int \frac{2x}{1+x^2} dx$ $= x \tan^{-1} x - \frac{1}{2} \log(1+x^2) + c$	<p>½</p> <p>½</p> <p>½</p> <p>½</p>
f)	Evaluate $\int_0^{\pi/2} \sin^3 x dx$	02	
Ans	$\int_0^{\pi/2} \sin^3 x dx$ $= \int_0^{\pi/2} \sin^2 x \cdot \sin x dx$ $= \int_0^{\pi/2} (1 - \cos^2 x) \sin x dx$ <p>Put $\cos x = t$ when $x = 0, t = 1$</p> <p>$\therefore -\sin x dx = dt$ when $x = \frac{\pi}{2}, t = 0$</p>	<p>½</p> <p>½</p>	



SUMMER – 17 EXAMINATION

Model Answer

Subject Code: **17301**

Q. No.	Sub Q. N.	Answer	Marking Scheme
1	f)	$= \int_1^0 (1-t^2) -dt$ $= \int_1^0 (-1+t^2) dt$ $= \left[-t + \frac{t^3}{3} \right]_1^0$ $= (0) - \left(-1 + \frac{1}{3} \right)$ $= \frac{2}{3}$	<p>½</p> <p>½</p>
		<p style="text-align: center;">OR</p> $\int_0^{\pi/2} \sin^3 x dx$ $= \int_0^{\pi/2} \frac{3 \sin x - \sin 3x}{4} dx$ $= \frac{1}{4} \left[3(-\cos x) + \frac{\cos 3x}{3} \right]_0^{\pi/2}$ $= \frac{1}{4} \left[0 + 0 + 3 - \frac{1}{3} \right]$ $= \frac{1}{4} \cdot \frac{8}{3}$ $= \frac{2}{3}$	<p>½</p> <p>½</p> <p>½</p>
	g)	Find the area of the region bounded by $x^2 = 16y$, $y = 1$, $y = 4$ and Y-axis in first quadrant	02
	Ans	$A = \int_a^b x dy$ $= \int_1^4 4\sqrt{y} dy$ $= 4 \left[\frac{y^{3/2}}{3/2} \right]_1^4$	<p>½</p> <p>½</p>



SUMMER – 17 EXAMINATION

Model Answer

Subject Code: **17301**

Q. No.	Sub Q. N.	Answer	Marking Scheme	
1	g)	$= \frac{8}{3} \left(4^{\frac{3}{2}} - 1^{\frac{3}{2}} \right)$	$\frac{1}{2}$	
		$= \frac{8}{3} (7)$		
		$= \frac{56}{3}$	$\frac{1}{2}$	

		h)	Determine the order and degree of $x^2 \frac{d^2 y}{dx^2} + x \frac{dy}{dx} = my$	02
	Ans	Order=2		1
		Degree=1		1

		i)	Form the differential equation if $y = 4(x - A)^2$. Where A is arbitrary constant	02
	Ans	$y = 4(x - A)^2$		
		$\therefore \frac{dy}{dx} = 8(x - A)$		$\frac{1}{2}$
		$y = 4 \left(\frac{1}{8} \frac{dy}{dx} \right)^2$		$\frac{1}{2}$
	$y = 4 \frac{1}{64} \left(\frac{dy}{dx} \right)^2$		$\frac{1}{2}$	
	$\therefore \left(\frac{dy}{dx} \right)^2 = 16y$		$\frac{1}{2}$	

	j)	A fair die is rolled. What is the probability that the number on the die is a prime number	02	
Ans	$S = \{1, 2, 3, 4, 5, 6\}$			
	$\therefore n(s) = 6$			
	$A = \{2, 3, 5\}$		$\frac{1}{2}$	
	$\therefore n(A) = 3$			
	$p(A) = \frac{n(A)}{n(s)} = \frac{3}{6}$		$\frac{1}{2}$	
	$= \frac{1}{2}$ or 0.5		1	



SUMMER – 17 EXAMINATION

Model Answer

Subject Code: **17301**

Q. No.	Sub Q. N.	Answer	Marking Scheme
1	k)	From 4 men and 2 women, 3 persons are chosen at random to form a committee. Find the probability that the committee consists of at least one person of either sex.	02
	Ans	$n(S) = {}^6C_3 = 20$ $n(A) = {}^4C_1 \times {}^2C_2 + {}^4C_2 \times {}^2C_1$ $= 16$ $p(A) = \frac{16}{20} = \frac{4}{5} \text{ or } 0.8$	<p>½</p> <p>1</p> <p>½</p>

1	l)	A person fires 10 shots at target. The probability that any shot will hit the target is $\frac{3}{5}$. Find the probability that the target is hit exactly 5 times.	02
	Ans	<p>Given : $n = 10, p = \frac{3}{5}, q = 1 - p = 1 - \frac{3}{5} = \frac{2}{5}$</p> $p(r) = {}^nC_r p^r q^{n-r}$ $p(5) = {}^{10}C_5 \left(\frac{3}{5}\right)^5 \left(\frac{2}{5}\right)^5$ $= 0.2007$	<p>1</p> <p>1</p>

1	m)	Evaluate $\int \frac{1}{\sqrt{9-4x^2}} dx$	02
	Ans.	$\int \frac{1}{\sqrt{9-4x^2}} dx \quad \text{OR} \quad \int \frac{1}{2\sqrt{\frac{9}{4}-x^2}} dx$ $= \int \frac{1}{\sqrt{3^2-(2x)^2}} dx \quad = \frac{1}{2} \int \frac{1}{\sqrt{\left(\frac{3}{2}\right)^2-x^2}} dx$ $= \sin^{-1}\left(\frac{2x}{3}\right) \cdot \frac{1}{2} + c \quad = \frac{1}{2} \sin^{-1}\left(\frac{x}{3/2}\right) + c = \frac{1}{2} \sin^{-1}\left(\frac{2x}{3}\right) + c$	<p>1</p> <p>1</p>



SUMMER – 17 EXAMINATION

Model Answer

Subject Code: **17301**

Q. No.	Sub Q. N.	Answer	Marking Scheme
1	n)	Evaluate $\int_1^e \frac{1}{x} \cdot \log x dx$	02
	Ans	$\int_1^e \frac{1}{x} \cdot \log x dx$ Put $\log x = t$ when $x = 1$ $t = \log 1 = 0$ $\frac{1}{x} dx = dt$ when $x = e$ $t = \log e = 1$ $= \int_0^1 t dt$ $= \left[\frac{t^2}{2} \right]_0^1$ $= \frac{1}{2}$	½ ½ ½ ½
2		Attempt any <u>FOUR</u> of the following:	16
	a)	Evaluate $\int \tan^3 x dx$	04
	Ans.	Considering index as 3 $\therefore \int \tan^3 x dx$ $= \int \tan^2 x \tan x dx$ $= \int (\sec^2 x - 1) \tan x dx$ $= \int (\tan x \sec^2 x - \tan x) dx$ $= \int \tan x \sec^2 x dx - \int \tan x dx$ In first integral , put $\tan x = t$ $\therefore \sec^2 x dx = dt$ $= \int t dt - \log(\sec x) + c$ $= \frac{t^2}{2} - \log(\sec x) + c$ $= \frac{\tan^2 x}{2} - \log(\sec x) + c$	½ 1 1 1 ½
		Note: If student attempted to solve the problem assuming any index value then consider it and reward appropriate marks to it.	



SUMMER – 17 EXAMINATION

Model Answer

Subject Code: **17301**

Q. No.	Sub Q. N.	Answer	Marking Scheme
2	b)	Evaluate $\int \frac{\log x}{x(2+\log x)(3+\log x)} dx$	04
	Ans	$\int \frac{\log x}{x(2+\log x)(3+\log x)} dx$ <p>Put $\log x = t$</p> $\therefore \frac{1}{x} dx = dt$ $\int \frac{t}{(2+t)(3+t)} dt$ <p>consider $\frac{t}{(2+t)(3+t)} = \frac{A}{2+t} + \frac{B}{3+t}$</p> $\therefore t = A(3+t) + B(2+t)$ <p>Put $t = -2$</p> $A = -2$ <p>Put $t = -3$</p> $B = 3$ $\therefore \frac{t}{(2+t)(3+t)} = \frac{-2}{2+t} + \frac{3}{3+t}$ $\therefore \int \frac{t}{(2+t)(3+t)} dt = \int \frac{-2}{2+t} + \frac{3}{3+t} dt$ $= -2 \log(2+t) + 3 \log(3+t) + c$ $= -2 \log(2+\log x) + 3 \log(3+\log x) + c$	<p>$\frac{1}{2}$</p> <p>$\frac{1}{2}$</p> <p>$\frac{1}{2}$</p> <p>$\frac{1}{2}$</p> <p>$\frac{1}{2}$</p> <p>$\frac{1}{2}$</p> <p>$\frac{1}{2}$</p>
	c)	Find the equations of the tangent and normal to the ellipse $2x^2 + 3y^2 = 5$ which is perpendicular to the line $3x + 2y + 7 = 0$	04
	Ans	<p>Slope of line $3x + 2y + 7 = 0$ is</p> $m_1 = \frac{-3}{2}$ $\therefore 2x^2 + 3y^2 = 5$ $\therefore 4(x) + 6y \frac{dy}{dx} = 0$ $\therefore \frac{dy}{dx} = \frac{-4x}{6y} = \frac{-2x}{3y}$	



SUMMER – 17 EXAMINATION

Model Answer

Subject Code: **17301**

Q. No.	Sub Q. N.	Answer	Marking Scheme
2	c)	$\therefore \text{slope of tangent} = m_2 = \frac{-2x}{3y}$ <p>Line and tangent are perpendicular</p> $\therefore m_1 m_2 = -1$ $\therefore \frac{-3}{2} \cdot \frac{-2x}{3y} = -1$ $\therefore x = -y \quad \therefore y = -x$ $\therefore 2x^2 + 3(-x)^2 = 5$ $2x^2 + 3x^2 = 5$ $\therefore x^2 = 1$ $\therefore x = \pm 1$ <p>if $x = 1$ $y = -1$ \therefore point is $(1, -1)$</p> <p>if $x = -1$ $y = 1$ \therefore point is $(-1, 1)$</p> <p>Equation of tangent at $(1, -1)$ is</p> $y + 1 = \frac{2}{3}(x - 1)$ $\therefore 2x - 3y - 5 = 0$ <p>Equation of tangent at $(-1, 1)$ is</p> $y - 1 = \frac{2}{3}(x + 1)$ $\therefore 2x - 3y + 5 = 0$ <p>Equation of normal at $(1, -1)$</p> $y + 1 = \frac{-3}{2}(x - 1)$ $\therefore 3x + 2y - 1 = 0$ <p>Equation of normal at $(-1, 1)$ is</p> $y - 1 = \frac{-3}{2}(x + 1)$ $\therefore 3x + 2y + 1 = 0$	<p>$\frac{1}{2}$</p> <p>$\frac{1}{2}$</p> <p>$\frac{1}{2}$</p> <p>$\frac{1}{2}$</p> <p>$\frac{1}{2}$</p> <p>$\frac{1}{2}$</p> <p>$\frac{1}{2}$</p>
	d)	<p>Find the radius of curvature for the curve $x = a \cos^3 \theta$, $y = a \sin^3 \theta$ at $\theta = \frac{\pi}{4}$</p>	04
Ans	$x = a \cos^3 \theta$ $\frac{dx}{d\theta} = -3a \cos^2 \theta \sin \theta$	$y = a \sin^3 \theta$ $\frac{dy}{d\theta} = 3a \sin^2 \theta \cos \theta$	$\frac{1}{2} + \frac{1}{2}$



SUMMER – 17 EXAMINATION

Model Answer

Subject Code: **17301**

Q. No.	Sub Q. N.	Answer	Marking Scheme
2	d)	$\frac{dy}{dx} = \frac{\frac{dy}{d\theta}}{\frac{dx}{d\theta}} = \frac{3a \sin^2 \theta \cos \theta}{-3a \cos^2 \theta \sin \theta}$ $\frac{dy}{dx} = -\tan \theta$ $\frac{d^2 y}{dx^2} = -\sec^2 \theta \frac{d\theta}{dx}$ $= -\sec^2 \theta \frac{1}{\frac{dx}{d\theta}}$ $= -\sec^2 \theta \frac{1}{-3a \cos^2 \theta \sin \theta}$ <p>at $\theta = \frac{\pi}{4}$</p> $\frac{dy}{dx} = -\tan\left(\frac{\pi}{4}\right) = -1$ $\frac{d^2 y}{dx^2} = -\sec^2\left(\frac{\pi}{4}\right) \frac{1}{-3a \cos^2\left(\frac{\pi}{4}\right) \sin\left(\frac{\pi}{4}\right)}$ $= -(\sqrt{2})^2 \cdot \frac{1}{-3a \left(\frac{1}{\sqrt{2}}\right)^2 \left(\frac{1}{\sqrt{2}}\right)}$ $= \frac{2}{3a \frac{1}{2\sqrt{2}}}$ $= \frac{4\sqrt{2}}{3a}$ $\text{Radius of curvature} = \frac{\left(1 + \left(\frac{dy}{dx}\right)^2\right)^{\frac{3}{2}}}{\frac{d^2 y}{dx^2}}$ $= \frac{(1 + (-1)^2)^{\frac{3}{2}}}{\frac{4\sqrt{2}}{3a}}$ $= \frac{3a}{2} \text{ or } (1.5)a$	<p>½</p> <p>½</p> <p>½</p> <p>½</p> <p>½</p>



SUMMER – 17 EXAMINATION

Model Answer

Subject Code: **17301**

Q. No.	Sub Q. N.	Answer	Marking Scheme
2	e)	A bullet is fired into a mud tank and penetrates $(120t - 3600t^2)$ meters in 't' seconds after impact. Calculate maximum depth of penetration.	04
	Ans	$y = 120t - 3600t^2$ $\frac{dy}{dt} = 120 - 7200t$ $\frac{d^2y}{dt^2} = -7200 < 0 \therefore \text{Depth is maximum.}$ <p>Let $\frac{dy}{dt} = 0$</p> $\therefore 120 - 7200t = 0$ $\therefore t = \frac{1}{60}$ $\therefore \text{Maximum depth } y = 120\left(\frac{1}{60}\right) - 3600\left(\frac{1}{60}\right)^2$ $= 1 \text{ meter}$ <hr style="border-top: 1px dashed black;"/>	<p>$\frac{1}{2}$</p> <p>$\frac{1}{2}$</p> <p>$\frac{1}{2}$</p> <p>1</p> <p>$\frac{1}{2}$</p> <p>1</p>
	f)	Evaluate $\int \frac{5x-4}{x^2-8x+12} dx$	04
	Ans	$\int \frac{5x-4}{x^2-8x+12} dx$ <p>Consider $\frac{5x-4}{x^2-8x+12} = \frac{5x-4}{(x-6)(x-2)}$</p> $\frac{5x-4}{(x-6)(x-2)} = \frac{A}{x-6} + \frac{B}{x-2}$ $\therefore 5x-4 = A(x-2) + B(x-6)$ <p>Put $x = 6$</p> $\therefore A = \frac{26}{4} = \frac{13}{2}$ <p>Put $x = 2$</p> $\therefore B = \frac{-6}{4} = \frac{-3}{2}$ $\frac{5x-4}{x^2-8x+12} = \frac{\frac{13}{2}}{x-6} + \frac{\frac{-3}{2}}{x-2}$ $\therefore \int \frac{5x-4}{x^2-8x+12} dx = \int \left(\frac{\frac{13}{2}}{x-6} + \frac{\frac{-3}{2}}{x-2} \right) dx$	<p>$\frac{1}{2}$</p> <p>$\frac{1}{2}$</p> <p>$\frac{1}{2}$</p> <p>$\frac{1}{2}$</p> <p>$\frac{1}{2}$</p> <p>$\frac{1}{2}$</p>



SUMMER – 17 EXAMINATION

Model Answer

Subject Code: **17301**

Q. No.	Sub Q. N.	Answer	Marking Scheme
2	f)	$I = \frac{13}{2} \log(x-6) - \frac{3}{2} \log(x-2) + c$	1
3		-----	16
		Attempt any <u>FOUR</u> of the following:	
	a)	Evaluate $\int_{-\frac{3}{2}}^{\frac{1}{2}} \frac{1}{4x^2 + 12x + 13} dx$	04
	Ans	$\int_{-\frac{3}{2}}^{\frac{1}{2}} \frac{1}{4x^2 + 12x + 13} dx$ $= \frac{1}{4} \int_{-\frac{3}{2}}^{\frac{1}{2}} \frac{1}{x^2 + 3x + \frac{13}{4}} dx$ <p>Third term = $\frac{(3x)^2}{4.(x)^2} = \frac{9}{4}$</p> $= \frac{1}{4} \int_{-\frac{3}{2}}^{\frac{1}{2}} \frac{1}{x^2 + 3x + \frac{9}{4} - \frac{9}{4} + \frac{13}{4}} dx$ $= \frac{1}{4} \int_{-\frac{3}{2}}^{\frac{1}{2}} \frac{1}{\left(x + \frac{3}{2}\right)^2 + 1^2} dx$ $= \left[\frac{1}{4} \tan^{-1} \left(x + \frac{3}{2} \right) \right]_{-\frac{3}{2}}^{\frac{1}{2}}$ $= \frac{1}{4} \tan^{-1} \left(\frac{1}{2} + \frac{3}{2} \right) - \frac{1}{4} \tan^{-1} \left(-\frac{3}{2} + \frac{3}{2} \right)$ $= \frac{1}{4} \tan^{-1} (2)$	<p>$\frac{1}{2}$</p> <p>$\frac{1}{2}$</p> <p>$\frac{1}{2}$</p> <p>1</p> <p>$\frac{1}{2}$</p> <p>$\frac{1}{2}$</p>
	b)	Evaluate $\int_{\frac{\pi}{6}}^{\frac{\pi}{3}} \frac{1}{1 + \sqrt[3]{\cot x}} dx$	04
	Ans	$\int_{\frac{\pi}{6}}^{\frac{\pi}{3}} \frac{1}{1 + \sqrt[3]{\cot x}} dx$	



SUMMER – 17 EXAMINATION

Model Answer

Subject Code: **17301**

Q. No.	Sub Q. N.	Answer	Marking Scheme
3	b)	$I = \int_{\pi/6}^{\pi/3} \frac{1}{1 + \sqrt[3]{\cot x}} dx$ $= \int_{\pi/6}^{\pi/3} \frac{1}{1 + \sqrt[3]{\frac{\cos x}{\sin x}}} dx$ $= \int_{\pi/6}^{\pi/3} \frac{1}{1 + \frac{\sqrt[3]{\cos x}}{\sqrt[3]{\sin x}}} dx$ $I = \int_{\pi/6}^{\pi/3} \frac{\sqrt[3]{\sin x}}{\sqrt[3]{\sin x} + \sqrt[3]{\cos x}} dx \text{ ----- (1)}$ $I = \int_{\pi/6}^{\pi/3} \frac{\sqrt[3]{\sin\left(\frac{\pi}{3} + \frac{\pi}{6} - x\right)}}{\sqrt[3]{\sin\left(\frac{\pi}{3} + \frac{\pi}{6} - x\right)} + \sqrt[3]{\cos\left(\frac{\pi}{3} + \frac{\pi}{6} - x\right)}} dx$ $\therefore I = \int_{\pi/6}^{\pi/3} \frac{\sqrt[3]{\sin\left(\frac{\pi}{2} - x\right)}}{\sqrt[3]{\sin\left(\frac{\pi}{2} - x\right)} + \sqrt[3]{\cos\left(\frac{\pi}{2} - x\right)}} dx$ $\therefore I = \int_{\pi/6}^{\pi/3} \frac{\sqrt[3]{\cos x}}{\sqrt[3]{\cos x} + \sqrt[3]{\sin x}} dx \text{ ----- (2)}$ <p>add (1) and (2)</p> $I + I = \int_{\pi/6}^{\pi/3} \frac{\sqrt[3]{\sin x}}{\sqrt[3]{\sin x} + \sqrt[3]{\cos x}} + \int_{\pi/6}^{\pi/3} \frac{\sqrt[3]{\cos x}}{\sqrt[3]{\cos x} + \sqrt[3]{\sin x}} dx$ $2I = \int_{\pi/6}^{\pi/3} \frac{\sqrt[3]{\sin x} + \sqrt[3]{\cos x}}{\sqrt[3]{\sin x} + \sqrt[3]{\cos x}} dx$ $2I = \int_{\pi/6}^{\pi/3} 1 dx$ $2I = [x]_{\pi/6}^{\pi/3}$ $2I = \frac{\pi}{3} - \frac{\pi}{6}$ $I = \frac{\pi}{12}$	<p>½</p> <p>1</p> <p>½</p> <p>½</p> <p>½</p> <p>½</p>



SUMMER – 17 EXAMINATION

Model Answer

Subject Code:

17301

Q. No.	Sub Q. N.	Answer	Marking Scheme
3	c)	Find the area of the region enclosed between parabola $y = x^2 + 1$ and the line $y = 2x + 1$	04
	Ans	$y = x^2 + 1 \text{ and } y = 2x + 1$ $\therefore x^2 + 1 = 2x + 1$ $x^2 - 2x = 0$ $x(x - 2) = 0$ $\therefore x = 0 \text{ \& } x = 2$ $\text{Area} = \int_a^b (y_1 - y_2) dx$ $= \int_0^2 [(2x + 1) - (x^2 + 1)] dx$ $= \int_0^2 [2x + 1 - x^2 - 1] dx$ $= \int_0^2 [2x - x^2] dx$ $= \left[\frac{2x^2}{2} - \frac{x^3}{3} \right]_0^2$ $= \left[2^2 - \frac{2^3}{3} \right] - [0]$ $= \frac{4}{3}$	<p>1</p> <p>½</p> <p>1</p> <p>1</p> <p>½</p>
	d)	Solve $x^2 \cdot \frac{dy}{dx} = x^2 + xy + y^2$	04
	Ans	$x^2 \cdot \frac{dy}{dx} = x^2 + xy + y^2$ $\frac{dy}{dx} = \frac{x^2 + xy + y^2}{x^2}$ <p>Put $y = vx$</p> $\therefore \frac{dy}{dx} = v + x \frac{dv}{dx}$ $v + x \frac{dv}{dx} = \frac{x^2 + x(vx) + (vx)^2}{x^2}$ $v + x \frac{dv}{dx} = \frac{x^2 + vx^2 + v^2x^2}{x^2}$	<p>½</p> <p>½</p>



SUMMER – 17 EXAMINATION

Model Answer

Subject Code: **17301**

Q. No.	Sub Q. N.	Answer	Marking Scheme
3	d)	$v + x \frac{dv}{dx} = \frac{x^2(1+v+v^2)}{x^2}$ $v + x \frac{dv}{dx} = 1 + v + v^2$ $x \frac{dv}{dx} = 1 + v^2$ $x dv = (1 + v^2) dx$ $\frac{1}{1+v^2} dv = \frac{1}{x} dx$ $\int \frac{1}{1+v^2} dv = \int \frac{1}{x} dx$ $\tan^{-1}(v) = \log x + c$ $\tan^{-1}\left(\frac{y}{x}\right) = \log x + c$	<p>1</p> <p>½</p> <p>1</p> <p>½</p>
	e)	Solve $\cos^2(x-2y) = 1 - 2 \frac{dy}{dx}$	04
	Ans	$\cos^2(x-2y) = 1 - 2 \frac{dy}{dx}$ <p>Put $x - 2y = v$</p> $1 - 2 \frac{dy}{dx} = \frac{dv}{dx}$ $\therefore \cos^2 v = \frac{dv}{dx}$ $dx = \frac{1}{\cos^2 v} dv$ <p>\therefore solution is</p> $\int dx = \int \sec^2 v dv$ $x = \tan v + c$ $x = \tan(x - 2y) + c$	<p>1</p> <p>1</p> <p>½</p> <p>1</p> <p>½</p>
f)	Solve $(1+x^2) \frac{dy}{dx} + y = e^{\tan^{-1}x}$	04	
Ans	$\therefore \frac{dy}{dx} + \frac{1}{1+x^2} y = \frac{e^{\tan^{-1}x}}{1+x^2}$ <p>Comparing with $\frac{dy}{dx} + Py = Q$</p>		



SUMMER – 17 EXAMINATION

Model Answer

Subject Code: **17301**

Q. No.	Sub Q. N.	Answer	Marking Scheme
4	a)	$2I = \int_3^7 \frac{(10-x)^2 + x^2}{x^2 + (10-x)^2} dx$ $2I = \int_3^7 1 dx$ $2I = [x]_3^7$ $2I = 7 - 3$ $I = \frac{4}{2}$ $I = 2$	<p>½</p> <p>½</p> <p>½</p> <p>½</p>
	b)	<p>-----</p> <p>Evaluate $\int_0^1 x \cdot \sin^{-1} x dx$</p>	04
	Ans	$\int_0^1 x \cdot \sin^{-1} x dx$ $= \sin^{-1} x \int_0^1 x \cdot dx - \int_0^1 \left[\int_0^1 x \cdot dx \frac{d(\sin^{-1} x)}{dx} \right] dx$ $= \sin^{-1} x \cdot \frac{x^2}{2} - \int_0^1 \frac{x^2}{2} \cdot \frac{1}{\sqrt{1-x^2}} dx$ $= \frac{x^2 \cdot \sin^{-1} x}{2} + \frac{1}{2} \int_0^1 \frac{1-x^2-1}{\sqrt{1-x^2}} dx$ $= \frac{x^2 \cdot \sin^{-1} x}{2} + \frac{1}{2} \left[\int_0^1 \left(\frac{1-x^2}{\sqrt{1-x^2}} - \frac{1}{\sqrt{1-x^2}} \right) dx \right]$ $= \frac{x^2 \cdot \sin^{-1} x}{2} + \frac{1}{2} \left[\int_0^1 \left(\sqrt{1-x^2} - \frac{1}{\sqrt{1-x^2}} \right) dx \right]$ $= \left[\frac{x^2 \cdot \sin^{-1} x}{2} + \frac{1}{2} \left[\frac{x}{2} \sqrt{1-x^2} + \frac{1^2}{2} \sin^{-1}(x) - \sin^{-1} x \right] \right]_0^1$ $= \left[\frac{x^2 \cdot \sin^{-1} x}{2} + \frac{x}{4} \sqrt{1-x^2} - \frac{1}{4} \sin^{-1}(x) \right]_0^1$ $= \left[\frac{1^2 \cdot \sin^{-1}(1)}{2} + 0 - \frac{1}{4} \sin^{-1}(1) \right] - 0$ $= \frac{\pi}{2} - \frac{1}{4} \cdot \frac{\pi}{2} = \frac{\pi}{4} - \frac{\pi}{8} = \frac{\pi}{8}$	<p>½</p> <p>½</p> <p>½</p> <p>1</p> <p>½</p> <p>1</p>



SUMMER – 17 EXAMINATION

Model Answer

Subject Code: **17301**

Q. No.	Sub Q. N.	Answer	Marking Scheme
4	c)	Find the area of the region in the first quadrant enclosed by the X-axis the line $y = x$ and the circle $x^2 + y^2 = 8$	04
	Ans	$\therefore y = x, x^2 + y^2 = 8$ $\therefore x^2 + x^2 = 8$ $2x^2 = 8$ $x^2 = 4$ $\therefore x = \pm 2$ In first quadrant $x = 0$ to $x = 2$	1
		Due to symmetry about the line $y=x$ the region in first quadrant of the circle is divided into two equal parts and hence can be integrated as follows:	
		$A = \int_a^b (y_2 - y_1)$	
		$\therefore A = \int_0^2 \left(\sqrt{(\sqrt{8})^2 - x^2} - x \right) dx$	$\frac{1}{2}$
		$\therefore A = \left[\left(\frac{x}{2} \sqrt{(\sqrt{8})^2 - x^2} + \frac{(\sqrt{8})^2}{2} \sin^{-1} \left(\frac{x}{\sqrt{8}} \right) \right) - \frac{x^2}{2} \right]_0^2$	1
		$\therefore A = \left[\frac{2}{2} \sqrt{(\sqrt{8})^2 - (2)^2} + \frac{(\sqrt{8})^2}{2} \sin^{-1} \left(\frac{2}{\sqrt{8}} \right) - \frac{(2)^2}{2} \right] - 0$	$\frac{1}{2}$
		$\therefore A = 2 + 4 \left(\frac{\pi}{4} \right) - 2$	
		$= \pi$	1
		OR	
		$\therefore y = x, x^2 + y^2 = 8$ $y^2 = 4$ $\therefore y = \pm 2$ In first quadrant $y = 0$ to $y = 2$	1
		$A = \int_a^b (x_2 - x_1) dy$	
		$\therefore A = \int_0^2 \left(\sqrt{(\sqrt{8})^2 - y^2} - y \right) dy$	$\frac{1}{2}$

SUMMER – 17 EXAMINATION

Model Answer

Subject Code: **17301**

Q. No.	Sub Q. N.	Answer	Marking Scheme
4	c)	$\therefore A = \left[\left(\frac{y}{2} \sqrt{(\sqrt{8})^2 - y^2} + \frac{(\sqrt{8})^2}{2} \sin^{-1} \left(\frac{y}{\sqrt{8}} \right) \right) - \frac{y^2}{2} \right]_0^2$ $\therefore A = \left[\frac{2}{2} \sqrt{(\sqrt{8})^2 - (2)^2} + \frac{(\sqrt{8})^2}{2} \sin^{-1} \left(\frac{2}{\sqrt{8}} \right) - \frac{(2)^2}{2} \right] - 0$ $\therefore A = 2 + 4 \left(\frac{\pi}{4} \right) - 2$ $= \pi$ <p><u>OR</u></p> <p>Find the area of the region in the first quadrant enclosed by the X-axis the line $y = x$ and the circle $x^2 + y^2 = 8$</p> <p>$\therefore y = x$, $x^2 + y^2 = 8$</p> <p>$\therefore x^2 + x^2 = 8$</p> <p>$2x^2 = 8$</p> <p>$x^2 = 4$</p> <p>$\therefore x = \pm 2$</p> <p>\therefore In first quadrant point of intersection is $(2, 2)$</p> <p>Let $BM \perp X$ - axis \therefore Required area = $A(\text{region } OBMO) + A(\text{region } BAMB)$</p> <p>$\therefore A(\text{region } OBMO) = \int_0^2 y \, dx$</p> <p>$= \int_0^2 x \, dx$</p> <p>$= \left[\frac{x^2}{2} \right]_0^2 = 2$</p>	<p>1</p> <p>$\frac{1}{2}$</p> <p>1</p> <p>1</p> <p>1</p>



SUMMER – 17 EXAMINATION

Model Answer

Subject Code: **17301**

Q. No.	Sub Q. N.	Answer	Marking Scheme
4	c)	$A(\text{region } BAMB) = \int_2^{2\sqrt{2}} y \, dx$ $= \int_2^{2\sqrt{2}} \sqrt{8-x^2} \, dx$ $= \left[\frac{x}{2} \sqrt{(\sqrt{8})^2 - x^2} + \frac{(\sqrt{8})^2}{2} \sin^{-1} \left(\frac{x}{\sqrt{8}} \right) \right]_2^{2\sqrt{2}}$ $= \left[0 + 4 \sin^{-1}(1) \right] - \left[\frac{2}{2} \sqrt{(\sqrt{8})^2 - (2)^2} + \frac{(\sqrt{8})^2}{2} \sin^{-1} \left(\frac{2}{\sqrt{8}} \right) \right]$ $= 4 \frac{\pi}{2} - 2 - 4 \sin^{-1} \left(\frac{1}{\sqrt{2}} \right)$ $= 2\pi - 2 - 4 \left(\frac{\pi}{4} \right)$ $= \pi - 2$ <p>∴ Required area = $2 + \pi - 2$</p> $= \pi$	<p>04</p> <p>1</p> <p>1</p>
	d)	<p>Solve $y^3 \cdot \sec^2 x dx + (3y^2 \tan x - \sec^2 y) dy = 0$</p> <p>Ans $y^3 \cdot \sec^2 x dx + (3y^2 \tan x - \sec^2 y) dy = 0$</p> <p>Comparing with $\int M dx + \int N dy = c$</p> <p>$M = y^3 \cdot \sec^2 x$ $N = 3y^2 \tan x - \sec^2 y$</p> <p>$\frac{\partial M}{\partial y} = 3y^2 \sec^2 x$ $\frac{\partial N}{\partial x} = 3y^2 \sec^2 x$</p> <p>∴ $\frac{\partial M}{\partial y} = \frac{\partial N}{\partial x}$</p> <p>D.E. is exact</p> <p>∴ Solution is</p> <p>$\int y^3 \cdot \sec^2 x dx + \int -\sec^2 y dy = c$</p> <p>$y^3 \tan x - \tan y = c$</p>	<p>1</p> <p>1</p> <p>1</p> <p>1</p>



SUMMER – 17 EXAMINATION

Model Answer

Subject Code: **17301**

Q. No.	Sub Q. N.	Answer	Marking Scheme
4	Ans	<p>Consider $y = e^{m \sin^{-1} x}$</p> $\frac{dy}{dx} = e^{m \sin^{-1} x} \cdot m \frac{1}{\sqrt{1-x^2}}$ $\frac{dy}{dx} = \frac{my}{\sqrt{1-x^2}}$ $\sqrt{1-x^2} \frac{dy}{dx} = my$ <p>Squaring,</p> $\therefore (1-x^2) \left(\frac{dy}{dx} \right)^2 = m^2 y^2$ $\therefore (1-x^2) 2 \frac{dy}{dx} \frac{d^2 y}{dx^2} + \left(\frac{dy}{dx} \right)^2 (-2x) = m^2 \left(2y \frac{dy}{dx} \right)$ $\therefore 2 \frac{dy}{dx} \left((1-x^2) \frac{d^2 y}{dx^2} - 2x \frac{dy}{dx} \right) = 2m^2 y \frac{dy}{dx}$ $\therefore (1-x^2) \frac{d^2 y}{dx^2} - x \frac{dy}{dx} = m^2 y$ $\therefore (1-x^2) \frac{d^2 y}{dx^2} - x \frac{dy}{dx} - m^2 y = 0$ <p>OR</p> $(1-x^2) \frac{d^2 y}{dx^2} - x \frac{dy}{dx} - m^2 y = 0$ <p>Consider $y = e^{m \sin^{-1} x}$</p> $\therefore \frac{dy}{dx} = e^{m \sin^{-1} x} \cdot m \frac{1}{\sqrt{1-x^2}}$ $\therefore \frac{dy}{dx} = \frac{my}{\sqrt{1-x^2}}$ $\therefore \sqrt{1-x^2} \frac{dy}{dx} = my$ $\therefore \sqrt{1-x^2} \frac{d^2 y}{dx^2} + \frac{dy}{dx} \frac{1}{2\sqrt{1-x^2}} (-2x) = m \frac{dy}{dx}$ $\therefore \left(\sqrt{1-x^2} \right)^2 \frac{d^2 y}{dx^2} - x \frac{dy}{dx} = m \sqrt{1-x^2} \frac{dy}{dx}$ $\therefore (1-x^2) \frac{d^2 y}{dx^2} - x \frac{dy}{dx} = m(my)$	<p>½</p> <p>½</p> <p>1</p> <p>1</p> <p>1</p> <p>½</p> <p>½</p> <p>1</p> <p>1</p> <p>½</p>



SUMMER – 17 EXAMINATION

Model Answer

Subject Code: **17301**

Q. No.	Sub Q. N.	Answer	Marking Scheme
4		$\therefore (1-x^2) \frac{d^2 y}{dx^2} - x \frac{dy}{dx} = m^2 y$ $\therefore (1-x^2) \frac{d^2 y}{dx^2} - x \frac{dy}{dx} - m^2 y = 0$	1
5		<p>Attempt any <u>FOUR</u> of the following:</p> <p>a) A Card is drawn at random from a well shuffled pack of 52 playing cards.</p> <p>A=event that the card drawn is not a spade. B=event that the card drawn is king. Verify that events A and B are independent.</p> <p>Ans $n(s) = {}^{52}C_1 = 52$</p> <p>$n(A) = {}^{39}C_1 = 39$</p> <p>$n(B) = {}^4C_1 = 4$</p> <p>$p(A) = \frac{n(A)}{n(s)} = \frac{39}{52} = \frac{3}{4}$</p> <p>$p(B) = \frac{n(B)}{n(s)} = \frac{4}{52} = \frac{1}{13}$</p> <p>Consider $p(A) \times p(B) = \frac{3}{4} \times \frac{1}{13} = \frac{3}{52}$</p> <p>$A \cap B$ = Event that the card drawn is a king of heart or of diamond or of club</p> <p>$n(A \cap B) = {}^3C_1 = 3$</p> <p>$p(A \cap B) = \frac{n(A \cap B)}{n(s)} = \frac{3}{52}$</p> <p>$\therefore p(A \cap B) = p(A) \times p(B)$</p> <p>$\therefore$ A and B Independent events.</p>	16
		<p>b) Assuming that the probability of a fatal accident during the year is $\frac{1}{1200}$.</p> <p>Calculate the probability that in a factory employing 300 workers there will be at least two fatal accidents in a year. $[e^{-0.25} = 0.7788]$</p> <p>Ans Given $n = 300, p = \frac{1}{1200}$</p> <p>$m = np = \frac{300}{1200} = 0.25$</p> <p>$p(\text{at least two fatal accidents}) = 1 - [p(0) + p(1)]$</p>	04
			1
			1



SUMMER – 17 EXAMINATION

Model Answer

Subject Code: **17301**

Q. No.	Sub Q. N.	Answer	Marking Scheme
5	b)	$p(\text{at least two fatal accidents}) = 1 - \left[\frac{e^{-0.25} (.025)^0}{0!} + \frac{e^{-0.25} (.025)^1}{1!} \right]$ $= 1 - [0.7788 + 0.7788 \times 0.25]$ $= 0.0265$	1 1
	c)	<p>In certain examination 500 students appeared. Mean score is 68 with S.D 8. Find the number of students scoring</p> <p>i) less than 50 ii) more than 60</p>	04
	Ans	<p>Given $\bar{x} = 68$, $\sigma = 8$</p> <p>i) when $x = 50$</p> $z = \frac{x - \bar{x}}{\sigma} = \frac{50 - 68}{8}$ $= -2.25$ <p>ii) when $x = 60$</p> $z = \frac{x - \bar{x}}{\sigma} = \frac{60 - 68}{8}$ $= -1$ <p><u>NOTE</u> : As the areas for the above problem are not given, the students cannot solve the problem completely. If students attempted to solve the problem and calculated upto value z. Full marks to be rewarded.</p>	2 2
	d)	<p>Evaluate $\int \frac{1}{4 + 5 \sin(2x)} dx$</p>	04
Ans	$\int \frac{1}{4 + 5 \sin(2x)} dx$ <p>Put $\tan x = t$, $dx = \frac{dt}{1+t^2}$, $\sin 2x = \frac{2t}{1+t^2}$</p> $= \int \frac{\frac{dt}{1+t^2}}{4 + 5 \left(\frac{2t}{1+t^2} \right)}$	1	



SUMMER – 17 EXAMINATION

Model Answer

Subject Code: **17301**

Q. No.	Sub Q. N.	Answer	Marking Scheme
5	d)	$= \int \frac{dt}{4+4t^2+10t}$ $= \int \frac{dt}{4t^2+10t+4}$ $= \int \frac{dt}{4t^2+10t+\frac{100}{16}-\frac{100}{16}+4}$ $= \int \frac{dt}{\left(2t+\frac{5}{2}\right)^2-\left(\frac{3}{2}\right)^2}$ $= \frac{1}{2 \times \frac{3}{2}} \log \left \frac{2t+\frac{5}{2}-\frac{3}{2}}{2t+\frac{5}{2}+\frac{3}{2}} \right \times \frac{1}{2} + c$ $= \frac{1}{6} \log \left \frac{2t+1}{2t+4} \right + c$ $= \frac{1}{6} \log \left \frac{2 \tan x + 1}{2 \tan x + 4} \right + c$ <p>OR</p> $\int \frac{1}{4+5 \sin(2x)} dx$ <p>Put $\tan x = t$, $dx = \frac{dt}{1+t^2}$, $\sin 2x = \frac{2t}{1+t^2}$</p> $= \int \frac{dt}{4+5\left(\frac{2t}{1+t^2}\right)}$ $= \int \frac{dt}{4+4t^2+10t}$ $\int \frac{dt}{4t^2+10t+4}$ $= \frac{1}{4} \int \frac{dt}{t^2+\frac{5}{2}t+1}$ $= \frac{1}{4} \int \frac{dt}{t^2+\frac{5}{2}t+\frac{25}{16}+1-\frac{25}{16}}$	<p>½</p> <p>½</p> <p>1</p> <p>½</p> <p>½</p> <p>1</p> <p>½</p>



SUMMER – 17 EXAMINATION

Model Answer

Subject Code: **17301**

Q. No.	Sub Q. N.	Answer	Marking Scheme
5		<p>∴ solution is</p> $\int_{y-\text{constant}} Mdx + \int_{\text{terms free from } x} Ndy = c$ $\int_{y-\text{constant}} (2x + e^x \log y) dx + \int 1dy = c$ $\therefore \frac{2x^2}{2} + e^x \log y + y = c$ $\therefore x^2 + e^x \log y + y = c$	1 1
6		<p>Attempt any <u>FOUR</u> of the following:</p> <p>a) A Husband and wife appeared in an interview for two vacancies in an office The Probability of husband's selection is $\frac{1}{7}$ and that of wife's selection is $\frac{1}{5}$ Find the probability that i) both of them are selected. ii) only one of them is selected.</p> <p>Ans Given $p(H) = \frac{1}{7}$ $p(W) = \frac{1}{5}$</p> $p(H') = 1 - p(H) = \frac{6}{7} \text{ and } p(W') = 1 - p(W) = \frac{4}{5}$ $i) p(H \cap W) = p(H) p(W) = \frac{1}{7} \times \frac{1}{5} = \frac{1}{35}$ $ii) p(H \cap W') + p(H' \cap W) = p(H) \times p(W') + p(H') \times p(W)$ $= \frac{1}{7} \times \frac{4}{5} + \frac{6}{7} \times \frac{1}{5}$ $= \frac{2}{7}$	16 04 1 1 1 1
		<p>b) A company manufactures electric motors. The probability that an electric motor is defective is 0.01. What is the probability that a sample of 300 electric motors will contain exactly 5 defective motors? ($e^{-3} = 0.0498$)</p> <p>Ans Given $n = 300, p = 0.01$ $m = np = 300 \times 0.01 = 3$</p> $P(5) = \frac{e^{-3} 3^5}{5!}$ $= 0.1008$	04 1 2 1



SUMMER – 17 EXAMINATION

Model Answer

Subject Code: **17301**

Q. No.	Sub Q. N.	Answer	Marking Scheme
6	c)	In a test of 2000 electric bulbs it was found that the life of particular make was normally distributed with average life of 2040 hrs. and S.D. of 60 hrs. Estimate the number of bulbs likely to burn for (i) between 1920hrs. and 2160 hrs. (ii) more than 2150 hrs.	04
	Ans	<p>Given that $A(2) = 0.4772$ $A(1.83) = 0.4664$ $\bar{x} = 2040, \sigma = 60$</p> <p>i) $x = 1920, \quad x = 2160$ $z = \frac{x - \bar{x}}{\sigma} = \frac{1920 - 2040}{60} = -2$ $z = \frac{x - \bar{x}}{\sigma} = \frac{2160 - 2040}{60} = 2$ $P(\text{Between } 1920 \text{ hrs. and } 2160 \text{ hrs.}) = A(-2) + A(2) = 0.4772 + 0.4772 = 0.9544$ <p>Number of bulbs having life between 1920 hrs. and 2160 hrs. $= 0.9544 \times 2000$ $= 1908.8 \approx 1909$</p> <p>ii) $x = 2150$ $z = \frac{x - \bar{x}}{S.D} = \frac{2150 - 2040}{60} = 1.83$ $P(\text{More than } 2150 \text{ hrs.}) = 0.5 - A(1.83)$ $= 0.5 - 0.4664$ $= 0.0336$ <p>Number of bulbs having life more than 2150 hrs. $= 0.0336 \times 2000 = 67.2 \approx 67$</p> </p></p>	
	d)	Find the maximum and minimum values of $2x^3 - 3x^2 - 36x + 10$	04
	Ans	$y = 2x^3 - 3x^2 - 36x + 10$ $\frac{dy}{dx} = 6x^2 - 6x - 36$ $\frac{d^2y}{dx^2} = 12x - 6$ $\frac{dy}{dx} = 0$	<p>$\frac{1}{2}$</p> <p>$\frac{1}{2}$</p>



SUMMER – 17 EXAMINATION

Model Answer

Subject Code: **17301**

Q. No.	Sub Q. N.	Answer	Marking Scheme
6	d)	$6x^2 - 6x - 36 = 0$ or $x^2 - x - 6 = 0$ $x = 3$ or $x = -2$ for $x = 3$ $\frac{d^2y}{dx^2} = 12(3) - 6 = 30$ $\therefore y$ is minimum at $x = 3$ $y_{\min} = 2(3)^3 - 3(3)^2 - 36(3) + 10 = -71$ for $x = -2$ $\frac{d^2y}{dx^2} = 12(-2) - 6 = -30$ $\therefore y$ is maximum at $x = -2$ $y_{\max} = 2(-2)^3 - 3(-2)^2 - 36(-2) + 10 = 54$	<p>1</p> <p>$\frac{1}{2}$</p> <p>$\frac{1}{2}$</p> <p>$\frac{1}{2}$</p> <p>$\frac{1}{2}$</p>
	e)	Find the equation of the tangent and the normal to the curve $2x^2 - xy + 3y^2 = 18$ at $(3,1)$	04
	Ans	$2x^2 - xy + 3y^2 = 18$ at $(3,1)$ $\therefore 4x - \left[x \frac{dy}{dx} + y \right] + 6y \frac{dy}{dx} = 0$ $4x - x \frac{dy}{dx} - y + 6y \frac{dy}{dx} = 0$ $\frac{dy}{dx} = \frac{y-4x}{6y-x}$ at $(3,1)$ $\frac{dy}{dx} = \frac{1-4(3)}{6(1)-3} = -\frac{11}{3}$ \therefore slope of tangent $= -\frac{11}{3}$ Equation of tangent is $y-1 = -\frac{11}{3}(x-3)$ $3y-3 = -11x+33$ $11x+3y-36=0$ \therefore slope of normal $= \frac{-1}{\frac{dy}{dx}} = \frac{3}{11}$ Equation of normal is	<p>1</p> <p>$\frac{1}{2}$</p> <p>1</p> <p>$\frac{1}{2}$</p>

