Que. No.	Sub. Que.	Model answers	Marks	Total Marks

Important Instructions to the 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 the candidate and those in the 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 the model answer.
6) In case of some questions credit may be given by judgment 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.

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1)		**Attempt any TEN of the following:**		
	a)	Find the point on the curve $y=3x-x^2$ at which slope is -5.		
	Ans.	$y = 3x-x^2$		
		$\therefore \frac{dy}{dx}=3-2x$	½	
		But given that, slope $m=-5$		
		$\therefore 3-2x=-5$		
		$\therefore -2x=-5-3=-8$		
		$\therefore x=4$	½	
		$\therefore y=3(4)-(4)^2=-4$	½	
		$\therefore$ the point is $(4,-4)$	½	**2**
	b)	Find the radius of curvature of the curve $y=\log(\sin x)$ at $x=\frac{\pi}{2}$.		
	Ans.	$y=\log(\sin x)$		
		$\therefore \frac{dy}{dx}=\frac{1}{\sin x}\cdot\cos x=\cot x$		
		& $\frac{d^2y}{dx^2}=-\operatorname{cosec}^2 x$		
		$\therefore at\ x=\frac{\pi}{2}$,		
		$\frac{dy}{dx}=\cot\left(\frac{\pi}{2}\right)=0$	½	
		$and\ \frac{d^2y}{dx^2}=-\operatorname{cosec}^2\left(\frac{\pi}{2}\right)=-1$	½	
		$\therefore \rho=\frac{\left[1+\left(\frac{dy}{dx}\right)^2\right]^{\frac{3}{2}}}{\frac{d^2y}{dx^2}}=\frac{\left[1+(0)^2\right]^{\frac{3}{2}}}{-1}=-1$	1	**2**
	c)	Integrate w. r. t. x of $\int\sqrt{1+\cos 2x}dx$		
	Ans.	$\int\sqrt{1+\cos 2x}dx=\int\sqrt{2\cos^2 x}dx$	½	
		$=\sqrt{2}\int\cos x dx$	½	
		$=\sqrt{2}\sin x+c$	1	
		Note: In the solution of **any integration problems**, if the constant c is not added, ½ mark may be deducted.		**2**

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1)	d)	Evaluate $\int \frac{\cos(\log x)}{x} dx$		
	Ans.	$\int \frac{\cos(\log x)}{x} dx$ Put $\log x = t$, $\therefore \frac{1}{x} dx = dt$	½	
		$= \int \cos t dt$	½	
		$= \sin t + c$	½	
		$= \sin(\log x) + c$	½	**2**
		OR		
		$I = \int \frac{\cos(\log x)}{x} dx$		
		Put $\log x = t$		
		$\therefore \frac{1}{x} dx = dt$	½	
		$\therefore I = \int \cos t dt$	½	
		$= \sin t + c$	½	
		$= \sin(\log x) + c$	½	**2**
	e)	Evaluate $\int \frac{dx}{x(x+1)}$		
	Ans.	$\frac{1}{x(x+1)} = \frac{A}{x} + \frac{B}{x+1}$		
		$\therefore \boxed{1 = (x+1)A + xB}$		
		Put $x = 0$		
		$\therefore 1 = (0+1)A + 0$		
		$\therefore \boxed{1 = A}$	½	
		Put $x+1=0$ $\therefore x = -1$,		
		$\therefore 1 = 0 + (-1)B$		
		$\therefore \boxed{-1 = B}$	½	
		$\therefore \frac{1}{x(x+1)} = \frac{1}{x} + \frac{-1}{x+1}$		
		$\int \frac{dx}{x(x+1)} = \int \left[\frac{1}{x} + \frac{-1}{x+1}\right] dx$		
		$= \log x - \log(x+1) + c$	½ + ½	**2**
		OR		

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1)		$\frac{1}{x(x+1)}=\frac{A}{x}+\frac{B}{x+1}$		
		$\therefore \boxed{1=(x+1)A+xB}$		
		$For\ x=0$		
		$A=\frac{1}{x+1}=\frac{1}{0+1}=1$	½	
		$For\ x+1=0 \quad \therefore x=-1,$		
		$B=\frac{1}{x}=\frac{1}{-1}=-1$	½	
		$\therefore \frac{1}{x(x+1)}=\frac{1}{x}+\frac{-1}{x+1}$		
		$\int\frac{dx}{x(x+1)}=\int\left[\frac{1}{x}+\frac{-1}{x+1}\right]dx$		2
		$=\log x-\log(x+1)+c$	½ + ½	
	f)	Evaluate $\int\tan^{-1}xdx$		
	Ans.	$\int\tan^{-1}xdx=\int 1\cdot\tan^{-1}xdx$		
		$=\tan^{-1}x\int 1dx-\int\left(\int 1dx\right)\frac{d}{dx}\left(\tan^{-1}x\right)dx$	½	
		$=x\tan^{-1}x-\int x\cdot\frac{1}{x^2+1}\cdot dx$	½	
		$=x\tan^{-1}x-\frac{1}{2}\int\frac{2x}{x^2+1}\cdot dx$	½	
		$=x\tan^{-1}x-\frac{1}{2}\log\left(x^2+1\right)+c$	½	2
	g)	Evaluate $\int_1^2\frac{1}{3x-2}dx$		
	Ans.	$\int_1^2\frac{1}{3x-2}dx=\left[\frac{\log(3x-2)}{3}\right]_1^2$	1	
		$=\frac{\log[3(2)-2]}{3}-\frac{\log[3(1)-2]}{3}$		
		$=\frac{\log 4}{3}-\frac{\log 1}{3}$	½	
		$=\frac{1}{3}\log 4$	½	2

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1)	h)	Find the area contained by the curve $y=1+x^3+2\sin x$ from $x=0$ to $x=\pi$.		
		$A=\int_a^b y\,dx$		
		$=\int_0^{\pi}\left(1+x^3+2\sin x\right)dx$	½	
		$=\left[x+\frac{x^4}{4}-2\cos x\right]_0^{\pi}$	½	
		$=\left[\pi+\frac{\pi^4}{4}-2\cos\pi\right]-\left[0+0-2\cos 0\right]$	½	
		$=\pi+\frac{\pi^4}{4}+4 \quad or \quad 31.494$	½	**2**
	i)	Find the order and degree of the D. E. $\frac{d^2y}{dx^2}=\sqrt{y-\frac{dy}{dx}}$.		
	Ans.	Order = 2.	1	
		$\frac{d^2y}{dx^2}=\sqrt{y-\frac{dy}{dx}}$		
		$\therefore\left(\frac{d^2y}{dx^2}\right)^2=y-\frac{dy}{dx}$	½	
		Degree = 2	½	**2**
	j) Ans.	Form a differential equation if $y=A\sin x+B\cos x$.		
		$y=A\sin x+B\cos x$		
		$\therefore\frac{dy}{dx}=A\cos x-B\sin x$	½	
		$\therefore\frac{d^2y}{dx^2}=-A\sin x-B\cos x$	½	
		$=-\left(A\sin x+B\cos x\right)$		
		$=-y$	½	
		$\therefore\frac{d^2y}{dx^2}+y=0$	½	**2**
	k)	From a pack of 52 cards one is drawn at random. Find the probability of getting a king.		
	Ans.	$p=\frac{m}{n}=\frac{4}{52}$	1½	
		$=\frac{1}{13} \quad or \quad 0.0769$	½	**2**
		OR		

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1)		$n = n(S) = 52$ OR $n = n(S) = {}^{52}C_1$	½	
		$m = n(A) = 4$ OR $m = n(A) = {}^{4}C_1$	½	
		$\therefore p = \frac{m}{n} = \frac{4}{52}$ OR $\therefore p = \frac{m}{n} = \frac{{}^{4}C_1}{{}^{52}C_1}$	½	
		$= \frac{1}{13}$ *or* 0.0769 OR $= \frac{1}{13}$ *or* 0.0769	½	**2**
	l)	An unbiased coin is tossed 5 times. Find the probability of getting 3 heads.		
	Ans.	$p = \frac{1}{2} = 0.5$	½	
		$\therefore q = 1 - p = \frac{1}{2} = 0.5$		
		Here $n = 5$		
		$p = {}^{n}C_r p^r q^{n-r}$		
		$= {}^{5}C_3 \left(\frac{1}{2}\right)^3 \left(\frac{1}{2}\right)^2$	1	
		$= \frac{5}{16}$ *or* 0.3125	½	**2**
2)		**Attempt any FOUR of the following:**		
	a)	Find the equation of the tangent and normal to the curve $13x^3 + 2x^2y + y^3 = 1$ at $(1, -2)$.		
	Ans.	$13x^3 + 2x^2y + y^3 = 1$		
		$\therefore 39x^2 + 2\left(x^2\frac{dy}{dx} + y \cdot 2x\right) + 3y^2\frac{dy}{dx} = 0$	½	
		$\therefore 39x^2 + 2x^2\frac{dy}{dx} + 4xy + 3y^2\frac{dy}{dx} = 0$		
		$\therefore (2x^2 + 3y^2)\frac{dy}{dx} = -39x^2 - 4xy$		
		$\therefore \frac{dy}{dx} = \frac{-39x^2 - 4xy}{2x^2 + 3y^2}$	½	
		$\therefore$ the slope of tangent at $(1, -2)$ is		
		$m = \frac{dy}{dx} = \frac{-39(1)^2 - 4(1)(-2)}{2(1)^2 + 3(-2)^2} = -\frac{31}{14}$	½	

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2)		$\therefore$ the equation of tangent is		
		$y+2=-\frac{31}{14}(x-1)$	½	
		$\therefore 14y+28=-31x+31$		
		$\therefore \boxed{31x+14y-3=0}$ *or* $\boxed{31x+14y=3}$	½	
		$\therefore$ the slope of normal $=-\frac{1}{m}=\frac{14}{31}$	½	
		$\therefore$ the equation of tangent is		
		$y+2=\frac{14}{31}(x-1)$	½	
		$\therefore 31y+62=14x-14$		
		$\therefore \boxed{14x-31y-76=0}$ *or* $\boxed{-14x+31y+76=0}$	½	**4**
	b)	A beam is bent in the form of the curve $y=2\sin x-\sin 2x$. Find the radius of curvature of the beam at this point at $x=\frac{\pi}{2}$.		
	Ans.	$y=2\sin x-\sin 2x$		
		$\therefore \frac{dy}{dx}=2\cos x-2\cos 2x$	½	
		& $\frac{d^2y}{dx^2}=-2\sin x+4\sin 2x$	½	
		$\therefore at\ x=\frac{\pi}{2}$,		
		$\frac{dy}{dx}=2\cos\left(\frac{\pi}{2}\right)-2\cos 2\left(\frac{\pi}{2}\right)=2$	1	
		and $\frac{d^2y}{dx^2}=-2\sin\left(\frac{\pi}{2}\right)+4\sin 2\left(\frac{\pi}{2}\right)=-2$	1	
		$\therefore \rho=\frac{\left[1+\left(\frac{dy}{dx}\right)^2\right]^{\frac{3}{2}}}{\frac{d^2y}{dx^2}}=\frac{\left[1+(2)^2\right]^{\frac{3}{2}}}{-2}=-\frac{5^{3/2}}{2}$ *or* $-\frac{5\sqrt{5}}{2}$ *or* -5.590	1	**4**
	c)	Find the maximum and minimum values of x^3-18x^2+96x.		
		Let $y=x^3-18x^2+96x$		
		$\therefore \frac{dy}{dx}=3x^2-36x+96$	½	
		$\therefore \frac{d^2y}{dx^2}=6x-36$	½	

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2)		$For\ stationary\ values,\ \frac{dy}{dx}=0$		
		$\therefore 3x^2-36x+96=0$		
		$\therefore x=4,\ 8$	1	
		$At\ x=4,\ \frac{d^2y}{dx^2}=6(4)-36=-12<0$	½	
		$\therefore At\ x=4,\ y\ has\ \max imum\ value\ and\ it\ is$		
		$y=(4)^3-18(4)^2+96(4)=160$	½	
		$At\ x=8,\ \frac{d^2y}{dx^2}=6(8)-36=12>0$	½	
		$\therefore At\ x=8,\ y\ has \min imum\ value\ and\ it\ is$		
		$y=(8)^3-18(8)^2+96(8)=128$	½	**4**
	d)	Evaluate $\int\frac{1-\tan x}{1+\tan x}dx$		
	Ans.	$\int\frac{1-\tan x}{1+\tan x}dx=\int\tan\left(\frac{\pi}{4}-x\right)dx$	2	
		$=-\log\sec\left(\frac{\pi}{4}-x\right)+c$	2	**4**
		OR		
		$\int\frac{1-\tan x}{1+\tan x}dx=\int\frac{1-\frac{\sin x}{\cos x}}{1+\frac{\sin x}{\cos x}}dx$		
		$=\int\frac{\cos x-\sin x}{\cos x+\sin x}dx$	2	
		$=\log(\cos x+\sin x)+c$	2	**4**
		OR		
		$\int\frac{1-\tan x}{1+\tan x}dx=\int\frac{1-\frac{\sin x}{\cos x}}{1+\frac{\sin x}{\cos x}}dx$		
		$=\int\frac{\cos x-\sin x}{\cos x+\sin x}dx$ $Put\ \cos x+\sin x=t$, $\therefore(-\sin x+\cos x)dx=dt$	1+1	
		$=\int\frac{1}{t}dx$	½	
		$=\log t+c$	1	
		$=\log(\cos x+\sin x)+c$	½	**4**

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2)	e)	Evaluate $\int \sin^3 x dx$		
	Ans.	$\int \sin^3 x dx = \int \frac{1}{4}(3\sin x - \sin 3x)dx$	2	
		$= \frac{1}{4}\left(-3\cos x + \frac{\cos 3x}{3}\right) + c$	2	**4**
		OR		
		$\int \sin^3 x dx = \int \sin^2 x \cdot \sin x dx$		
		$= \int (1-\cos^2 x)\sin x dx$ Put $\cos x = t$, $\therefore -\sin x dx = dt$	1	
		$= -\int (1-t^2) dt$	1	
		$= -\left(t - \frac{t^3}{3}\right) + c$	1	
		$= -\left(\cos x - \frac{\cos^3 x}{3}\right) + c$	1	**4**
		--		
	f)	Evaluate $\int \frac{x+1}{x(x^2-4)} dx$		
	Ans.	$I = \int \frac{x+1}{x(x^2-4)} dx = \int \frac{x+1}{x(x-2)(x+2)} dx$		
		$\frac{x+1}{x(x-2)(x+2)} = \frac{A}{x} + \frac{B}{x-2} + \frac{C}{x+2}$		
		For $x = 0$		
		$A = \frac{x+1}{(x-2)(x+2)} = \frac{0+1}{(0-2)(0+2)} = \boxed{-\frac{1}{4}}$	1	
		For $x - 2 = 0$ $\therefore x = 2,$		
		$B = \frac{x+1}{x(x+2)} = \frac{2+1}{2(2+2)} = \boxed{\frac{3}{8}}$	1	
		For $x + 2 = 0$ $\therefore x = -2,$		
		$C = \frac{x+1}{x(x-2)} = \frac{-2+1}{-2(-2+2)} = \boxed{-\frac{1}{8}}$	1	
		$\therefore \frac{x+1}{x(x-2)(x+2)} = \frac{-1/4}{x} + \frac{3/8}{x-2} + \frac{-1/8}{x+2}$		
		$I = \int \left[\frac{-1/4}{x} + \frac{3/8}{x-2} + \frac{-1/8}{x+2}\right] dx$		
		$= -\frac{1}{4}\log x + \frac{3}{8}\log(x-2) - \frac{1}{8}\log(x+2) + c$	1	**4**
		OR		

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2)		**OR**		
		$I=\int\frac{x+1}{x\left(x^2-4\right)}dx=\int\frac{x+1}{x(x-2)(x+2)}dx$		
		$\frac{x+1}{x(x-2)(x+2)}=\frac{A}{x}+\frac{B}{x-2}+\frac{C}{x+2}$		
		$\therefore \boxed{x+1=(x-2)(x+2)A+x(x+2)B+x(x-2)C}$		
		$Put\ x=0$		
		$\therefore 0+1=(0-2)(0+2)A+0+0$		
		$\therefore \boxed{-\frac{1}{4}=A}$	1	
		$Put\ x-2=0 \quad \therefore x=2,$		
		$\therefore 2+1=0+2(2+2)B+0$		
		$\therefore \boxed{\frac{3}{8}=B}$	1	
		$Put\ x+2=0 \quad \therefore x=-2,$		
		$\therefore -2+1=0+0-2(-2-2)C$	1	
		$\therefore \boxed{-\frac{1}{8}=C}$		
		$\therefore \frac{x+1}{x(x-2)(x+2)}=\frac{-1/4}{x}+\frac{3/8}{x-2}+\frac{-1/8}{x+2}$		
		$I=\int\left[\frac{-1/4}{x}+\frac{3/8}{x-2}+\frac{-1/8}{x+2}\right]dx$		
		$=-\frac{1}{4}\log x+\frac{3}{8}\log(x-2)-\frac{1}{8}\log(x+2)+c$	1	**4**
		--		
3)		**Attempt any FOUR of the following.**		
	a)	Evaluate $\int_0^4\frac{dx}{\sqrt{4x-x^2}}$		
	Ans.	$4x-x^2=4-4+4x-x^2=4-(x-2)^2$		
		$=2^2-(x-2)^2$	1	
		$\int_0^4\frac{dx}{\sqrt{4x-x^2}}=\int_0^4\frac{dx}{\sqrt{2^2-(x-2)^2}}$		
		$=\left[\sin^{-1}\left(\frac{x-2}{2}\right)\right]_0^4$	1	
		$=\sin^{-1}\left(\frac{4-2}{2}\right)-\sin^{-1}\left(\frac{0-2}{2}\right)$		
		$=\sin^{-1}(1)-\sin^{-1}(-1)$	1	
		$=\frac{\pi}{2}+\frac{\pi}{2}=\pi$	1	**4**

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3)		**OR**		
		$\int_0^4 \frac{dx}{\sqrt{4x-x^2}} = \int_0^4 \frac{dx}{\sqrt{4-4+4x-x^2}}$		
		$= \int_0^4 \frac{dx}{\sqrt{4-(x-2)^2}}$		
		$= \int_0^4 \frac{dx}{\sqrt{2^2-(x-2)^2}}$	1	
		$= \left[\sin^{-1}\left(\frac{x-2}{2}\right)\right]_0^4$	1	
		$= \sin^{-1}\left(\frac{4-2}{2}\right) - \sin^{-1}\left(\frac{0-2}{2}\right)$		
		$= \sin^{-1}(1) - \sin^{-1}(-1)$	1	
		$= \frac{\pi}{2} + \frac{\pi}{2} = \pi$	1	**4**
		--		
	b)	Evaluate $\int_0^5 \frac{\sqrt{9-x}}{\sqrt{9-x}+\sqrt{x+4}} dx$		
		$I = \int_0^5 \frac{\sqrt{9-x}}{\sqrt{9-x}+\sqrt{x+4}} dx$ Replace $x \to 5-x$; $\therefore 9-x \to x+4$ & $x+4 \to 9-x$	1	
		$\therefore I = \int_0^5 \frac{\sqrt{x+4}}{\sqrt{x+4}+\sqrt{9-x}} dx$		
		$\therefore 2I = \int_0^5 \frac{\sqrt{9-x}+\sqrt{x+4}}{\sqrt{9-x}+\sqrt{x+4}} dx$	1	
		$\therefore 2I = \int_0^5 1 \cdot dx$	½	
		$\therefore 2I = [x]_0^5$	½	
		$\therefore 2I = 5-0$	½	
		$\therefore I = \frac{5}{2}$	½	**4**
		OR		
		$I = \int_0^5 \frac{\sqrt{9-x}}{\sqrt{9-x}+\sqrt{x+4}} dx$		
		$= \int_0^5 \frac{\sqrt{9-(5-x)}}{\sqrt{9-(5-x)}+\sqrt{5-x+4}} dx$	½	

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3)		$\therefore I=\int_0^5 \frac{\sqrt{x+4}}{\sqrt{x+4}+\sqrt{9-x}}dx$	½	
		$\therefore 2I=\int_0^5 \frac{\sqrt{9-x}+\sqrt{x+4}}{\sqrt{9-x}+\sqrt{x+4}}dx$	1	**4**
		$\therefore 2I=\int_0^5 1\cdot dx$	½	
		$\therefore 2I=\left[x\right]_0^5$	½	
		$\therefore 2I=5-0$	½	
		$\therefore I=\frac{5}{2}$	½	
		--		
	c)	Find the area of region included between the parabola $y=x^2+1$ and the line $y=2x+1$.		
	Ans.	$y=x^2+1 \quad and \quad y=2x+1$		
		$\therefore x^2+1=2x+1 \quad or \quad x^2-2x=0$		
		$\therefore x(x-2)=0$		
		$\therefore x=0,\ 2$	1	
		$\therefore A=\int_0^a (y_2-y_1)dx$		**4**
		$=\int_0^2\left[(2x+1)-(x^2+1)\right]dx$		
		$=\int_0^2\left[2x-x^2\right]dx$	1	
		$=\left[x^2-\frac{x^3}{3}\right]_0^2$	1	
		$=\left[2^2-\frac{2^3}{3}\right]-\left[0-0\right]$	½	
		$=\frac{4}{3} \quad or \ 1.333$	½	
		OR		
		$y=x^2+1 \quad and \quad y=2x+1$		
		$\therefore x^2+1=2x+1 \quad or \quad x^2-2x=0$		
		$\therefore x(x-2)=0$		
		$\therefore x=0,\ 2$	1	
		$\therefore A=\int_0^2\left[(x^2+1)-(2x+1)\right]dx$		
		$=\int_0^2\left[x^2-2x\right]dx$	1	

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3)		$=\left[\frac{x^3}{3}-x^2\right]_0^2$	1	
		$=\left[\frac{2^3}{3}-2^2\right]-\left[0-0\right]$	½	
		$=-\frac{4}{3}\quad or\quad -1.333$		
		$\therefore A=\frac{4}{3}\quad or\quad 1.333$	½	**4**
		--		
	d)	Solve the D. E. $x\left(1+y^2\right)dx+y\left(1+x^2\right)dy=0$		
	Ans.	$\therefore \frac{x}{1+x^2}dx+\frac{y}{1+y^2}dy=0$	1	
		$\therefore \int\frac{x}{1+x^2}dx+\int\frac{y}{1+y^2}dy=c$	1	
		$\therefore \frac{1}{2}\int\frac{2x}{1+x^2}dx+\frac{1}{2}\int\frac{2y}{1+y^2}dy=c$	1	
		$\therefore \frac{1}{2}\log\left(1+x^2\right)+\frac{1}{2}\log\left(1+y^2\right)=c$	1	**4**
		OR		
		$\therefore \frac{x}{1+x^2}dx+\frac{y}{1+y^2}dy=0$	1	
		$\therefore \int\frac{x}{1+x^2}dx+\int\frac{y}{1+y^2}dy=c$	1	
		$Put\ 1+x^2=u\quad and\quad 1+y^2=v$		
		$\therefore\quad 2xdx=du\qquad 2ydy=dv$	½	
		$\therefore \frac{1}{2}\int\frac{1}{u}du+\frac{1}{2}\int\frac{1}{v}dv=c$	½	
		$\therefore \frac{1}{2}\log(u)+\frac{1}{2}\log(v)=c$	½	
		$\therefore \frac{1}{2}\log\left(1+x^2\right)+\frac{1}{2}\log\left(1+y^2\right)=c$	½	**4**
		OR		
		$M=x\left(1+y^2\right)\qquad \therefore \frac{\partial M}{\partial y}=2xy$	1	
		$N=y\left(1+x^2\right)\qquad \therefore \frac{\partial N}{\partial x}=2xy$	1	
		$\therefore the\ equation\ is\ exact.$		
		$\int\limits_{y\ constant} Mdx+\int\limits_{terms\ free\ from\ x} Ndy=c$		

Que. No.	Sub. Que.	Model answers	Marks	Total Marks
3)		$\int x\left(1+y^2\right)dx+\int ydy=c$	1	
		$\therefore \left(1+y^2\right)\cdot\frac{x^2}{2}+\frac{y^2}{2}=c$	1	4
		--		
	e)	Solve the D. E. $\left(4x+y\right)^2\frac{dy}{dx}=1$		
	Ans.	$Put\ \ 4x+y=v$		
		$\therefore 4+\frac{dy}{dx}=\frac{dv}{dx}$	½	
		$\therefore v^2\left(\frac{dv}{dx}-4\right)=1$	½	
		$\therefore \frac{dv}{dx}-4=\frac{1}{v^2}$		
		$\therefore \frac{dv}{dx}=\frac{1}{v^2}+4=\frac{1+4v^2}{v^2}$		
		$\therefore \frac{v^2}{1+4v^2}dv=dx$	½	
		$\therefore \int\frac{v^2}{1+4v^2}dv=\int dx$		
		$\therefore \frac{1}{4}\int\frac{4v^2}{1+4v^2}dv=\int dx$		
		$\therefore \frac{1}{4}\int\left[1-\frac{1}{1+4v^2}\right]dv=\int dx$	1	
		$\therefore \frac{1}{4}\left[v-\frac{1}{2}\tan^{-1}\left(2v\right)\right]=x+c$	1	
		$\therefore \frac{1}{4}\left[4x+y-\frac{1}{2}\tan^{-1}2\left(4x+y\right)\right]=x+c$	½	4
		--		
	f)	Solve the D. E. $x\left(x+y\right)dy-y^2dx=0$		
	Ans.	$x\left(x+y\right)dy-y^2dx=0$		
		$\therefore x\left(x+y\right)dy=y^2dx$		
		$\therefore \frac{dy}{dx}=\frac{y^2}{x\left(x+y\right)}=\frac{y^2}{x^2+xy}$		
		$Put\ \frac{y}{x}=v\ \ or\ \ y=vx$		
		$\therefore \frac{dy}{dx}=v+x\frac{dv}{dx}$	1	
		$\therefore v+x\frac{dv}{dx}=\frac{\left(vx\right)^2}{x^2+x.vx}$		

Que. No.	Sub. Que.	Model answers	Marks	Total Marks
3)		$\therefore v + x\dfrac{dv}{dx} = \dfrac{v^2}{1+v}$	½	
		$\therefore x\dfrac{dv}{dx} = \dfrac{v^2}{1+v} - v$		
		$\therefore x\dfrac{dv}{dx} = -\dfrac{v}{1+v}$		
		$\therefore \dfrac{1+v}{v}dv = -\dfrac{dx}{x}$	½	
		$\therefore \int \dfrac{1+v}{v}dv = -\int \dfrac{dx}{x}$		
		$\therefore \int \left[\dfrac{1}{v}+1\right]dv = -\int \dfrac{dx}{x}$	½	
		$\therefore \log v + v = -\log x + c$	1	
		$\therefore \log\left(\dfrac{y}{x}\right) + \dfrac{y}{x} = -\log x + c$	½	4
		---		
4)		**Attempt any FOUR of the following.**		
	a)	Evaluate $\int_{\pi/6}^{\pi/3} \dfrac{dx}{1+\sqrt{\cot x}}$		
		$I = \int_{\pi/6}^{\pi/3} \dfrac{dx}{1+\sqrt{\cot x}} = \int_{\pi/6}^{\pi/3} \dfrac{dx}{1+\dfrac{\sqrt{\cos x}}{\sqrt{\sin x}}}$		
		$I = \int_{\pi/6}^{\pi/3} \dfrac{\sqrt{\sin x}}{\sqrt{\sin x}+\sqrt{\cos x}}dx$ Replace $x \to \pi/2 - x$ $\therefore \sin x \to \cos x$ & $\cos x \to \sin x$	1	
		$\therefore I = \int_{\pi/6}^{\pi/3} \dfrac{\sqrt{\cos x}}{\sqrt{\cos x}+\sqrt{\sin x}}dx$		
		$\therefore 2I = \int_{\pi/6}^{\pi/3} \dfrac{\sqrt{\cos x}+\sqrt{\sin x}}{\sqrt{\cos x}+\sqrt{\sin x}}dx$	1	
		$\therefore 2I = \int_{\pi/6}^{\pi/3} 1 \cdot dx$	½	
		$\therefore 2I = [x]_{\pi/6}^{\pi/3}$	½	
		$= \dfrac{\pi}{3} - \dfrac{\pi}{6} = \dfrac{\pi}{6}$	½	
		$\therefore I = \dfrac{\pi}{12}$	½	4

Que. No.	Sub. Que.	Model answers	Marks	Total Marks
4)		**OR**		
		$I=\int_{\pi/6}^{\pi/3}\frac{dx}{1+\sqrt{\cot x}}$		
		$=\int_{\pi/6}^{\pi/3}\frac{dx}{1+\frac{\sqrt{\cos x}}{\sqrt{\sin x}}}$		
		$=\int_{\pi/6}^{\pi/3}\frac{\sqrt{\sin x}}{\sqrt{\sin x}+\sqrt{\cos x}}dx$		
		$=\int_{\pi/6}^{\pi/3}\frac{\sqrt{\sin\left(\frac{\pi}{2}-x\right)}}{\sqrt{\sin\left(\frac{\pi}{2}-x\right)}+\sqrt{\cos\left(\frac{\pi}{2}-x\right)}}dx$	½	
		$\therefore I=\int_{\pi/6}^{\pi/3}\frac{\sqrt{\cos x}}{\sqrt{\cos x}+\sqrt{\sin x}}dx$	½	
		$\therefore 2I=\int_{\pi/6}^{\pi/3}\frac{\sqrt{\cos x}+\sqrt{\sin x}}{\sqrt{\cos x}+\sqrt{\sin x}}dx$	1	
		$\therefore 2I=\int_{\pi/6}^{\pi/3}1\cdot dx$	½	
		$\therefore 2I=\left[x\right]_{\pi/6}^{\pi/3}$	½	
		$=\frac{\pi}{3}-\frac{\pi}{6}=\frac{\pi}{6}$	½	
		$\therefore I=\frac{\pi}{12}$	½	**4**
		---		
	b)	Evaluate $\int_{0}^{\pi}\frac{x\sin x}{1+\cos^2 x}dx$		
	Ans.	$I=\int_{0}^{\pi}\frac{x\sin x}{1+\cos^2 x}dx$		
		$=\int_{0}^{\pi}\frac{(\pi-x)\sin(\pi-x)}{1+\cos^2(\pi-x)}dx$	½	
		$=\int_{0}^{\pi}\frac{(\pi-x)\sin x}{1+\cos^2 x}dx$	½	
		$=\pi\int_{0}^{\pi}\frac{\sin x}{1+\cos^2 x}dx-\int_{0}^{\pi}\frac{x\sin x}{1+\cos^2 x}dx$		
		$=\pi\int_{0}^{\pi}\frac{\sin x}{1+\cos^2 x}dx-I$	½	

Que. No.	Sub. Que.	Model answers	Marks	Total Marks
4)		$\therefore 2I=\pi\int_0^{\pi}\frac{\sin x}{1+\cos^2 x}dx$ Put $\cos x=t$ $\therefore -\sin x dx=dt$ x: 0, π t: 1, -1	½	
		$\therefore 2I=-\pi\int_1^{-1}\frac{dt}{1+t^2}$	½	
		$\therefore 2I=-\pi\left[\tan^{-1}t\right]_1^{-1}$	½	
		$\therefore 2I=-\pi\left[\tan^{-1}(-1)-\tan^{-1}(1)\right]$	½	
		$\therefore 2I=\frac{\pi^2}{2}$		
		$\therefore I=\frac{\pi^2}{4}$	½	**4**
	c)	Find the area of the circle $x^2+y^2=16$ by integration.		
	Ans.	$x^2+y^2=16$ $\therefore y=\sqrt{16-x^2}$ $y=0$ gives $x^2=16$ $\therefore x=4,\ -4$	1	
		$A=4\int_0^a ydx$ $=4\int_0^4\sqrt{16-x^2}dx$ $=4\int_0^4\sqrt{4^2-x^2}dx$		
		$=4\left[\frac{x}{2}\sqrt{16-x^2}+\frac{4^2}{2}\sin^{-1}\left(\frac{x}{4}\right)\right]_0^4$	1	
		$=4\left[\frac{4}{2}\sqrt{16-4^2}+\frac{4^2}{2}\sin^{-1}(1)\right]-4\left[0+\frac{4^2}{2}\sin^{-1}0\right]$	1	
		$=4\left[0+\frac{4^2}{2}\cdot\frac{\pi}{2}\right]-4[0+0]$		
		$=16\pi$	1	**4**
		Note: The above can also be solve on the same line as follows: $A=2\int_a^b ydx=2\int_{-4}^{4}\sqrt{16-x^2}dx=16\pi$ OR $A=\int_a^b ydx=\int_{-4}^{4}\sqrt{16-x^2}dx=4\pi$ and The Area = 16π.		

Que. No.	Sub. Que.	Model answers	Marks	Total Marks
4)	d)	Solve the D. E. $\frac{dy}{dx}+y\tan x=\cos^2 x$		
	Ans.	$\frac{dy}{dx}+y\tan x=\cos^2 x$		
		$\therefore P=\tan x$ and $Q=\cos^2 x$		
		$\therefore IF=e^{\int pdx}=e^{\int \tan x dx}=e^{\log\sec x}=\sec x$	1	
		$\therefore y\cdot IF=\int Q\cdot IF\cdot dx+c$		
		$\therefore y\cdot\sec x=\int\cos^2 x\cdot\sec x\cdot dx+c$	1	
		$\therefore y\cdot\sec x=\int\cos x\cdot dx+c$	1	
		$\therefore y\cdot\sec x=\sin x+c$	1	**4**
	e)	Solve the D. E. $\left(e^x+2xy^2+y^3\right)dx+\left(a^y+2x^2y+3xy^2\right)dy=0$		
	Ans.	$M=e^x+2xy^2+y^3$		
		$\therefore\frac{\partial M}{\partial y}=4xy+3y^2$	1	
		$N=a^y+2x^2y+3xy^2$		
		$\therefore\frac{\partial N}{\partial x}=4xy+3y^2$	½	
		$\therefore$ *the equation is exact.*	½	
		$\int_{y\ \text{constant}} Mdx+\int_{\text{terms free from }x} Ndy=c$		
		$\int\left(e^x+2xy^2+y^3\right)dx+\int a^y dy=c$	1	
		$\therefore e^x+2y^2\cdot\frac{x^2}{2}+y^3x+\frac{a^y}{\log a}=c$	1	
		or $e^x+x^2y^2+xy^3+\frac{a^y}{\log a}=c$		**4**
	f)	Verify that $y=\log x$ is a solution of $x\frac{d^2y}{dx^2}+\frac{dy}{dx}=0$		
	Ans.	$y=\log x$		
		$\therefore\frac{dy}{dx}=\frac{1}{x}$	1	
		$\therefore x\frac{dy}{dx}=1$	1	
		$\therefore x\frac{d^2y}{dx^2}+\frac{dy}{dx}=0$	2	**4**

Que. No.	Sub. Que.	Model answers	Marks	Total Marks
4)		**OR**		
		$y=\log x$		
		$\therefore \dfrac{dy}{dx}=\dfrac{1}{x}$	1	
		$\therefore \dfrac{d^2y}{dx^2}=-\dfrac{1}{x^2}$	1	
		$\therefore x\dfrac{d^2y}{dx^2}+\dfrac{dy}{dx}=x\left(-\dfrac{1}{x^2}\right)+\dfrac{1}{x}$	1	
		$=-\dfrac{1}{x}+\dfrac{1}{x}=0$	1	**4**
5)		**Attempt any FOUR of the following.**		
	a)	A room has 3 electric lamps. From a collection of 15 electric bulbs of which only 10 are good, 3 are selected at random and put in the lamps. Find the probability that the room is lighted by at least one of the bulbs.		
	Ans.	$Total=10\ Good+5\ Bad=15$		
		$n={}^{15}C_3$	1	
		$p=p(\text{room is lightened by at least one bulb})$		
		$=1-p(\text{room is not lightened})$	1	
		$=1-p(\text{bad bulbs})$		
		$=1-\dfrac{{}^{5}C_3}{{}^{15}C_3}$	1	
		$=\dfrac{89}{91}\quad or\quad 0.978\qquad ...(*)$	1	**4**
		OR		
		$Total=10\ Good+5\ Bad=15$		
		$n={}^{15}C_3$	1	
		$p=p(\text{room is lightened by at least one bulb})$		
		$=p(\text{1G \& 2B or 2G \& 1B or 3G})$	1	
		$=\dfrac{{}^{10}C_1\times{}^{5}C_2+{}^{10}C_2\times{}^{5}C_1+{}^{10}C_3}{{}^{15}C_3}$	1	**4**
		$=\dfrac{89}{91}\quad or\quad 0.978\qquad ...(*)$	1	
		Note: As the use of Non-programmable Electronic Pocket Calculator is permissible, **calculating the value directly without using the actual formula of ${}^{n}C_r$ as shown in (*) is allowed** and thus no mark to be deducted.		

Que. No.	Sub. Que.	Model answers	Marks	Total Marks
5)	b)	If 20% of the bolts produced by a machine are defective. Find the probability that out of 4 bolts drawn i) One is defective. ii) At most two are defective.		
	Ans.	$p=\frac{20}{100}=0.2$	½	
		$\therefore q=0.8$		
		$Here\ \ n=4$		
		$i)\ p={}^{n}C_{r}p^{r}q^{n-r}$		
		$={}^{4}C_{1}(0.2)^{1}(0.8)^{3}$	1	
		$=0.4096$	½	
		$ii)\ p=p(0)+p(1)+p(2)$	½	
		$={}^{4}C_{0}(0.2)^{0}(0.8)^{4}+{}^{4}C_{1}(0.2)^{1}(0.8)^{3}+{}^{4}C_{2}(0.2)^{2}(0.8)^{2}$	1	
		$=0.4096+0.4096+0.1536$		
		$=0.9728$	½	
		OR		
		$p=1-p(\text{at least 3})$	½	
		$=1-\left[p(3)+p(4)\right]$	½	
		$=1-\left[{}^{4}C_{3}(0.2)^{3}(0.8)^{1}+{}^{4}C_{4}(0.2)^{4}(0.8)^{0}\right]$	½	
		$=0.9728$	½	**4**
	c)	A box contains 10 red, 5 white, 5 black balls. Two balls are drawn at random. Find the probability that they are not of the same colour.		
	Ans.	$Total\ Balls=10+5+5=20$		
		$n=n(S)={}^{20}C_{2}=190$	1	
		$m=n(\text{not of same colour})$		
		$=n(\text{1R1W or 1W1B or 1R1B})$		
		$=10\times5+5\times5+10\times5$	1	
		$=125$	1	
		$\therefore p=\frac{m}{n}=\frac{125}{190}\ \ or\ \ 0.659$	1	**4**
		OR		

Que. No.	Sub. Que.	Model answers	Marks	Total Marks
5)		$Total\ Balls = 10+5+5=20$		
		$n = n(S) = {}^{20}C_2 = 190 \quad ...(*)$	1	
		$p = p(\text{not of same colour})$		
		$= p(\text{1R1W or 1W1B or 1R1B})$	1	
		$= \dfrac{{}^{10}C_1 \times {}^5C_1 + {}^5C_1 \times {}^5C_1 + {}^{10}C_1 \times {}^5C_1}{{}^{20}C_2} \quad ...(**)$	1	
		$= \dfrac{25}{38} \quad or \quad 0.659$	1	**4**
		Note: If the step (*) is not written and directly the step (**) is written, full marks to be given.		
		--		
	d)	Evaluate $\displaystyle\int \frac{dx}{4-5\cos x}$		
		$Put\ \tan\frac{x}{2} = t$		
		$\therefore dx = \dfrac{2dt}{1+t^2}, \quad \cos x = \dfrac{1-t^2}{1+t^2}$	1	
		$\displaystyle\int \frac{dx}{4-5\cos x} = \int \frac{\frac{2dt}{1+t^2}}{4-5\left(\frac{1-t^2}{1+t^2}\right)}$	½	
		$= \displaystyle\int \frac{\frac{2dt}{1+t^2}}{\frac{4(1+t^2)-5(1-t^2)}{1+t^2}}$		
		$= \displaystyle\int \frac{2dt}{4+4t^2-5+5t^2}$		
		$= 2\displaystyle\int \frac{dt}{9t^2-1}$	½	
		$= 2\displaystyle\int \frac{dt}{(3t)^2-1^2} \quad or \quad \frac{2}{9}\int \frac{dt}{t^2-\left(\frac{1}{3}\right)^2}$	½	
		$= 2\cdot\dfrac{1}{2\times1}\log\left(\dfrac{3t-1}{3t+1}\right)\times\dfrac{1}{3}+c \quad or \quad \dfrac{2}{9}\cdot\dfrac{1}{2\times\frac{1}{3}}\log\left(\dfrac{t-\frac{1}{3}}{t+\frac{1}{3}}\right)+c$	1	
		$= \dfrac{1}{3}\log\left(\dfrac{3\tan\frac{x}{2}-1}{3\tan\frac{x}{2}+1}\right)+c$	½	**4**

Que. No.	Sub. Que.	Model answers	Marks	Total Marks
5)	e)	Evaluate $\int_0^{\pi/4} \log(1+\tan x)\,dx$		
	Ans.	$I = \int_0^{\pi/4} \log(1+\tan x)\,dx$		
		$= \int_0^{\pi/4} \log\left[1+\tan\left(\frac{\pi}{4}-x\right)\right]dx$	½	
		$= \int_0^{\pi/4} \log\left[1+\frac{1-\tan x}{1+\tan x}\right]dx$	1	
		$= \int_0^{\pi/4} \log\left[\frac{2}{1+\tan x}\right]dx$		
		$= \int_0^{\pi/4} \left[\log 2-\log(1+\tan x)\right]dx$	½	
		$= \int_0^{\pi/4} \log 2dx - \int_0^{\pi/4} \log(1+\tan x)\,dx$		
		$= \int_0^{\pi/4} \log 2dx - I$	½	
		$\therefore 2I = \int_0^{\pi/4} \log 2dx$		
		$= \log 2\int_0^{\pi/4} dx$		
		$= \log 2\left[x\right]_0^{\pi/4}$	½	
		$= \frac{\pi}{4}\log 2$	½	
		$\therefore I = \frac{\pi}{8}\log 2$	½	**4**
		---		
	f)	Solve the D. E. $\frac{dy}{dx}+\frac{y}{x}=y^2$		
	Ans.	$\frac{dy}{dx}+\frac{y}{x}=y^2$		
		$\therefore \frac{1}{y^2}\frac{dy}{dx}+\frac{1}{x}\cdot\frac{1}{y}=1$		
		Put $\frac{1}{y}=t$		
		$\therefore -\frac{1}{y^2}\frac{dy}{dx}=\frac{dt}{dx}$	1	
		$\therefore -\frac{dt}{dx}+\frac{1}{x}\cdot t=1$	½	
		$\therefore \frac{dt}{dx}-\frac{1}{x}\cdot t=-1$		
		$P=-\frac{1}{x}$ and $Q=-1$		

Que. No.	Sub. Que.	Model answers	Marks	Total Marks
5)		$\therefore IF = e^{\int pdx} = e^{\int \frac{-1}{x}dx} = e^{-\log x} = e^{\log\left(x^{-1}\right)} = x^{-1} = \frac{1}{x}$	1	
		$\therefore$ the solution is,		
		$t \cdot IF = \int Q \cdot IF \cdot dx + c$		
		$\therefore \quad t \cdot \frac{1}{x} = \int -1 \cdot \frac{1}{x} \cdot dx + c$	½	
		$\therefore \quad t \cdot \frac{1}{x} = -\log x + c$	½	
		$\therefore \quad \frac{1}{xy} = -\log x + c$	½	**4**
6)		**Attempt any FOUR of the following.**		
	a)	If $P(A) = \frac{1}{5}$, $P(B') = \frac{3}{5}$ and $P\left(\frac{A}{B}\right) = \frac{3}{4}$, find $P(A \cap B)$ and $P\left(\frac{B}{A}\right)$.		
	Ans.	$P(B) = 1 - P(B') = 1 - \frac{3}{5} = \frac{2}{5}$	1	
		$P\left(\frac{A}{B}\right) = \frac{P(A \cap B)}{P(B)}$		
		$\therefore P(A \cap B) = P\left(\frac{A}{B}\right) \cdot P(B) = \frac{3}{4} \cdot \frac{2}{5} = \frac{3}{10}$	1 ½	
		$P\left(\frac{B}{A}\right) = \frac{P(A \cap B)}{P(A)} = \frac{3/10}{1/5} = \frac{3}{2}$	1 ½	**4**
	b)	Using Poisson distribution, find the probability that the ace of spades will be drawn from a pack of well shuffled cards at least one in 104 consecutive trials.		
	Ans.	$n = 104$		
		$p = \frac{1}{52}$	1	
		$\therefore m = np = 104 \times \frac{1}{52} = 2$	1	
		$\therefore p = p(\text{at least one})$		
		$= 1 - p(\text{at most } 0) \;\; or \;\; 1 - p(0)$		
		$= 1 - \frac{e^{-2} \cdot 2^0}{0!}$	1	
		$= 0.8646$	1	**4**

Que. No.	Sub. Que.	Model answers	Marks	Total Marks
6)	c)	In a sample of 1000 cases, the mean of certain test is 14 and standard deviation is 2.5. Assuming the distribution to be normal, find i) How many students score between 12 and 15? ii) How many students score above 18? Given A(0.8) = 0.2881, A(0.4) = 0.1554 and A(1.6) = 0.4452		
	Ans.	Given $\bar{x}=14, \quad \sigma=2.5$		
		$z=\dfrac{x-\bar{x}}{\sigma}$		
		$i) \; z=\dfrac{12-14}{2.5}=-0.8$		
		$z=\dfrac{15-14}{2.5}=0.4$		
		$\therefore p=A(-0.8\le z\le 0.4) \qquad ....(*)$	½	
		$=A(-0.8\le z\le 0)+A(0\le z\le 0.4)$		
		$=A(0\le z\le 0.8)+A(0\le z\le 0.4)$	½	
		$=0.2881+0.1554$		
		$=0.4435$	½	
		$\therefore$ No. of students $=1000\times 0.4435$		
		$=443.5$	½	
		≈ 444		
		$ii) \; z=\dfrac{18-14}{2.5}=1.6$		
		$\therefore p=A(z\ge 1.6)$	½	
		$=A(0\le z)-A(0\le z\le 1.6)$		
		$=0.5-A(0\le z\le 1.6)$	½	
		$=0.5-0.4452$		
		$=0.0548$	½	
		$\therefore$ No. of students $=1000\times 0.0548$		
		$=54.8$	½	
		≈ 55		
		(*) Note: As the area under Standard Normal Curve represents probability, many authors use symbol of probability p instead of the symbol of area A i. e., instead of writing $A(-0.8\le z\le 0.4)$ it is also written as $p(-0.8\le z\le 0.4)$.		

Que. No.	Sub. Que.	Model answers	Marks	Total Marks
6)	d)	A manufacturer can sell x items at price of Rs. $(330-x)$ each. The cost of producing x items in Rs. is $x^2+10x+12$. How many items must be sold so that his profit is maximum.		
	Ans.	Selling price $= x(330-x)$		
		Cost price $= x^2+10x+12$		
		But, profit = selling price − cost price		
		$\therefore p = x(330-x)-(x^2+10x+12)$		
		$\therefore p = -2x^2+320x-12$	1	
		$\therefore \dfrac{dp}{dx} = -4x+320$	½	
		$\therefore \dfrac{d^2p}{dx^2} = -4$	½	
		For stationary values, $\dfrac{dp}{dx}=0$		
		$\therefore -4x+320=0$		
		$\therefore x=80$	1	
		At $x=80$, $\dfrac{d^2p}{dx^2}=-4<0$	½	
		$\therefore$ *At* $x=80$, p is maximum.	½	
		Thus the manufacturer can sell maximum 80 items.		**4**
	e)	Find the equation of the tangents to the curve $y=x^2-2x-3$, where it cuts x-axis.		
		$y=x^2-2x-3$		
		$\therefore \dfrac{dy}{dx}=2x-2$	½	
		The curve cuts x-axis,		
		$\therefore y=0$		
		$\therefore x^2-2x-3=0$		
		$\therefore x=-1, 3$	½	
		$\therefore$ the points on x-axis are $(-1, 0)$ *and* $(3, 0)$		
		$\therefore$ the slope of tangent at $(-1, 0)$ is		
		$m=\dfrac{dy}{dx}=2(-1)-2=-4$	½	
		$\therefore$ the equation of tangent is		
		$y-0=-4(x+1)$		
		$\therefore \boxed{y=-4x-4}$ *or* $\boxed{4x+y+4=0}$	1	

Que. No.	Sub. Que.	Model answers	Marks	Total Marks
6)		$\therefore$ the slope of tangent at $(3,\ 0)$ is		
		$m=\dfrac{dy}{dx}=2(3)-2=4$	½	
		$\therefore$ the equation of tangent is		
		$y-0=4(x-3)$		
		$\therefore$ $\boxed{y=4x-12}$ *or* $\boxed{4x-y-12=0}$	1	
		---		
	f)	Find the area of the region lying between the parabolas $y^2=4ax$ and $x^2=4ay$.		
	Ans.	$y^2=4ax,\quad x^2=4ay$		
		$\therefore\left(\dfrac{x^2}{4a}\right)^2=4ax \qquad \left(Also\ y=2\sqrt{a}\cdot\sqrt{x}\ \ and\ \ y=\dfrac{x^2}{4a}\right)$		
		$\therefore x^4=64a^3x$		
		$\therefore x\left(x^3-64a^3\right)=0$		
		$\therefore x=0,\quad x=4a$	1	
		$A=\int_a^b\left(y_2-y_1\right)dx$		
		$=\int_0^{4a}\left[2\sqrt{a}\cdot\sqrt{x}-\dfrac{x^2}{4a}\right]dx \qquad or\ \ also\ \int_0^{4a}\left[\dfrac{x^2}{4a}-2\sqrt{a}\cdot\sqrt{x}\right]dx$	1	
		$=\left[2\sqrt{a}\cdot\dfrac{2}{3}x^{3/2}-\dfrac{1}{4a}\cdot\dfrac{x^3}{3}\right]_0^{4a}$	1	
		$=\left[2\sqrt{a}\cdot\dfrac{2}{3}(4a)^{3/2}-\dfrac{1}{4a}\cdot\dfrac{(4a)^3}{3}\right]-0$	½	
		$=\dfrac{16}{3}a^2$	½	**4**

		Important Note		
		In the solution of the question paper, wherever possible all the possible alternative methods of solution are given for the sake of convenience. Still student may follow a method other than the given herein. In such case, FIRST SEE whether the method falls within the scope of the curriculum, and THEN ONLY give appropriate marks in accordance with the scheme of marking.		

