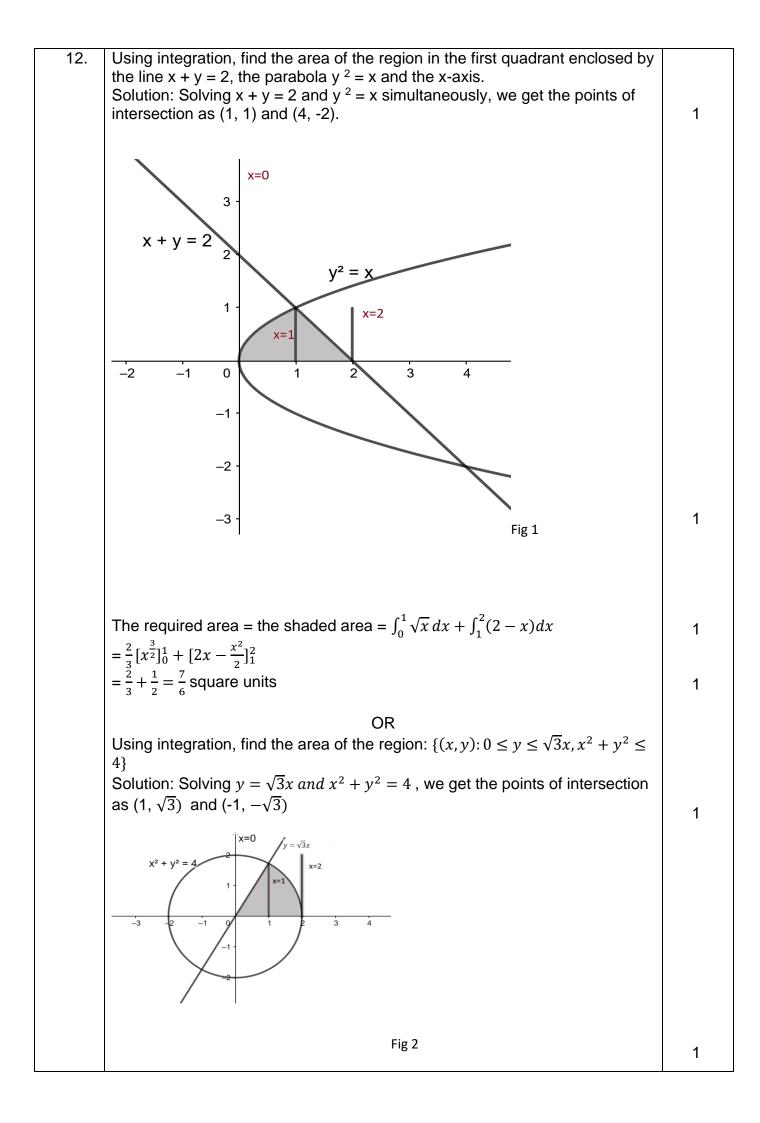
	Marking Scheme CLASS: XII		
	Session: 2021-22 Mathematics (Code-041) Term - 2		
	<u>SECTION – A</u>		
1.	Find: $\int \frac{\log x}{(1+\log x)^2} dx$		
	Solution: $\int \frac{\log x}{(1+\log x)^2} dx = \int \frac{\log x+1-1}{(1+\log x)^2} dx = \int \frac{1}{1+\log x} dx - \int \frac{1}{(1+\log x)^2} dx$ $= \frac{1}{1+\log x} \times x - \int \frac{-1}{(1+\log x)^2} \times \frac{1}{x} \times x dx - \int \frac{1}{(1+\log x)^2} dx = \frac{x}{1+\log x} + c$	1/2	
	OR OR	1+1/2	
	Find: $\int \frac{\sin 2x}{\sqrt{9-\cos^4 x}} dx$ Solution: Put $\cos^2 x = t \Rightarrow -2\cos x \sin x dx = dt \Rightarrow \sin 2x dx = -dt$	1	
2.	The given integral = $-\int \frac{dt}{\sqrt{3^2 - t^2}} = -\sin^{-1}\frac{t}{3} + c = -\sin^{-1}\frac{\cos^2 x}{3} + c$		
Ζ.	Write the sum of the order and the degree of the following differential equation: $\frac{d}{dx}\left(\frac{dy}{dx}\right) = 5$		
	Solution: Order = 2	1	
	Degree = 1 Sum = 3	1/2 1⁄2	
3.	If $\hat{a}$ and $\hat{b}$ are unit vectors, then prove that $ \hat{a} + \hat{b}  = 2\cos\frac{\theta}{2}$ , where $\theta$ is the angle between them.		
	Solution: $(\hat{a} + \hat{b}) \cdot (\hat{a} + \hat{b}) =  \hat{a} ^2 +  \hat{b} ^2 + 2(\hat{a} \cdot \hat{b})$	1	
	$\left \hat{a} + \hat{b}\right ^2 = 1 + 1 + 2\cos\theta$		
	$= 2(1 + \cos\theta) = 4\cos^2\frac{\theta}{2}$	1/2	
	$\therefore \left  \hat{a} + \hat{b} \right  = 2\cos\frac{\theta}{2},$	1/2	
4.	Find the direction cosines of the following line:		
	$\frac{3-x}{-1} = \frac{2y-1}{2} = \frac{z}{4}$		
	Solution: The given line is		
	$\frac{x-3}{1} = \frac{y-\frac{1}{2}}{1} = \frac{z}{4}$	1	
	Its direction ratios are <1, 1, 4> Its direction cosines are	1/2	
	$\left\langle \frac{1}{3\sqrt{2}}, \frac{1}{3\sqrt{2}}, \frac{4}{3\sqrt{2}} \right\rangle$	1/2	

5.	A bag contains 1 red and 3 white balls. Find the probability distribution of the number of red balls if 2 balls are drawn at random from the bag one-by-one without replacement. Solution: Let X be the random variable defined as the number of red balls.			
	Then X = 0, 1			1/2 1/2
	$P(X=0) = \frac{3}{4} \times \frac{2}{3} = \frac{6}{12} = \frac{1}{2}$ $P(X=1) = \frac{1}{4} \times \frac{3}{3} + \frac{3}{4} \times \frac{1}{3} = \frac{6}{12} = \frac{1}{2}$ Probability Distribution Table:		1/2	
	X     P(X)	0 1	1	1/2
		$\frac{1}{2}$	$\frac{1}{2}$	72
6.	Two cards are drawn at rand replacement. What is the pro Jack?			
	Solution: The required probability = P((The first is a red jack card and The second is a jack card) or (The first is a red non-jack card and The second is			1
	a jack card)) = $\frac{2}{52} \times \frac{3}{51} + \frac{24}{52} \times \frac{4}{51} = \frac{1}{26}$			1
		<u>SECTION – B</u>		
7.	Find: $\int \frac{x+1}{(x^2+1)x} dx$ Solution: Let $\frac{x+1}{(x^2+1)x} = \frac{Ax+B}{x^2+1} + \Rightarrow x + 1 = (Ax + B)x + C(x^2)$			1/2
	Equating the coefficients, we B = 1, C = 1, A + C = 0 Hence, A = -1, B = 1, C = 1 The given integral = $\int \frac{-x+1}{x^2+1} dx$	get		1⁄2
	$= \frac{-1}{2} \int \frac{2x-2}{x^2+1} dx + \int \frac{1}{x} dx$ $= \frac{-1}{2} \int \frac{2x}{x^2+1} dx + \int \frac{1}{x} dx$	x		1/2
	$= \frac{-1}{2}\log(x^2 + 1) + \tan^{-1}x + \frac{1}{2}\log(x^2 + 1) + \tan^{-1}x + \frac{1}{2}\log(x^2 + 1) + \frac$	$\log  x  + c$		1+1/2
8.	Find the general solution of t $x \frac{dy}{dx} = y - xsin(\frac{y}{x})$ Solution: We have the difference		l equation:	
	$\frac{dy}{dx} = \frac{y}{x} - sin(\frac{y}{x})$ The equation is a homogene	ous differential equatio	ın.	
	Putting $y = vx \Rightarrow \frac{dy}{dx} = v + x\frac{dy}{dx}$ The differential equation bec $v + x\frac{dv}{dx} = v - sinv$			1
	$v + x \frac{dx}{dx} = v - sinv$ $\Rightarrow \frac{dv}{sinv} = -\frac{dx}{x} \Rightarrow cosecvdv =$ Integrating both sides, we get			1⁄2

$\begin{aligned} & \text{big}(\operatorname{cose} v - \operatorname{cot} v)   = \log X \\ & \Rightarrow  \operatorname{cose} v - \operatorname{cot} v) x  = \log X \\ & \Rightarrow  \operatorname{cose} v - \operatorname{cot} v) x  = k \\ & \Rightarrow  \operatorname{cose} v - \operatorname{cot} v) x  = k \\ & \Rightarrow  \operatorname{cose} v - \operatorname{cot} v) x  = k \\ & \Rightarrow  \operatorname{cose} v - \operatorname{cot} v) x  = k \\ & \Rightarrow  \operatorname{cose} v - \operatorname{cot} v) x  = k \\ & \Rightarrow  \operatorname{cose} v - \operatorname{cot} v) x  = k \\ & \Rightarrow  \operatorname{cose} v - \operatorname{cot} v) x  = k \\ & \Rightarrow  \operatorname{cose} v - \operatorname{cot} v) x  = k \\ & \Rightarrow  \operatorname{cose} v - \operatorname{cot} v) x  = k \\ & \Rightarrow  \operatorname{cose} v - \operatorname{cot} v) x  = k \\ & \Rightarrow  \operatorname{cose} v - \operatorname{cot} v) x  = k \\ & \Rightarrow  \operatorname{cose} v - \operatorname{cot} v) x  = k \\ & \Rightarrow  \operatorname{cose} v - \operatorname{cot} v) x  = k \\ & \Rightarrow  \operatorname{cose} v - \operatorname{cot} v) x  = k \\ & \Rightarrow  \operatorname{cose} v - \operatorname{cot} v) x  = k \\ & \Rightarrow  \operatorname{cose} v - \operatorname{cot} v  x  = k \\ & \Rightarrow  \operatorname{cose} v - \operatorname{cot} v  x  = k \\ & \Rightarrow  \operatorname{cose} v - \operatorname{cot} v  x  = k \\ & & \text{solution:} \\ & \text{The differential equation is a linear differential equation} \\ & \text{IF } = \operatorname{clocutx} = \operatorname{clocutx} = \operatorname{sinx} \\ & \text{The general solution is given by} \\ & ysinx = 2 \int 1 \frac{1}{1 + \operatorname{sinx}} dx \\ & \Rightarrow ysinx = 2 \int \frac{1}{1 - \frac{1}{1 + \operatorname{cos} (\frac{\pi}{k} - x)}} dx \\ & \Rightarrow ysinx = 2 \int 1 \frac{1}{1 - \frac{1}{1 + \operatorname{cos} (\frac{\pi}{k} - x)}} dx \\ & \Rightarrow ysinx = 2 \int 1 \frac{1}{1 - \frac{1}{2 \operatorname{cos}^2} (\frac{\pi}{k} - \frac{x}{2})} dx \\ & \Rightarrow ysinx = 2 \int 1 \frac{1}{1 - \frac{1}{2 \operatorname{cos}^2} (\frac{\pi}{k} - \frac{x}{2})} dx \\ & \Rightarrow ysinx = 2 \int 1 \frac{1}{1 - \frac{1}{2 \operatorname{cos}^2} (\frac{\pi}{k} - \frac{x}{2})} dx \\ & \Rightarrow ysinx = 2 [x + \operatorname{tn} (\frac{\pi}{k} - \frac{x}{2})] + c \\ & \text{Given that } y = 0, \text{ when } x = \frac{\pi}{k}. \\ & \text{Hence, 0} = 2[\frac{\pi}{k} \tan \pi = \frac{\pi}{k}] + c \\ & \Rightarrow c = -\frac{\pi}{k} - 2 \tan \pi = \frac{\pi}{k} \\ & \text{Hence, the particular solution is} \\ & y = \operatorname{cosecx}[2 \{x + \operatorname{tn} (\frac{\pi}{k} - \frac{x}{2})] - (\frac{\pi}{k} + 2 \tan \pi = \frac{\pi}{k})] \\ & \text{Hone, the bard } d(\overline{b} - \overline{c}) \\ & \Rightarrow \overline{b} = \overline{c} \text{ or } d + (\overline{b} - \overline{c}) \\ & \Rightarrow \overline{b} = \overline{c} \text{ or } d + (\overline{b} - \overline{c}) \\ & \Rightarrow \overline{b} = \overline{c} \text{ or } d + (\overline{b} - \overline{c}) \\ & \Rightarrow \overline{b} = \overline{c} \text{ or } d + (\overline{b} - \overline{c}) \\ & \Rightarrow \overline{b} = \overline{c} \text{ or } d + (\overline{b} - \overline{c}) \\ & \Rightarrow \overline{b} = \overline{c} \text{ or } d + (\overline{b} - \overline{c}) \\ & \Rightarrow \overline{b} = \overline{c} \text{ or } d + (\overline{b} - \overline{c}) \\ & \Rightarrow \overline{b} = \overline{c} \text{ or } d + (\overline{b} - \overline{c}) \\ & \Rightarrow \overline{b} = \overline{c} \text{ or } d + (\overline{b} - \overline{c}) \\ & \Rightarrow \overline{c} = \overline{c} = \overline{c} +$		$\log \log \alpha = \log  \alpha  + \log  K  > 0$ (Here $\log  K  = 0$ orbitron)	
$ \begin{array}{l} \hline box{in the set of the s$		log cosecv - cotv  = -log x  + logK, K > 0 (Here, $logK$ is an arbitrary constant.)	1
$ \Rightarrow \overline{(cosec y - cotv)} x = \pm K $ $ \Rightarrow (cosec \frac{x}{x} - cot \frac{x}{x}) x = C, \text{ which is the required general solution.} $ $ OR $ Find the particular solution of the following differential equation, given that y $ = 0 \text{ when } x = \frac{\pi}{4}; $ $ \frac{dy}{dx} + ycotx = \frac{2}{1 + sinx} $ Solution: The differential equation is a linear differential equation $ IF = e^{\int cotxx} = e^{\log ginx} = sinx $ The general solution is given by $ ysinx = \int 2 \frac{sinx}{1 + sinx} dx = 2 \int [1 - \frac{1}{1 + sinx}] dx $ $ \Rightarrow ysinx = 2 \int \frac{sinx + 1 - 1}{1 + sinx} dx = 2 \int [1 - \frac{1}{1 + sinx}] dx $ $ \Rightarrow ysinx = 2 \int [1 - \frac{1}{2 \cos^2} (\frac{\pi}{4} - \frac{x}{2})] dx $ $ \Rightarrow ysinx = 2 \int [1 - \frac{1}{2 \cos^2} (\frac{\pi}{4} - \frac{x}{2})] dx $ $ \Rightarrow ysinx = 2 \int [1 - \frac{1}{2 \csc^2} (\frac{\pi}{4} - \frac{x}{2})] + c $ Given that y = 0, when $x = \frac{\pi}{4}.$ Hence, the particular solution is $ y = cosc_1 [2 + tan (\frac{\pi}{4} - \frac{x}{2})] - (\frac{\pi}{2} + 2tan \frac{\pi}{8})] $ $ 9.  \text{If } d \neq \overline{0}, d. \vec{b} = d. \vec{c}, d \times \vec{b} = d \times \vec{c}, \text{ then show that } \vec{b} = \vec{c}.$ Solution: We have $d.(\vec{b} - \vec{c}) = 0 $ $ \Rightarrow (\vec{b} - \vec{c}) = \vec{0} \text{ or } \vec{a} \perp (\vec{b} - \vec{c}) $ $ \Rightarrow \vec{b} = \vec{c} \text{ or } \vec{a} \mid (\vec{b} - \vec{c}) $ $ \Rightarrow \vec{b} = \vec{c} \text{ or } \vec{a} \mid (\vec{b} - \vec{c}) $ $ \Rightarrow \vec{b} = \vec{c} \text{ or } \vec{a} \mid (\vec{b} - \vec{c}) $ $ \Rightarrow \vec{b} = \vec{c} \text{ or } \vec{a} \mid (\vec{b} - \vec{c}) $ $ \Rightarrow \vec{b} = \vec{c} \text{ or } \vec{a} \mid (\vec{b} - \vec{c}) $ $ \Rightarrow \vec{b} = \vec{c} \text{ or } \vec{a} \mid (\vec{b} - \vec{c}) $ $ \Rightarrow \vec{b} = \vec{c} \text{ or } \vec{a} \mid (\vec{b} - \vec{c}) $ $ \Rightarrow \vec{b} = \vec{c} \text{ or } \vec{a} \mid (\vec{b} - \vec{c}) $ $ \Rightarrow \vec{b} = \vec{c} \text{ or } \vec{a} \mid (\vec{b} - \vec{c}) $ $ \Rightarrow \vec{b} = \vec{c} \text{ or } \vec{a} \mid (\vec{b} - \vec{c}) $ $ \Rightarrow \vec{b} = \vec{c} \text{ or } \vec{a} \mid (\vec{b} - \vec{c}) $ $ \Rightarrow \vec{b} = \vec{c} \text{ or } \vec{a} \mid (\vec{b} - \vec{c}) $ $ \Rightarrow \vec{b} = \vec{c} \text{ of } \vec{a} \mid (\vec{b} - \vec{c}) $ $ \Rightarrow \vec{b} = \vec{c} \text{ of } =  (\vec{b} - \vec{c}) $ $ \Rightarrow \vec{b} = \vec{c} \text{ of } =  (\vec{b} - \vec{c}) $ $ \Rightarrow \vec{b} = \vec{c} \text{ of } =  (\vec{b} - \vec{c}) $ $ \Rightarrow \vec{b} = \vec{c} \text{ of } =  (\vec{b} - \vec{c}) $ $ \Rightarrow \vec{b} = \vec{c} \text{ of } =  (\vec{b} - \vec{c}) $ $ \Rightarrow \vec{b} = \vec{c} \text{ of } =  (\vec{b} - \vec{c}) $ $ \Rightarrow \vec{b} = \vec{c} \text{ of } =  (\vec{b} - \vec{c}) $ $ \Rightarrow \vec{b} = \vec{c} \text{ of } =  (\vec{b} - \vec{c}) $ $ \Rightarrow $		,	
$ \Rightarrow \left( cosec \frac{y}{x} - cot \frac{y}{x} \right) x = C, \text{ which is the required general solution.} $ $ OR $ Find the particular solution of the following differential equation, given that y $ = 0 \text{ when } x = \frac{\pi}{4}; $ $ \frac{dy}{dx} + ycotx = \frac{2}{1 + sinx} $ Solution: The differential equation is a linear differential equation $ IF = e^{\int cotxtx} = e^{\log \sin tx} = \sin x $ $ The general solution is given by $ $ ysinx = \int 2 \frac{\sin x + 1 - 1}{1 + \sin x} dx = 2 \int [1 - \frac{1}{1 + sinx}] dx $ $ \Rightarrow ysinx = 2 \int [1 - \frac{1}{1 + cos(\frac{\pi}{2} - x)}] dx $ $ \Rightarrow ysinx = 2 \int [1 - \frac{1}{2cos^2}(\frac{\pi}{4} - \frac{x}{2})] dx $ $ \Rightarrow ysinx = 2 \int [1 - \frac{1}{2cos^2}(\frac{\pi}{4} - \frac{x}{2})] dx $ $ \Rightarrow ysinx = 2 \int [1 - \frac{1}{2cos^2}(\frac{\pi}{4} - \frac{x}{2})] + c $ $ Given that y = 0, \text{ when } x = \frac{\pi}{4}; $ $ Hence, 0 = 2[\frac{\pi}{4} + tan[\frac{\pi}{4} + \frac{x}{2})] - (\frac{\pi}{2} + 2tan[\frac{\pi}{8})] $ $ y = cosecx[2 \left\{x + tan(\frac{\pi}{4} - \frac{x}{2})\right\} - (\frac{\pi}{2} + 2tan[\frac{\pi}{8})] $ $ y = cosecx[2 \left\{x + tan(\frac{\pi}{4} - \frac{x}{2})\right\} - (\frac{\pi}{2} + 2tan[\frac{\pi}{8})] $ $ y = b = \hat{c} \text{ or } \hat{a} \perp (\hat{b} - \hat{c}) $ $ \Rightarrow \hat{b} = \hat{c} \text{ or } \hat{a} \parallel (\hat{b} - \hat{c}) $ $ \Rightarrow \hat{b} = \hat{c} \text{ or } \hat{a} \parallel (\hat{b} - \hat{c}) $ $ \Rightarrow \hat{b} = \hat{c} \text{ or } \hat{a} \parallel (\hat{b} - \hat{c}) $ $ \Rightarrow \hat{b} = \hat{c} \text{ or } \hat{a} \parallel (\hat{b} - \hat{c}) $ $ 1 $ $ 1 $ $ 1 $ $ 1 $ $ 1 $ $ 1 $ $ 1 $ $ 1 $ $ 1 $ $ 1 $ $ 1 $ $ 1 $ $ 1 $ $ 1 $ $ 1 $ $ 1 $ $ 1 $ $ 2 $ $ 2 $ $ 2 $ $ 2 $ $ 2 $ $ 2 $ $ 2 $ $ 2 $ $ 2 $ $ 2 $ $ 2 $ $ 2 $ $ 2 $ $ 2 $ $ 2 $ $ 2 $ $ 3 $ $ 3 $ $ 3 $ $ 3 $ $ 3 $ $ 3 $ $ 3 $ $ 3 $ $ 3 $ $ 4 $ $ 4 $ $ 4 $ $ 5 $			
$ \begin{array}{c} OR \\ Find the particular solution of the following differential equation, given that y \\ = 0 when x = \frac{\pi}{4}; \\ \frac{dy}{dx} + ycotx = \frac{2}{1 + sinx} \\ Solution: \\ The differential equation is a linear differential equation \\ IF = e^{\int cotxdx} = e^{\log inx} = sinx \\ The general solution is given by \\ ysinx = \int 2 \frac{sinx}{1 + sinx} dx = 2 \int [1 - \frac{1}{1 + sinx}] dx \\ \Rightarrow ysinx = 2 \int [1 - \frac{1}{1 + sinx} dx = 2 \int [1 - \frac{1}{1 + sinx}] dx \\ \Rightarrow ysinx = 2 \int [1 - \frac{1}{2cos^2} (\frac{\pi}{4} - \frac{x}{2})] dx \\ \Rightarrow ysinx = 2 \int [1 - \frac{1}{2cos^2} (\frac{\pi}{4} - \frac{x}{2})] dx \\ \Rightarrow ysinx = 2 \int [1 - \frac{1}{2cos^2} (\frac{\pi}{4} - \frac{x}{2})] dx \\ \Rightarrow ysinx = 2 \int [1 - \frac{1}{2cos^2} (\frac{\pi}{4} - \frac{x}{2})] dx \\ \Rightarrow ysinx = 2 \int [1 - \frac{1}{2cos^2} (\frac{\pi}{4} - \frac{x}{2})] dx \\ \Rightarrow ysinx = 2 \int [1 - \frac{1}{2cos^2} (\frac{\pi}{4} - \frac{x}{2})] + c \\ Given that y = 0, when x = \frac{\pi}{4}. \\ Hence, 0 = 2[\frac{\pi}{4} + tan \frac{\pi}{4}] + c \\ \Rightarrow c = -\frac{\pi}{2} - 2tan \frac{\pi}{8} \\ Hence, the particular solution is \\ Hence, the particular solution is \\ y = cosecx [2 \{x + tan (\frac{\pi}{4} - \frac{x}{2})\} - (\frac{\pi}{2} + 2tan \frac{\pi}{8})] \\ y_{2} \\ \hline 9.  If \ d \neq 0, \ d . \ b = d . \ c , \ d . \ b = d . \ c , \ d . \ b = d . \ c , \ d . \ b = d . \\ Solution: We have \ d . \ (b - c) = 0 \\ \Rightarrow (b - c) = 0 \ o \ d . \ (b - c) \\ \Rightarrow \ b = c \ o \ a \ (b - c) \\ \Rightarrow \ b = c \ o \ a \ (b - c) \\ \Rightarrow \ b = c \ o \ a \ (b - c) \\ \Rightarrow \ b = c \ o \ a \ (b - c) \\ \Rightarrow \ b = c \ o \ a \ (b - c) \\ \Rightarrow \ b = c \ o \ a \ (b - c) \\ \Rightarrow \ b = c \ o \ a \ (b - c) \\ \Rightarrow \ d \ b = c \ o \ a \ (b - c) \\ \Rightarrow \ d \ b = c \ o \ a \ (b - c) \\ \Rightarrow \ d \ b = c \ o \ a \ (b - c) \\ \Rightarrow \ d \ b = c \ o \ a \ (b - c) \\ \Rightarrow \ d \ b = c \ o \ a \ (b - c) \\ \Rightarrow \ d \ b = c \ o \ a \ (b - c) \\ \Rightarrow \ d \ b = c \ o \ a \ (b - c) \\ \Rightarrow \ d \ b = c \ o \ a \ (b - c) \\ \Rightarrow \ d \ b = c \ o \ a \ (b - c) \\ \Rightarrow \ d \ b = c \ o \ a \ (b - c) \\ \Rightarrow \ d \ b = c \ o \ a \ (b - c) \\ \Rightarrow \ d \ b = c \ o \ a \ (b - c) \\ \Rightarrow \ d \ b = c \ o \ a \ (b - c) \\ = 1 \ d \ d \ b \ d \ b \ c \ c \ d \ c \ d \ c \ d \ d \ d \ d$			1/
Find the particular solution of the following differential equation, given that $y = 0$ when $x = \frac{\pi}{4}$ : $\frac{dy}{dx} + ycotx = \frac{2}{1 + sinx}$ Solution: The differential equation is a linear differential equation $IF = e^{f \circ txdx} = e^{logsinx} = sinx$ The general solution is given by $ysinx = \int 2 \frac{sinx}{1 + sinx} dx$ $\frac{y_2}{2}$ $\Rightarrow ysinx = 2 \int \frac{sinx + 1 - 1}{1 + sinx} dx = 2 \int [1 - \frac{1}{1 + sinx}] dx$ $\Rightarrow ysinx = 2 \int [1 - \frac{1}{1 + cos(\frac{\pi}{2} - x)}] dx$ $\Rightarrow ysinx = 2 \int [1 - \frac{1}{2 \cos^2(\frac{\pi}{4} - \frac{x}{2})}] dx$ $\Rightarrow ysinx = 2 \int [1 - \frac{1}{2 \csc^2(\frac{\pi}{4} - \frac{x}{2})}] dx$ $\Rightarrow ysinx = 2 \int [1 - \frac{1}{2 \csc^2(\frac{\pi}{4} - \frac{x}{2})}] dx$ $\Rightarrow ysinx = 2 \int [1 - \frac{1}{2 \csc^2(\frac{\pi}{4} - \frac{x}{2})}] + c$ Given that $y = 0$ , when $x = \frac{\pi}{4}$ , Hence, $0 = 2[\frac{\pi}{4} + tan[\frac{\pi}{4} + c] + c]$ $\Rightarrow c = -\frac{\pi}{2} - 2tan[\frac{\pi}{8}] + c$ $\Rightarrow c = -\frac{\pi}{2} - 2tan[\frac{\pi}{8}] + c$ $\Rightarrow c = -\frac{\pi}{2} - 2tan[\frac{\pi}{8}] + c$ $\Rightarrow c = -\frac{\pi}{2} - 2tan[\frac{\pi}{8}] + c]$ $\Rightarrow \frac{\pi}{6} = \vec{c} \circ \vec{a} \perp (\vec{b} - \vec{c})$ $\Rightarrow \vec{b} = \vec{c} \circ \vec{a} \perp (\vec{b} - \vec{c})$ $Also, \vec{a} \times (\vec{b} - \vec{c}) = \vec{0} \Rightarrow (\vec{b} - \vec{c}) = \vec{0} \circ \vec{a} \parallel (\vec{b} - \vec{c}) \Rightarrow \vec{b} = \vec{c} \circ \vec{a} \parallel (\vec{b} - \vec{c}) \Rightarrow \vec{b} = \vec{c} \circ \vec{a} \parallel (\vec{b} - \vec{c}) \Rightarrow \vec{b} = \vec{c} \circ \vec{a} \parallel (\vec{b} - \vec{c}) = \frac{1}{2} (\vec{b} - \vec{c}) = \vec{0} = \vec{c} = 1 1 10. Find the shortest distance between the following lines:\vec{r} = (l + j - k) + s(2l + j + k)$		$\Rightarrow \left( cosec \frac{y}{x} - cot \frac{y}{x} \right) x = C$ , which is the required general solution.	/2
$= 0 \text{ when } x = \frac{\pi}{4};$ $\frac{dy}{dx} + y \cot x = \frac{2}{1 + \sin x}$ Solution: The differential equation is a linear differential equation $ F = e^{\int \cot x dx} = e^{\log \sin x} = \sin x$ The general solution is given by $y \sin x = \int 2 \frac{\sin x}{1 + \sin x} dx$ $\Rightarrow y \sin x = 2 \int [2 \frac{\sin x}{1 + \sin x} dx] = 2 \int [1 - \frac{1}{1 + \sin x}] dx$ $\Rightarrow y \sin x = 2 \int [1 - \frac{1}{1 + \cos(\frac{\pi}{2} - x)}] dx$ $\Rightarrow y \sin x = 2 \int [1 - \frac{1}{2 \cos^2}(\frac{\pi}{4} - \frac{x}{2})] dx$ $\Rightarrow y \sin x = 2 \int [1 - \frac{1}{2 \csc^2}(\frac{\pi}{4} - \frac{x}{2})] dx$ $\Rightarrow y \sin x = 2 \int [1 - \frac{1}{2 \sec^2}(\frac{\pi}{4} - \frac{x}{2})] dx$ $\Rightarrow y \sin x = 2 \int [1 - \frac{1}{2 \sec^2}(\frac{\pi}{4} - \frac{x}{2})] + c$ Given that $y = 0$ , when $x = \frac{\pi}{4}$ , Hence, $0 = 2[\frac{\pi}{4} + \tan \frac{\pi}{6}] + c$ $\Rightarrow c = -\frac{\pi}{2} - 2\tan \frac{\pi}{8}$ Hence, the particular solution is $y = \csc x[2 \{x + \tan(\frac{\pi}{4} - \frac{x}{2})\} - (\frac{\pi}{2} + 2\tan \frac{\pi}{8})]$ $y_{2}$ 9. If $d \neq \overline{0}, d. \vec{b} = d. \vec{c}, d. \times \vec{b} = d. \times \vec{c}$ , then show that $\vec{b} = \vec{c}$ . Solution: We have $\vec{a}. (\vec{b} - \vec{c}) = 0$ $\Rightarrow (\vec{b} - \vec{c}) = \vec{0}$ $\Rightarrow (\vec{c} - \vec{c}) + \vec{b} = \vec{c}$ $= (1 + \vec{j} - \vec{k}) + s(2i + j + \vec{k})$		OR	
$ \begin{array}{c} \frac{dy}{dx} + y \cot x = \frac{2}{1 + \sin x} \\ \text{Solution:} \\ \text{The differential equation is a linear differential equation} \\   F = e^{\int \cot x x} = e^{\log \sin x} = \sin x \\ \text{The general solution is given by} \\ y \sin x = \int 2 \frac{\sin x}{1 + \sin x} dx = 2 \int [1 - \frac{1}{1 + \sin x}] dx \\ \Rightarrow y \sin x = 2 \int \frac{\sin x + 1 - 1}{1 + \sin x} dx = 2 \int [1 - \frac{1}{1 + \sin x}] dx \\ \Rightarrow y \sin x = 2 \int [1 - \frac{1}{2 \cos^2} (\frac{\pi}{4} - \frac{x}{2})] dx \\ \Rightarrow y \sin x = 2 \int [1 - \frac{1}{2 \cos^2} (\frac{\pi}{4} - \frac{x}{2})] dx \\ \Rightarrow y \sin x = 2 \int [1 - \frac{1}{2 \cos^2} (\frac{\pi}{4} - \frac{x}{2})] dx \\ \Rightarrow y \sin x = 2 \int [1 - \frac{1}{2 \cos^2} (\frac{\pi}{4} - \frac{x}{2})] dx \\ \Rightarrow y \sin x = 2 \int [1 - \frac{1}{2 \cos^2} (\frac{\pi}{4} - \frac{x}{2})] dx \\ \Rightarrow y \sin x = 2 \int [1 - \frac{1}{2 \cos^2} (\frac{\pi}{4} - \frac{x}{2})] dx \\ \Rightarrow y \sin x = 2 \int [1 - \frac{1}{2 \cos^2} (\frac{\pi}{4} - \frac{x}{2})] dx \\ \Rightarrow y \sin x = 2 \int [x + \tan (\frac{\pi}{4} - \frac{x}{2})] + c \\ \text{Given that } y = 0, \text{ when } x = \frac{\pi}{4}, \\ \text{Hence, } 0 = 2 [\frac{\pi}{4} + \tan \frac{\pi}{8}] + c \\ \Rightarrow c = -\frac{\pi}{2} - 2 \tan \frac{\pi}{8} \\ \text{Hence, the particular solution is} \\ y = \cos cx [2 \{x + \tan (\frac{\pi}{4} - \frac{x}{2})\} - (\frac{\pi}{2} + 2 \tan \frac{\pi}{8})] \\ y_2 \end{array}$		Find the particular solution of the following differential equation, given that y	
Solution: The differential equation is a linear differential equation $I F = e^{\int \cot x dx} = e^{\log \sin x} = \sin x$ The general solution is given by $y \sin x = 2 \int \frac{\sin x}{1 + \sin x} dx$ $\Rightarrow y \sin x = 2 \int \frac{1}{1 + \sin x} dx = 2 \int [1 - \frac{1}{1 + \sin x}] dx$ $\Rightarrow y \sin x = 2 \int [1 - \frac{1}{1 + \cos(\frac{\pi}{2} - x)}] dx$ $\Rightarrow y \sin x = 2 \int [1 - \frac{1}{2 \cos^2(\frac{\pi}{4} - \frac{x}{2})}] dx$ $\Rightarrow y \sin x = 2 \int [1 - \frac{1}{2 \cos^2(\frac{\pi}{4} - \frac{x}{2})}] dx$ $\Rightarrow y \sin x = 2 \int [1 - \frac{1}{2 \cos^2(\frac{\pi}{4} - \frac{x}{2})}] dx$ $\Rightarrow y \sin x = 2 \int [1 - \frac{1}{2 \cos^2(\frac{\pi}{4} - \frac{x}{2})}] dx$ $\Rightarrow y \sin x = 2 \int [1 - \frac{1}{2 \cos^2(\frac{\pi}{4} - \frac{x}{2})}] dx$ $\Rightarrow y \sin x = 2 \int [1 - \frac{1}{2 \cos^2(\frac{\pi}{4} - \frac{x}{2})}] dx$ $\Rightarrow y \sin x = 2 \int [1 - \frac{1}{2 \cos^2(\frac{\pi}{4} - \frac{x}{2})}] dx$ $\Rightarrow y \sin x = 2 [x + \tan(\frac{\pi}{4} - \frac{x}{2})] + c$ Given that $y = 0$ , when $x = \frac{\pi}{4}$ . Hence, the particular solution is $y = cosecx [2 \{x + tan(\frac{\pi}{4} - \frac{x}{2})\} - (\frac{\pi}{2} + 2tan\frac{\pi}{8})]$ 9. If $\vec{a} \neq \vec{0}$ , $\vec{a} \cdot \vec{b} = \vec{a} \cdot \vec{c}$ , then show that $\vec{b} = \vec{c}$ . Solution: We have $\vec{a}$ . $(\vec{b} - \vec{c}) = 0$ $\Rightarrow (\vec{b} - \vec{c}) = \vec{0} \text{ or } \vec{a} + (\vec{b} - \vec{c})$ $\Rightarrow \vec{b} = \vec{c} \text{ or } \vec{a} + (\vec{b} - \vec{c})$ $\Rightarrow \vec{b} = \vec{c} \text{ or } \vec{a} + (\vec{b} - \vec{c})$ $\Rightarrow \vec{b} = \vec{c} \text{ or } \vec{a} + (\vec{b} - \vec{c})$ $\Rightarrow \vec{b} = \vec{c} \text{ or } \vec{a} + (\vec{b} - \vec{c})$ $\Rightarrow \vec{b} = \vec{c} \text{ or } \vec{a} + (\vec{b} - \vec{c})$ $\Rightarrow \vec{b} = \vec{c} \text{ or } \vec{a} + (\vec{b} - \vec{c})$ $\Rightarrow \vec{b} = \vec{c} \text{ or } \vec{a} + (\vec{b} - \vec{c})$ $\Rightarrow \vec{b} = \vec{c} \text{ or } \vec{a} + (\vec{b} - \vec{c})$ $\Rightarrow \vec{b} = \vec{c} \text{ or } \vec{a} + (\vec{b} - \vec{c})$ $\Rightarrow \vec{b} = \vec{c} \text{ or } \vec{a} + (\vec{b} - \vec{c})$ $\Rightarrow \vec{b} = \vec{c} \text{ or } \vec{a} + (\vec{b} - \vec{c})$ $\Rightarrow \vec{b} = \vec{c} \text{ or } \vec{a} + (\vec{b} - \vec{c})$ $\Rightarrow \vec{b} = \vec{c} \text{ or } \vec{a} + (\vec{b} - \vec{c})$ $\Rightarrow \vec{b} = \vec{c} \text{ or } \vec{a} + (\vec{b} - \vec{c})$ $\Rightarrow \vec{b} = \vec{c} \text{ or } \vec{a} + (\vec{b} - \vec{c})$ $\Rightarrow \vec{b} = \vec{c} \text{ or } \vec{a} + (\vec{b} - \vec{c})$ $\Rightarrow \vec{b} = \vec{c} \text{ or } \vec{a} + (\vec{b} - \vec{c})$ $\Rightarrow \vec{b} = \vec{c} \text{ or } \vec{a} + (\vec{b} - \vec{c})$ $\Rightarrow \vec{b} = \vec{c} \text{ or } \vec{a} + (\vec{b} - \vec{c})$ $\Rightarrow \vec{b} = \vec{c} \text{ or } \vec{a} + (\vec{b} - \vec{c})$ $\Rightarrow \vec{b} = \vec{c} \text{ or } \vec{a} + (\vec{b} - \vec{c})$ $\Rightarrow \vec{b} = \vec{c} + \vec{c} + \vec{c} + \vec{c} + \vec{c} +$		= 0 when $x = \frac{\pi}{4}$ :	
Solution: The differential equation is a linear differential equation $IF = e^{\int \cot x dx} = e^{\log \sin x} = \sin x$ The general solution is given by $ysinx = \int 2 \frac{\sin x}{1 + \sin x} dx$ $\Rightarrow ysinx = 2 \int \frac{\sin x + 1 - 1}{1 + \sin x} dx = 2 \int [1 - \frac{1}{1 + \sin x}] dx$ $\Rightarrow ysinx = 2 \int [1 - \frac{1}{1 + \cos(\frac{\pi}{2} - x)}] dx$ $\Rightarrow ysinx = 2 \int [1 - \frac{1}{2 \cos^2(\frac{\pi}{4} - \frac{\pi}{2})}] dx$ $\Rightarrow ysinx = 2 \int [1 - \frac{1}{2 \cos^2(\frac{\pi}{4} - \frac{\pi}{2})}] dx$ $\Rightarrow ysinx = 2 \int [1 - \frac{1}{2 \cos^2(\frac{\pi}{4} - \frac{\pi}{2})}] dx$ $\Rightarrow ysinx = 2 \int [1 - \frac{1}{2 \cos^2(\frac{\pi}{4} - \frac{\pi}{2})}] dx$ $\Rightarrow ysinx = 2 \int [1 - \frac{1}{2 \cos^2(\frac{\pi}{4} - \frac{\pi}{2})}] dx$ $\Rightarrow ysinx = 2 \int [1 - \frac{1}{2 \cos^2(\frac{\pi}{4} - \frac{\pi}{2})}] dx$ $\Rightarrow ysinx = 2 \int [1 - \frac{1}{2 \cos^2(\frac{\pi}{4} - \frac{\pi}{2})}] dx$ $\Rightarrow ysinx = 2 \left[x + \tan(\frac{\pi}{4} - \frac{\pi}{2})\right] + c$ Given that $y = 0$ , when $x = \frac{\pi}{4}$ . Hence, the particular solution is $y = cosecx[2 \left\{x + tan(\frac{\pi}{4} - \frac{\pi}{2})\right\} - (\frac{\pi}{2} + 2tan\frac{\pi}{8})]$ 9. If $\vec{a} \neq \vec{0}$ , $\vec{a}$ , $\vec{b} = \vec{a}$ , $\vec{c}$ , $\vec{a}$ , $\vec{b} = \vec{a} \times \vec{c}$ , then show that $\vec{b} = \vec{c}$ . Solution: We have $\vec{a}$ . ( $\vec{b} - \vec{c}$ ) $\Rightarrow \vec{b} = \vec{c}$ or $\vec{a} \perp (\vec{b} - \vec{c})$ $\Rightarrow \vec{b} = \vec{c}$ or $\vec{a} \parallel (\vec{b} - \vec{c})$ $\Rightarrow \vec{b} = \vec{c}$ or $\vec{a} \parallel (\vec{b} - \vec{c})$ $\Rightarrow \vec{b} = \vec{c}$ or $\vec{a} \parallel (\vec{b} - \vec{c})$ $\Rightarrow \vec{b} = \vec{c}$ or $\vec{a} \parallel (\vec{b} - \vec{c})$ $\Rightarrow \vec{b} = \vec{c}$ or $\vec{a} \parallel (\vec{b} - \vec{c})$ $\Rightarrow \vec{b} = \vec{c}$ or $\vec{a} \parallel (\vec{b} - \vec{c})$ $\Rightarrow \vec{b} = \vec{c}$ or $\vec{a} \parallel (\vec{b} - \vec{c})$ $\Rightarrow \vec{b} = \vec{c}$ or $\vec{a} \parallel (\vec{b} - \vec{c})$ $\Rightarrow \vec{b} = \vec{c}$ or $\vec{a} \parallel (\vec{b} - \vec{c})$ $\Rightarrow \vec{b} = \vec{c}$ or $\vec{a} \parallel (\vec{b} - \vec{c})$ $\Rightarrow \vec{b} = \vec{c}$ or $\vec{a} \parallel (\vec{b} - \vec{c})$ $\Rightarrow \vec{b} = \vec{c}$ or $\vec{a} \parallel (\vec{b} - \vec{c})$ $\Rightarrow \vec{b} = \vec{c}$ or $\vec{a} \parallel (\vec{b} - \vec{c})$ $\Rightarrow \vec{c} = (i + j - k) + s(2i + j + k)$		1	
The differential equation is a linear differential equation $IF = e^{\int \cot xx} = e^{\log xinx} = \sin x$ The general solution is given by $ysinx = \int 2 \frac{sinx}{1 + sinx} dx$ $\Rightarrow ysinx = 2 \int \frac{sinx + 1 - 1}{1 + sinx} dx = 2 \int [1 - \frac{1}{1 + sinx}] dx$ $\Rightarrow ysinx = 2 \int [1 - \frac{1}{1 + cos(\frac{\pi}{2} - x)}] dx$ $\Rightarrow ysinx = 2 \int [1 - \frac{1}{2cos^2}(\frac{\pi}{4} - \frac{x}{2})] dx$ $\Rightarrow ysinx = 2 \int [1 - \frac{1}{2cos^2}(\frac{\pi}{4} - \frac{x}{2})] dx$ $\Rightarrow ysinx = 2 \int [1 - \frac{1}{2sec^2}(\frac{\pi}{4} - \frac{x}{2})] dx$ $\Rightarrow ysinx = 2 \int [1 - \frac{1}{2sec^2}(\frac{\pi}{4} - \frac{x}{2})] dx$ $\Rightarrow ysinx = 2 \int [1 - \frac{1}{2sec^2}(\frac{\pi}{4} - \frac{x}{2})] dx$ $\Rightarrow ysinx = 2 \int [1 - \frac{1}{2sec^2}(\frac{\pi}{4} - \frac{x}{2})] dx$ $\Rightarrow ysinx = 2 [x + tan(\frac{\pi}{4} - \frac{x}{2})] + c$ Given that y = 0, when x = $\frac{\pi}{4}$ . Hence, 0 = $2[\frac{\pi}{4} + tan\frac{\pi}{8}] + c$ $\Rightarrow c = -\frac{\pi}{2} - 2tan\frac{\pi}{8}$ Hence, the particular solution is $y = cosecx[2 \{x + tan(\frac{\pi}{4} - \frac{x}{2})\} - (\frac{\pi}{2} + 2tan\frac{\pi}{8})]$ 9. If $\hat{a} \neq \vec{0}$ , $\hat{a}.\vec{b} = \hat{a}.\vec{c}.\vec{a}.\vec{b} = \vec{a}.\vec{c}$ , then show that $\vec{b} = \vec{c}$ . Solution: We have $\hat{a}.(\vec{b} - \vec{c}) = 0$ $\Rightarrow (\vec{b} - \vec{c}) = \vec{0} \text{ or } \vec{a} \perp (\vec{b} - \vec{c})$ $\Rightarrow \vec{b} = \vec{c} \text{ or } \vec{a} \perp (\vec{b} - \vec{c})$ $\Rightarrow \vec{b} = \vec{c} \text{ or } \vec{a} \parallel (\vec{b} - \vec{c})$ $\Rightarrow \vec{b} = \vec{c} \text{ or } \vec{a} \parallel (\vec{b} - \vec{c})$ $\Rightarrow \vec{b} = \vec{c} \text{ or } \vec{a} \parallel (\vec{b} - \vec{c})$ $= \frac{1}{1}$ 10. Find the shortest distance between the following lines: $\vec{r} = (t + f - \hat{k}) + s(2t + f + \hat{k})$			
$\begin{aligned} \mathbf{F} &= e^{\int \cot x dx} = e^{\log x \ln x} = \sin x \\ \text{The general solution is given by} \\ ysinx &= \int 2 \frac{\sin x}{1 + \sin x} dx = 2 \int [1 - \frac{1}{1 + \sin x}] dx \\ &\Rightarrow ysinx = 2 \int \frac{\sin x + 1 - 1}{1 + \sin x} dx = 2 \int [1 - \frac{1}{1 + \sin x}] dx \\ &\Rightarrow ysinx = 2 \int [1 - \frac{1}{1 + \cos(\frac{\pi}{2} - x)}] dx \\ &\Rightarrow ysinx = 2 \int [1 - \frac{1}{2 \csc^2}(\frac{\pi}{4} - \frac{x}{2})] dx \\ &\Rightarrow ysinx = 2 \int [1 - \frac{1}{2 \sec^2}(\frac{\pi}{4} - \frac{x}{2})] dx \\ &\Rightarrow ysinx = 2 \int [1 - \frac{1}{2 \sec^2}(\frac{\pi}{4} - \frac{x}{2})] dx \\ &\Rightarrow ysinx = 2 \int [1 - \frac{1}{2 \sec^2}(\frac{\pi}{4} - \frac{x}{2})] dx \\ &\Rightarrow ysinx = 2 \int [1 - \frac{1}{2 \sec^2}(\frac{\pi}{4} - \frac{x}{2})] dx \\ &\Rightarrow ysinx = 2 \int [1 - \frac{1}{2 \sec^2}(\frac{\pi}{4} - \frac{x}{2})] dx \\ &\Rightarrow ysinx = 2 \int [1 - \frac{1}{2 \sec^2}(\frac{\pi}{4} - \frac{x}{2})] dx \\ &\Rightarrow ysinx = 2 \int [1 - \frac{1}{2 \sec^2}(\frac{\pi}{4} - \frac{x}{2})] dx \\ &\Rightarrow ysinx = 2 \int [1 - \frac{\pi}{2} + \tan(\frac{\pi}{4} - \frac{x}{2})] + c \\ &\text{Given that y = 0, when x = \frac{\pi}{4}, \\ &\text{Hence, 0} = 2 [\frac{\pi}{4} + \tan(\frac{\pi}{4} - \frac{x}{2})] + c \\ &\Rightarrow c = -\frac{\pi}{2} - 2 \tan \frac{\pi}{8} \\ &\text{Hence, the particular solution is} \\ &y = \csc x [2 \{x + \tan(\frac{\pi}{4} - \frac{x}{2})\} - (\frac{\pi}{2} + 2 \tan \frac{\pi}{8})] \\ &y = \frac{\pi}{2} = \vec{0} \text{ or } \vec{a} \perp (\vec{b} - \vec{c}) = 0 \\ &\Rightarrow (\vec{b} - \vec{c}) = \vec{0} \text{ or } \vec{a} \perp (\vec{b} - \vec{c}) \\ &\Rightarrow \vec{b} = \vec{c} \text{ or } \vec{a} \perp (\vec{b} - \vec{c}) \\ &\Rightarrow \vec{b} = \vec{c} \text{ or } \vec{a} \parallel (\vec{b} - \vec{c}) \\ &\Rightarrow \vec{b} = \vec{c} \text{ or } \vec{a} \parallel (\vec{b} - \vec{c}) \\ &\Rightarrow \vec{b} = \vec{c} \text{ or } \vec{a} \parallel (\vec{b} - \vec{c}) \\ &\Rightarrow \vec{b} = \vec{c} \text{ or } \vec{a} \parallel (\vec{b} - \vec{c}) \\ &\Rightarrow \vec{b} = \vec{c} \text{ or } \vec{a} \parallel (\vec{b} - \vec{c}) \\ &= 1 \\ \text{Hence, } \vec{b} = \vec{c} . \\ 1 \\ \text{10. Find the shortest distance between the following lines:} \\ \vec{r} = (i + f - \hat{k}) + s(2i + f + \hat{k}) \end{aligned}$			
The general solution is given by $ysinx = \int 2 \frac{sinx}{1 + sinx} dx$ $\Rightarrow ysinx = 2 \int \frac{sinx + 1 - 1}{1 + sinx} dx = 2 \int [1 - \frac{1}{1 + sinx}] dx$ $\Rightarrow ysinx = 2 \int [1 - \frac{1}{1 + cos(\frac{\pi}{2} - x)}] dx$ $\Rightarrow ysinx = 2 \int [1 - \frac{1}{2cos^2}(\frac{\pi}{4} - \frac{x}{2})] dx$ $\Rightarrow ysinx = 2 \int [1 - \frac{1}{2cos^2}(\frac{\pi}{4} - \frac{x}{2})] dx$ $\Rightarrow ysinx = 2 \int [1 - \frac{1}{2sec^2}(\frac{\pi}{4} - \frac{x}{2})] dx$ $\Rightarrow ysinx = 2 \int [1 - \frac{1}{2sec^2}(\frac{\pi}{4} - \frac{x}{2})] dx$ $\Rightarrow ysinx = 2 \int [1 - \frac{1}{2cos^2} + tan(\frac{\pi}{4} - \frac{x}{2})] dx$ $\Rightarrow ysinx = 2 \int [1 - \frac{1}{2cos^2}(\frac{\pi}{4} - \frac{x}{2})] dx$ $\Rightarrow ysinx = 2 \int [1 - \frac{1}{2cos^2}(\frac{\pi}{4} - \frac{x}{2})] dx$ $\Rightarrow ysinx = 2 \int [1 - \frac{1}{2cos^2}(\frac{\pi}{4} - \frac{x}{2})] dx$ $\Rightarrow ysinx = 2 \int [1 - \frac{1}{2cos^2}(\frac{\pi}{4} - \frac{x}{2})] dx$ $\Rightarrow ysinx = 2 \int [1 - \frac{\pi}{2} + tan(\frac{\pi}{4} - \frac{x}{2})] dx$ $\Rightarrow ysinx = 2 \int [1 - \frac{\pi}{2} + tan(\frac{\pi}{4} - \frac{x}{2})] dx$ $\Rightarrow ycosecx [2 \{x + tan(\frac{\pi}{4} - \frac{x}{2})\} - (\frac{\pi}{2} + 2tan\frac{\pi}{8})]$ 9. If $\vec{a} \neq \vec{0}$ , $\vec{a}.\vec{b} = \vec{a}.\vec{c}$ , $\vec{a}.\vec{b} = \vec{a}.\vec{c}$ , then show that $\vec{b} = \vec{c}$ . Solution: We have $\vec{a}.(\vec{b} - \vec{c}) = 0$ $\Rightarrow (\vec{b} - \vec{c}) = \vec{0} \text{ or } \vec{a} \perp (\vec{b} - \vec{c})$ $\Rightarrow \vec{b} = \vec{c} \text{ or } \vec{a} \perp (\vec{b} - \vec{c})$ $\Rightarrow \vec{b} = \vec{c} \text{ or } \vec{a} \parallel (\vec{b} - \vec{c})$ $\Rightarrow \vec{b} = \vec{c} \text{ or } \vec{a} \parallel (\vec{b} - \vec{c})$ $\Rightarrow \vec{b} = \vec{c} \text{ or } \vec{a} \parallel (\vec{b} - \vec{c})$ $\Rightarrow \vec{b} = \vec{c} \text{ or } \vec{a} \parallel (\vec{b} - \vec{c})$ $\Rightarrow \vec{b} = \vec{c} \text{ or } \vec{a} \parallel (\vec{b} - \vec{c})$ $\Rightarrow \vec{b} = \vec{c} \text{ or } \vec{a} \parallel (\vec{b} - \vec{c})$ $\Rightarrow \vec{b} = \vec{c} \text{ or } \vec{a} \parallel (\vec{b} - \vec{c})$ $\Rightarrow \vec{b} = \vec{c} \text{ or } \vec{a} \parallel (\vec{b} - \vec{c})$ $\Rightarrow \vec{b} = \vec{c} \text{ or } \vec{a} \parallel (\vec{b} - \vec{c})$ $\Rightarrow \vec{b} = \vec{c} \text{ or } \vec{a} \parallel (\vec{b} - \vec{c})$ $\Rightarrow \vec{b} = \vec{c} \text{ or } \vec{a} \parallel (\vec{b} - \vec{c})$ $\Rightarrow \vec{b} = \vec{c} \text{ or } \vec{a} \parallel (\vec{b} - \vec{c})$ $\Rightarrow \vec{b} = \vec{c} \text{ or } \vec{a} \parallel (\vec{b} - \vec{c})$ $\Rightarrow \vec{b} = \vec{c} \text{ or } \vec{a} \parallel (\vec{b} - \vec{c})$ $\Rightarrow \vec{b} = \vec{c} \text{ or } \vec{a} \parallel (\vec{b} - \vec{c})$ $\Rightarrow \vec{b} = \vec{c} \text{ or } \vec{a} \parallel (\vec{b} - \vec{c})$ $\Rightarrow \vec{b} = \vec{c} \text{ or } \vec{a} \parallel (\vec{b} - \vec{c})$ $\Rightarrow \vec{b} = \vec{c} \text{ or } \vec{a} \parallel (\vec{b} - \vec{c})$ $\Rightarrow \vec{b} = \vec{c} \text{ or } \vec{a} \parallel (\vec{b} - \vec{c})$ $\Rightarrow \vec{b} = \vec{c} + \vec{b} + \vec{b} + \vec{b}$			1
$y_{2} = \int 2 \frac{\sin x}{1 + \sin x} dx \qquad y_{2}$ $\Rightarrow y_{2} = \int \frac{\sin x + 1 - 1}{1 + \sin x} dx = 2 \int [1 - \frac{1}{1 + \sin x}] dx$ $\Rightarrow y_{2} = 2 \int [1 - \frac{1}{1 + \cos(\frac{\pi}{2} - x)}] dx$ $\Rightarrow y_{2} = 2 \int [1 - \frac{1}{1 - \cos(\frac{\pi}{2} - x)}] dx$ $\Rightarrow y_{2} = 2 \int [1 - \frac{1}{2 \cos^{2}(\frac{\pi}{4} - \frac{x}{2})}] dx$ $\Rightarrow y_{2} = 2 \int [1 - \frac{1}{2 \csc^{2}(\frac{\pi}{4} - \frac{x}{2})}] dx$ $\Rightarrow y_{2} = 2 \int [1 - \frac{1}{2 \csc^{2}(\frac{\pi}{4} - \frac{x}{2})}] dx$ $\Rightarrow y_{2} = 2 \int [1 - \frac{1}{2 \csc^{2}(\frac{\pi}{4} - \frac{x}{2})}] dx$ $\Rightarrow y_{2} = 2 \int [1 - \frac{1}{2 \csc^{2}(\frac{\pi}{4} - \frac{x}{2})}] dx$ $\Rightarrow y_{2} = 2 \int [1 - \frac{1}{2 \csc^{2}(\frac{\pi}{4} - \frac{x}{2})}] dx$ $\Rightarrow y_{2} = 2 \int [1 - \frac{1}{2 \csc^{2}(\frac{\pi}{4} - \frac{x}{2})}] dx$ $\Rightarrow y_{2} = 2 \int [1 - \frac{1}{2 \csc^{2}(\frac{\pi}{4} - \frac{x}{2})}] dx$ $\Rightarrow y_{2} = 2 \int [1 - \frac{1}{2 \csc^{2}(\frac{\pi}{4} - \frac{x}{2})}] dx$ $\Rightarrow y_{2} = 2 \int [1 - \frac{\pi}{4} + 2 \cos^{2}(\frac{\pi}{4} - \frac{\pi}{4})] dx$ $\Rightarrow y_{2} = 2 \int [1 - \frac{\pi}{4} + 2 \cos^{2}(\frac{\pi}{4} - \frac{\pi}{4})] dx$ $\Rightarrow y_{2} = 2 \int [1 - \frac{\pi}{4} + 2 \cos^{2}(\frac{\pi}{4} - \frac{\pi}{4})] dx$ $\Rightarrow y_{2} = 2 \int [1 - \frac{\pi}{4} + 2 \cos^{2}(\frac{\pi}{4} - \frac{\pi}{4})] dx$ $\Rightarrow y_{2} = 2 \int [1 - \frac{\pi}{4} + 2 \cos^{2}(\frac{\pi}{4} - \frac{\pi}{4})] dx$ $\Rightarrow y_{2} = 2 \int [1 - \frac{\pi}{4} + 2 \cos^{2}(\frac{\pi}{4} - \frac{\pi}{4})] dx$ $\Rightarrow y_{2} = 2 \int [1 - \frac{\pi}{4} + 2 \cos^{2}(\frac{\pi}{4} - \frac{\pi}{4})] dx$ $\Rightarrow y_{2} = 2 \int [1 - \frac{\pi}{4} + 2 \cos^{2}(\frac{\pi}{4} - \frac{\pi}{4})] dx$ $\Rightarrow y_{2} = 2 \int [1 - \frac{\pi}{4} + 2 \cos^{2}(\frac{\pi}{4} - \frac{\pi}{4})] dx$ $\Rightarrow y_{2} = 2 \int [1 - \frac{\pi}{4} + 2 \cos^{2}(\frac{\pi}{4} - \frac{\pi}{4})] dx$ $\Rightarrow y_{2} = 2 \int [1 - \frac{\pi}{4} + 2 \cos^{2}(\frac{\pi}{4} - \frac{\pi}{4})] dx$ $\Rightarrow y_{2} = 2 \int [1 - \frac{\pi}{4} + 2 \cos^{2}(\frac{\pi}{4} - \frac{\pi}{4})] dx$ $\Rightarrow y_{2} = 2 \int [1 - \frac{\pi}{4} + 2 \cos^{2}(\frac{\pi}{4} - \frac{\pi}{4})] dx$ $\Rightarrow y_{2} = 2 \int [1 - \frac{\pi}{4} + 2 \cos^{2}(\frac{\pi}{4} - \frac{\pi}{4})] dx$ $\Rightarrow y_{2} = 2 \int [1 - \frac{\pi}{4} + 2 \cos^{2}(\frac{\pi}{4} - \frac{\pi}{4})] dx$ $\Rightarrow y_{2} = 2 \int [1 - \frac{\pi}{4} + 2 \cos^{2}(\frac{\pi}{4} - \frac{\pi}{4})] dx$ $\Rightarrow y_{2} = 2 \int [1 - \frac{\pi}{4} + 2 \cos^{2}(\frac{\pi}{4} - \frac{\pi}{4})] dx$ $\Rightarrow y_{2} = 2 \int [1 - \frac{\pi}{4} + 2 \cos^{2}(\frac{\pi}{4} - \frac{\pi}{4})] dx$ $\Rightarrow y_{2} = 2 \int [1 - \frac{\pi}{4} + 2 \cos^{2}(\frac{\pi}{4} - \frac{\pi}{4})] dx$ $\Rightarrow y_{2} = 2 \int [1 - \frac{\pi}{4} + 2 \cos^{2}(\frac{\pi}{4} - \frac{\pi}{4})] dx$ $\Rightarrow y_{2} = 2 \int [1 - \frac{\pi}{4} + \frac{\pi}{4} + \frac{\pi}{4} + \frac{\pi}{4} + \frac{\pi}{4} + $			
$ \Rightarrow ysinx = 2 \int \frac{sinx + 1 - 1}{1 + sinx} dx = 2 \int [1 - \frac{1}{1 + sinx}] dx $ $ \Rightarrow ysinx = 2 \int [1 - \frac{1}{1 + cos(\frac{\pi}{2} - x)}] dx $ $ \Rightarrow ysinx = 2 \int [1 - \frac{1}{2cos^2}(\frac{\pi}{4} - \frac{x}{2})] dx $ $ \Rightarrow ysinx = 2 \int [1 - \frac{1}{2}sec^2(\frac{\pi}{4} - \frac{x}{2})] dx $ $ \Rightarrow ysinx = 2 [x + tan(\frac{\pi}{4} - \frac{x}{2})] + c $ Given that y = 0, when x = $\frac{\pi}{4}$ , Hence, 0 = $2[\frac{\pi}{4} + tan\frac{\pi}{8}] + c$ $ \Rightarrow c = -\frac{\pi}{2} - 2tan\frac{\pi}{8}$ Hence, the particular solution is $y = cosecx[2\{x + tan(\frac{\pi}{4} - \frac{x}{2})\} - (\frac{\pi}{2} + 2tan\frac{\pi}{8})] $ 9. If $\vec{a} \neq \vec{0}$ , $\vec{a} \cdot \vec{b} = \vec{a} \cdot \vec{c}$ , $\vec{a} \times \vec{b} = \vec{a} \times \vec{c}$ , then show that $\vec{b} = \vec{c}$ . Solution: We have $\vec{a} \cdot (\vec{b} - \vec{c}) = 0$ $ \Rightarrow (\vec{b} - \vec{c}) = \vec{0} \text{ or } \vec{a} \perp (\vec{b} - \vec{c})$ $ \Rightarrow \vec{b} = \vec{c} \text{ or } \vec{a} \perp (\vec{b} - \vec{c})$ $ \Rightarrow \vec{b} = \vec{c} \text{ or } \vec{a} \parallel (\vec{b} - \vec{c})$ $ \Rightarrow \vec{b} = \vec{c} \text{ or } \vec{a} \parallel (\vec{b} - \vec{c})$ $ \Rightarrow \vec{b} = \vec{c} \text{ or } \vec{a} \parallel (\vec{b} - \vec{c})$ $ \Rightarrow \vec{b} = \vec{c} \text{ or } \vec{a} \parallel (\vec{b} - \vec{c})$ $ \Rightarrow \vec{b} = \vec{c} \text{ or } \vec{a} \parallel (\vec{b} - \vec{c})$ $ = 1$ $ 10. Find the shortest distance between the following lines:  \vec{r} = (\hat{t} + \hat{j} - \hat{k}) + s(2\hat{t} + \hat{j} + \hat{k})$		$using = \int 2^{-sinx} dx$	1/
$\Rightarrow y \sin x = 2 \int \left[1 - \frac{1}{1 + \cos\left(\frac{\pi}{2} - x\right)}\right] dx$ $\Rightarrow y \sin x = 2 \int \left[1 - \frac{1}{2\cos^2\left(\frac{\pi}{4} - \frac{x}{2}\right)}\right] dx$ $\Rightarrow y \sin x = 2 \int \left[1 - \frac{1}{2} \sec^2\left(\frac{\pi}{4} - \frac{x}{2}\right)\right] dx$ $\Rightarrow y \sin x = 2 \left[x + \tan\left(\frac{\pi}{4} - \frac{x}{2}\right)\right] + c$ Given that y = 0, when x = $\frac{\pi}{4}$ , Hence, 0 = $2\left[\frac{\pi}{4} + \tan\frac{\pi}{8}\right] + c$ $\Rightarrow c = -\frac{\pi}{2} - 2\tan\frac{\pi}{8}$ Hence, the particular solution is $y = \csc x \left[2\left\{x + \tan\left(\frac{\pi}{4} - \frac{x}{2}\right)\right\} - \left(\frac{\pi}{2} + 2\tan\frac{\pi}{8}\right)\right]$ 9. If $\vec{a} \neq \vec{0}, \vec{a}.\vec{b} = \vec{a}.\vec{c}, \vec{a} \times \vec{b} = \vec{a} \times \vec{c}$ , then show that $\vec{b} = \vec{c}$ . Solution: We have $\vec{a}.(\vec{b} - \vec{c}) = 0$ $\Rightarrow (\vec{b} - \vec{c}) = \vec{0} \text{ or } \vec{a} \perp (\vec{b} - \vec{c})$ $\Rightarrow \vec{b} = \vec{c} \text{ or } \vec{a} \perp (\vec{b} - \vec{c})$ $\Rightarrow \vec{b} = \vec{c} \text{ or } \vec{a} \parallel (\vec{b} - \vec{c})$ $\Rightarrow \vec{b} = \vec{c} \text{ or } \vec{a} \parallel (\vec{b} - \vec{c})$ $\Rightarrow \vec{b} = \vec{c} \text{ or } \vec{a} \parallel (\vec{b} - \vec{c})$ $\Rightarrow \vec{b} = \vec{c} \text{ or } \vec{a} \parallel (\vec{b} - \vec{c})$ $= \frac{1}{4} \tan t \cos t \sin t t \sin t \sin t \sin t t \sin t t \sin t t t t$		$ystnx = \int 2\frac{1}{1+sinx} dx$	/2
$\Rightarrow ysinx = 2 \int \left[1 - \frac{1}{2cos^2} \left(\frac{\pi}{4} - \frac{x}{2}\right)\right] dx$ $\Rightarrow ysinx = 2 \int \left[1 - \frac{1}{2} \sec^2 \left(\frac{\pi}{4} - \frac{x}{2}\right)\right] dx$ $\Rightarrow ysinx = 2 \left[x + \tan \left(\frac{\pi}{4} - \frac{x}{2}\right)\right] + c$ Given that y = 0, when x = $\frac{\pi}{4}$ , Hence, 0 = $2 \left[\frac{\pi}{4} + tan \frac{\pi}{8}\right] + c$ $\Rightarrow c = -\frac{\pi}{2} - 2tan \frac{\pi}{8}$ Hence, the particular solution is $y = cosecx \left[2 \left\{x + tan \left(\frac{\pi}{4} - \frac{x}{2}\right)\right\} - \left(\frac{\pi}{2} + 2tan \frac{\pi}{8}\right)\right]$ 9. If $\vec{a} \neq \vec{0}, \vec{a}.\vec{b} = \vec{a}.\vec{c}, \vec{a} \times \vec{b} = \vec{a} \times \vec{c}$ , then show that $\vec{b} = \vec{c}$ . Solution: We have $\vec{a}.(\vec{b} - \vec{c}) = 0$ $\Rightarrow (\vec{b} - \vec{c}) = \vec{0} \text{ or } \vec{a} \perp (\vec{b} - \vec{c})$ $\Rightarrow \vec{b} = \vec{c} \text{ or } \vec{a} \perp (\vec{b} - \vec{c})$ $\Rightarrow \vec{b} = \vec{c} \text{ or } \vec{a} \parallel (\vec{b} - \vec{c})$ $\Rightarrow \vec{b} = \vec{c} \text{ or } \vec{a} \parallel (\vec{b} - \vec{c})$ $\Rightarrow \vec{b} = \vec{c} \text{ or } \vec{a} \parallel (\vec{b} - \vec{c})$ $\Rightarrow \vec{b} = \vec{c} \text{ or } \vec{a} \parallel (\vec{b} - \vec{c})$ $= \frac{1}{4}$ 10. Find the shortest distance between the following lines: $\vec{r} = (\hat{i} + \hat{j} - \hat{k}) + s(2\hat{i} + \hat{j} + \hat{k})$			
$\Rightarrow ysinx = 2 \int [1 - \frac{1}{2}sec^{2}(\frac{\pi}{4} - \frac{x}{2})]dx$ $\Rightarrow ysinx = 2[x + \tan(\frac{\pi}{4} - \frac{x}{2})] + c$ Given that y = 0, when x = $\frac{\pi}{4}$ , Hence, 0 = 2[ $\frac{\pi}{4} + tan \frac{\pi}{8}] + c$ $\Rightarrow c = -\frac{\pi}{2} - 2tan \frac{\pi}{8}$ Hence, the particular solution is y = cosecx[2 {x + tan $(\frac{\pi}{4} - \frac{x}{2})$ } - $(\frac{\pi}{2} + 2tan \frac{\pi}{8})$ ] y/2 9. If $\vec{a} \neq \vec{0}$ , $\vec{a}$ , $\vec{b} = \vec{a}$ , $\vec{c}$ , $\vec{a} \times \vec{b} = \vec{a} \times \vec{c}$ , then show that $\vec{b} = \vec{c}$ . Solution: We have $\vec{a}$ . ( $\vec{b} - \vec{c}$ ) = 0 $\Rightarrow (\vec{b} - \vec{c}) = \vec{0} \text{ or } \vec{a} \perp (\vec{b} - \vec{c})$ $\Rightarrow \vec{b} = \vec{c} \text{ or } \vec{a} \perp (\vec{b} - \vec{c})$ $\Rightarrow \vec{b} = \vec{c} \text{ or } \vec{a} \parallel (\vec{b} - \vec{c})$ $\Rightarrow \vec{b} = \vec{c} \text{ or } \vec{a} \parallel (\vec{b} - \vec{c})$ $\Rightarrow \vec{b} = \vec{c} \text{ or } \vec{a} \parallel (\vec{b} - \vec{c})$ $\Rightarrow \vec{b} = \vec{c} \text{ or } \vec{a} \parallel (\vec{b} - \vec{c})$ $\Rightarrow \vec{b} = \vec{c} \text{ or } \vec{a} \parallel (\vec{b} - \vec{c})$ $\Rightarrow \vec{b} = \vec{c} \text{ or } \vec{a} \parallel (\vec{b} - \vec{c})$ $\Rightarrow \vec{b} = \vec{c} \text{ or } \vec{a} \parallel (\vec{b} - \vec{c})$ $\Rightarrow \vec{b} = \vec{c} \text{ or } \vec{a} \parallel (\vec{b} - \vec{c})$ $\Rightarrow \vec{b} = \vec{c} \text{ or } \vec{a} \parallel (\vec{b} - \vec{c})$ $\Rightarrow \vec{b} = \vec{c} \text{ or } \vec{a} \parallel (\vec{b} - \vec{c})$ $\Rightarrow \vec{b} = \vec{c} \text{ or } \vec{a} \parallel (\vec{b} - \vec{c})$ $= 1$ 10. Find the shortest distance between the following lines: \vec{r} = (\hat{\iota} + \hat{\jmath} - \hat{k}) + s(2\hat{\iota} + \hat{\jmath} + \hat{k})		$\Rightarrow ysinx = 2 \int \left[1 - \frac{1}{1 + \cos\left(\frac{\pi}{2} - x\right)}\right] dx$	
$\Rightarrow ysinx = 2 \int [1 - \frac{1}{2}sec^{2}(\frac{\pi}{4} - \frac{x}{2})]dx$ $\Rightarrow ysinx = 2[x + \tan(\frac{\pi}{4} - \frac{x}{2})] + c$ Given that y = 0, when x = $\frac{\pi}{4}$ , Hence, 0 = 2[ $\frac{\pi}{4} + tan \frac{\pi}{8}] + c$ $\Rightarrow c = -\frac{\pi}{2} - 2tan \frac{\pi}{8}$ Hence, the particular solution is y = cosecx[2 {x + tan $(\frac{\pi}{4} - \frac{x}{2})$ } - $(\frac{\pi}{2} + 2tan \frac{\pi}{8})$ ] y/2 9. If $\vec{a} \neq \vec{0}$ , $\vec{a}$ , $\vec{b} = \vec{a}$ , $\vec{c}$ , $\vec{a} \times \vec{b} = \vec{a} \times \vec{c}$ , then show that $\vec{b} = \vec{c}$ . Solution: We have $\vec{a}$ . ( $\vec{b} - \vec{c}$ ) = 0 $\Rightarrow (\vec{b} - \vec{c}) = \vec{0} \text{ or } \vec{a} \perp (\vec{b} - \vec{c})$ $\Rightarrow \vec{b} = \vec{c} \text{ or } \vec{a} \perp (\vec{b} - \vec{c})$ $\Rightarrow \vec{b} = \vec{c} \text{ or } \vec{a} \parallel (\vec{b} - \vec{c})$ $\Rightarrow \vec{b} = \vec{c} \text{ or } \vec{a} \parallel (\vec{b} - \vec{c})$ $\Rightarrow \vec{b} = \vec{c} \text{ or } \vec{a} \parallel (\vec{b} - \vec{c})$ $\Rightarrow \vec{b} = \vec{c} \text{ or } \vec{a} \parallel (\vec{b} - \vec{c})$ $\Rightarrow \vec{b} = \vec{c} \text{ or } \vec{a} \parallel (\vec{b} - \vec{c})$ $\Rightarrow \vec{b} = \vec{c} \text{ or } \vec{a} \parallel (\vec{b} - \vec{c})$ $\Rightarrow \vec{b} = \vec{c} \text{ or } \vec{a} \parallel (\vec{b} - \vec{c})$ $\Rightarrow \vec{b} = \vec{c} \text{ or } \vec{a} \parallel (\vec{b} - \vec{c})$ $\Rightarrow \vec{b} = \vec{c} \text{ or } \vec{a} \parallel (\vec{b} - \vec{c})$ $\Rightarrow \vec{b} = \vec{c} \text{ or } \vec{a} \parallel (\vec{b} - \vec{c})$ $\Rightarrow \vec{b} = \vec{c} \text{ or } \vec{a} \parallel (\vec{b} - \vec{c})$ $= 1$ 10. Find the shortest distance between the following lines: \vec{r} = (\hat{\iota} + \hat{\jmath} - \hat{k}) + s(2\hat{\iota} + \hat{\jmath} + \hat{k})		$\Rightarrow ysinx = 2 \int \left[1 - \frac{1}{2cos^2 \left(\frac{\pi}{4} - \frac{x}{2}\right)}\right] dx$	
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Given that $y = 0$ , when $x = \frac{\pi}{4}$ , Hence, $0 = 2[\frac{\pi}{4} + tan \frac{\pi}{8}] + c$ $\Rightarrow c = -\frac{\pi}{2} - 2tan \frac{\pi}{8}$ Hence, the particular solution is $y = cosecx[2\left\{x + tan\left(\frac{\pi}{4} - \frac{x}{2}\right)\right\} - \left(\frac{\pi}{2} + 2tan\frac{\pi}{8}\right)]$ 9. If $\vec{a} \neq \vec{0}$ , $\vec{a}.\vec{b} = \vec{a}.\vec{c}, \vec{a} \times \vec{b} = \vec{a} \times \vec{c}$ , then show that $\vec{b} = \vec{c}$ . Solution: We have $\vec{a}.(\vec{b} - \vec{c}) = 0$ $\Rightarrow (\vec{b} - \vec{c}) = \vec{0}$ or $\vec{a} \perp (\vec{b} - \vec{c})$ $\Rightarrow \vec{b} = \vec{c}$ or $\vec{a} \perp (\vec{b} - \vec{c})$ $Also, \vec{a} \times (\vec{b} - \vec{c}) = \vec{0}$ $\Rightarrow (\vec{b} - \vec{c}) = \vec{0}$ or $\vec{a} \parallel (\vec{b} - \vec{c})$ $\vec{a} can not be both perpendicular to (\vec{b} - \vec{c}) and parallel to (\vec{b} - \vec{c})Hence, \vec{b} = \vec{c}.10. Find the shortest distance between the following lines:\vec{r} = (\hat{\iota} + \hat{j} - \hat{k}) + s(2\hat{\iota} + \hat{j} + \hat{k})$		$\Rightarrow ysinx = 2[x + \tan\left(\frac{\pi}{4} - \frac{x}{2}\right)] + c$	1
$\Rightarrow c = -\frac{\pi}{2} - 2tan\frac{\pi}{8}$ Hence, the particular solution is $y = cosecx[2\left\{x + tan\left(\frac{\pi}{4} - \frac{x}{2}\right)\right\} - \left(\frac{\pi}{2} + 2tan\frac{\pi}{8}\right)]$ 9. If $\vec{a} \neq \vec{0}$ , $\vec{a}$ , $\vec{b} = \vec{a}$ , $\vec{c}$ , $\vec{a} \times \vec{b} = \vec{a} \times \vec{c}$ , then show that $\vec{b} = \vec{c}$ . Solution: We have $\vec{a}$ . $(\vec{b} - \vec{c}) = 0$ $\Rightarrow (\vec{b} - \vec{c}) = \vec{0} \text{ or } \vec{a} \perp (\vec{b} - \vec{c})$ $\Rightarrow \vec{b} = \vec{c} \text{ or } \vec{a} \perp (\vec{b} - \vec{c})$ Also, $\vec{a} \times (\vec{b} - \vec{c}) = \vec{0}$ $\Rightarrow (\vec{b} - \vec{c}) = \vec{0} \text{ or } \vec{a} \parallel (\vec{b} - \vec{c})$ $\Rightarrow \vec{b} = \vec{c} \text{ or } \vec{a} \parallel (\vec{b} - \vec{c})$ $\Rightarrow \vec{b} = \vec{c} \text{ or } \vec{a} \parallel (\vec{b} - \vec{c})$ $\Rightarrow \vec{b} = \vec{c} \text{ or } \vec{a} \parallel (\vec{b} - \vec{c})$ $= 1$ 10. Find the shortest distance between the following lines: $\vec{r} = (\hat{i} + \hat{j} - \hat{k}) + s(2\hat{i} + \hat{j} + \hat{k})$		Given that $y = 0$ , when $x = \frac{\pi}{4}$ ,	
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Hence, the particular solution is $y = cosecx[2\left\{x + tan\left(\frac{\pi}{4} - \frac{x}{2}\right)\right\} - \left(\frac{\pi}{2} + 2tan\frac{\pi}{8}\right)]$ 9. If $\vec{a} \neq \vec{0}$ , $\vec{a} . \vec{b} = \vec{a} . \vec{c}$ , $\vec{a} \times \vec{b} = \vec{a} \times \vec{c}$ , then show that $\vec{b} = \vec{c}$ . Solution: We have $\vec{a} . (\vec{b} - \vec{c}) = 0$ $\Rightarrow (\vec{b} - \vec{c}) = \vec{0} \text{ or } \vec{a} \perp (\vec{b} - \vec{c})$ $\Rightarrow \vec{b} = \vec{c} \text{ or } \vec{a} \perp (\vec{b} - \vec{c})$ Also, $\vec{a} \times (\vec{b} - \vec{c}) = \vec{0}$ $\Rightarrow (\vec{b} - \vec{c}) = \vec{0} \text{ or } \vec{a} \parallel (\vec{b} - \vec{c})$ $\Rightarrow \vec{b} = \vec{c} \text{ or } \vec{a} \parallel (\vec{b} - \vec{c})$ $\Rightarrow \vec{b} = \vec{c} \text{ or } \vec{a} \parallel (\vec{b} - \vec{c})$ $\Rightarrow \vec{b} = \vec{c} \text{ or } \vec{a} \parallel (\vec{b} - \vec{c})$ $\Rightarrow \vec{b} = \vec{c} \text{ or } \vec{a} \parallel (\vec{b} - \vec{c})$ Hence, $\vec{b} = \vec{c}$ . 10. Find the shortest distance between the following lines: $\vec{r} = (\hat{\iota} + \hat{\jmath} - \hat{k}) + s(2\hat{\iota} + \hat{\jmath} + \hat{k})$		1 0	
9. If $\vec{a} \neq \vec{0}$ , $\vec{a} \cdot \vec{b} = \vec{a} \cdot \vec{c}$ , $\vec{a} \times \vec{b} = \vec{a} \times \vec{c}$ , then show that $\vec{b} = \vec{c}$ . Solution: We have $\vec{a} \cdot (\vec{b} - \vec{c}) = 0$ $\Rightarrow (\vec{b} - \vec{c}) = \vec{0}$ or $\vec{a} \perp (\vec{b} - \vec{c})$ $\Rightarrow \vec{b} = \vec{c}$ or $\vec{a} \perp (\vec{b} - \vec{c})$ Also, $\vec{a} \times (\vec{b} - \vec{c}) = \vec{0}$ $\Rightarrow (\vec{b} - \vec{c}) = \vec{0}$ or $\vec{a} \parallel (\vec{b} - \vec{c})$ $\Rightarrow \vec{b} = \vec{c}$ or $\vec{a} \parallel (\vec{b} - \vec{c})$ $\Rightarrow \vec{b} = \vec{c}$ or $\vec{a} \parallel (\vec{b} - \vec{c})$ $\Rightarrow \vec{b} = \vec{c}$ or $\vec{a} \parallel (\vec{b} - \vec{c})$ $\Rightarrow \vec{b} = \vec{c}$ or $\vec{a} \parallel (\vec{b} - \vec{c})$ $= \vec{b} = \vec{c}$ . 1 10. Find the shortest distance between the following lines: $\vec{r} = (\hat{i} + \hat{j} - \hat{k}) + s(2\hat{i} + \hat{j} + \hat{k})$			
9. If $\vec{a} \neq \vec{0}$ , $\vec{a}$ . $\vec{b} = \vec{a}$ . $\vec{c}$ , $\vec{a} \times \vec{b} = \vec{a} \times \vec{c}$ , then show that $\vec{b} = \vec{c}$ . Solution: We have $\vec{a}$ . $(\vec{b} - \vec{c}) = 0$ $\Rightarrow (\vec{b} - \vec{c}) = \vec{0}$ or $\vec{a} \perp (\vec{b} - \vec{c})$ $\Rightarrow \vec{b} = \vec{c}$ or $\vec{a} \perp (\vec{b} - \vec{c})$ Also, $\vec{a} \times (\vec{b} - \vec{c}) = \vec{0}$ $\Rightarrow (\vec{b} - \vec{c}) = \vec{0}$ or $\vec{a} \parallel (\vec{b} - \vec{c})$ $\Rightarrow \vec{b} = \vec{c}$ or $\vec{a} \parallel (\vec{b} - \vec{c})$ $\Rightarrow \vec{b} = \vec{c}$ or $\vec{a} \parallel (\vec{b} - \vec{c})$ $\vec{a}$ can not be both perpendicular to $(\vec{b} - \vec{c})$ and parallel to $(\vec{b} - \vec{c})$ Hence, $\vec{b} = \vec{c}$ . 1 10. Find the shortest distance between the following lines: $\vec{r} = (\hat{\iota} + \hat{j} - \hat{k}) + s(2\hat{\iota} + \hat{j} + \hat{k})$			
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Solution: We have $\vec{a}.(\vec{b} - \vec{c}) = 0$ $\Rightarrow (\vec{b} - \vec{c}) = \vec{0} \text{ or } \vec{a} \perp (\vec{b} - \vec{c})$ $\Rightarrow \vec{b} = \vec{c} \text{ or } \vec{a} \perp (\vec{b} - \vec{c})$ Also, $\vec{a} \times (\vec{b} - \vec{c}) = \vec{0}$ $\Rightarrow (\vec{b} - \vec{c}) = \vec{0} \text{ or } \vec{a} \parallel (\vec{b} - \vec{c})$ $\Rightarrow \vec{b} = \vec{c} \text{ or } \vec{a} \parallel (\vec{b} - \vec{c})$ $\vec{a} can not be both perpendicular to (\vec{b} - \vec{c}) and parallel to (\vec{b} - \vec{c})Hence, \vec{b} = \vec{c}.110. Find the shortest distance between the following lines:\vec{r} = (\hat{\iota} + \hat{j} - \hat{k}) + s(2\hat{\iota} + \hat{j} + \hat{k})$			
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$ \Rightarrow (\vec{b} - \vec{c}) = \vec{0} \text{ or } \vec{a} \perp (\vec{b} - \vec{c}) $ $ \Rightarrow \vec{b} = \vec{c} \text{ or } \vec{a} \perp (\vec{b} - \vec{c}) $ $ \Rightarrow \vec{b} = \vec{c} \text{ or } \vec{a} \perp (\vec{b} - \vec{c}) $ $ \Rightarrow (\vec{b} - \vec{c}) = \vec{0} \text{ or } \vec{a} \parallel (\vec{b} - \vec{c}) $ $ \Rightarrow \vec{b} = \vec{c} \text{ or } \vec{a} \parallel (\vec{b} - \vec{c}) $ $ \vec{a} \text{ can not be both perpendicular to } (\vec{b} - \vec{c}) \text{ and parallel to } (\vec{b} - \vec{c}) $ $ \text{Hence, } \vec{b} = \vec{c}. $ $ 1$ $ 10. \text{ Find the shortest distance between the following lines:} $ $ \vec{r} = (\hat{\iota} + \hat{\jmath} - \hat{k}) + s(2\hat{\iota} + \hat{\jmath} + \hat{k}) $			
$\Rightarrow \vec{b} = \vec{c} \text{ or } \vec{a} \perp (\vec{b} - \vec{c}) $ $Also, \vec{a} \times (\vec{b} - \vec{c}) = \vec{0}$ $\Rightarrow (\vec{b} - \vec{c}) = \vec{0} \text{ or } \vec{a} \parallel (\vec{b} - \vec{c})$ $\Rightarrow \vec{b} = \vec{c} \text{ or } \vec{a} \parallel (\vec{b} - \vec{c}) $ $\vec{a} can not be both perpendicular to (\vec{b} - \vec{c}) and parallel to (\vec{b} - \vec{c})$ $Hence, \vec{b} = \vec{c}.$ $1$ $10. Find the shortest distance between the following lines:$ $\vec{r} = (\hat{i} + \hat{j} - \hat{k}) + s(2\hat{i} + \hat{j} + \hat{k})$			
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$\Rightarrow (\vec{b} - \vec{c}) = \vec{0} \text{ or } \vec{a} \parallel (\vec{b} - \vec{c})$ $\Rightarrow \vec{b} = \vec{c} \text{ or } \vec{a} \parallel (\vec{b} - \vec{c})$ $\vec{a} \text{ can not be both perpendicular to } (\vec{b} - \vec{c}) \text{ and parallel to } (\vec{b} - \vec{c})$ Hence, $\vec{b} = \vec{c}$ . 1 10. Find the shortest distance between the following lines: $\vec{r} = (\hat{i} + \hat{j} - \hat{k}) + s(2\hat{i} + \hat{j} + \hat{k})$			
$\Rightarrow \vec{b} = \vec{c} \text{ or } \vec{a} \parallel (\vec{b} - \vec{c}) $ $\vec{a} \text{ can not be both perpendicular to } (\vec{b} - \vec{c}) \text{ and parallel to } (\vec{b} - \vec{c}) $ $\text{Hence, } \vec{b} = \vec{c}. $ 10. Find the shortest distance between the following lines: $\vec{r} = (\hat{i} + \hat{j} - \hat{k}) + s(2\hat{i} + \hat{j} + \hat{k})$			
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10. Find the shortest distance between the following lines: $\vec{r} = (\hat{i} + \hat{j} - \hat{k}) + s(2\hat{i} + \hat{j} + \hat{k})$			1
$\vec{r} = (\hat{\imath} + \hat{\jmath} - \hat{k}) + s(2\hat{\imath} + \hat{\jmath} + \hat{k})$	10.		
$\vec{r} = (\hat{\imath} + \hat{\jmath} + 2\hat{k}) + t(4\hat{\imath} + 2\hat{\jmath} + 2\hat{k})$			
		$\vec{r} = (\hat{\imath} + \hat{\jmath} + 2\hat{k}) + t(4\hat{\imath} + 2\hat{\jmath} + 2\hat{k})$	

	Solution: Here, the lines are parallel. The shortest distance = $\frac{ (\vec{a_2} - \vec{a_1}) \times \vec{b} }{ \vec{b} }$		
	$=\frac{\left (3\hat{k}) \times (2\hat{i} + \hat{j} + \hat{k})\right }{\sqrt{4+1+1}}$	1+1/2	
	$(3\hat{k}) \times (2\hat{\imath} + \hat{\jmath} + \hat{k}) = \begin{vmatrix} \hat{\imath} & \hat{\jmath} & \hat{k} \\ 0 & 0 & 3 \\ 2 & 1 & 1 \end{vmatrix} = -3\hat{\imath} + 6\hat{\jmath}$	1	
	Hence, the required shortest distance = $\frac{3\sqrt{5}}{\sqrt{6}}$ units	1/2	
	ÖR		
	Find the vector and the cartesian equations of the plane containing the point $\hat{i} + 2\hat{j} - \hat{k}$ and parallel to the lines $\vec{r} = (\hat{i} + 2\hat{j} + 2\hat{k}) + s(2\hat{i} - 3\hat{j} + 2\hat{k})$ and $\vec{r} = (3\hat{i} + \hat{j} - 2\hat{k}) + t(\hat{i} - 3\hat{j} + \hat{k})$ Solution: Since, the plane is parallel to the given lines, the cross product of the vectors $2\hat{i} - 2\hat{k} + 2\hat{k}$ and $\hat{i} - 2\hat{k} + \hat{k}$ will be a normal to the plane.		
	the vectors $2\hat{\imath} - 3\hat{\jmath} + 2\hat{k}$ and $\hat{\imath} - 3\hat{\jmath} + \hat{k}$ will be a normal to the plane $(2\hat{\imath} - 3\hat{\jmath} + 2\hat{k}) \times (\hat{\imath} - 3\hat{\jmath} + \hat{k}) = \begin{vmatrix} \hat{\imath} & \hat{\jmath} & \hat{k} \\ 2 & -3 & 2 \\ 1 & -3 & 1 \end{vmatrix} = 3\hat{\imath} - 3\hat{k}$	1	
	$\begin{vmatrix} 1 & -3 & 1 \\ 1 & -3 & 1 \end{vmatrix}$ The vector equation of the plane is $\vec{r} \cdot (3\hat{\imath} - 3\hat{k}) = (\hat{\imath} + 2\hat{\jmath} - \hat{k}) \cdot (3\hat{\imath} - 3\hat{k})$ or, $\vec{r} \cdot (\hat{\imath} - \hat{k}) = 2$	1	
	and the cartesian equation of the plane is $x - z - 2 = 0$	1	
<u>SECTION – C</u>			
	<u>Section - C</u>		
11.	Evaluate: $\int_{-1}^{2}  x^3 - 3x^2 + 2x  dx$		
11.			
11.	Evaluate: $\int_{-1}^{2}  x^{3} - 3x^{2} + 2x  dx$ Solution: The given definite integral = $\int_{-1}^{2}  x(x - 1)(x - 2)  dx$ $= \int_{-1}^{0}  x(x - 1)(x - 2)  dx + \int_{0}^{1}  x(x - 1)(x - 2)  dx + \int_{1}^{2}  x(x - 1)(x - 2)  dx$	1+1/2	
11.	Evaluate: $\int_{-1}^{2}  x^{3} - 3x^{2} + 2x  dx$ Solution: The given definite integral = $\int_{-1}^{2}  x(x - 1)(x - 2)  dx$ $= \int_{-1}^{0}  x(x - 1)(x - 2)  dx + \int_{0}^{1}  x(x - 1)(x - 2)  dx + \int_{1}^{2}  x(x - 1)(x - 2)  dx$ $= -\int_{-1}^{0} (x^{3} - 3x^{2} + 2x) dx + \int_{0}^{1} (x^{3} - 3x^{2} + 2x) dx - \int_{1}^{2} (x^{3} - 3x^{2} + 2x) dx$	1+1/2 1/2	
11.	Evaluate: $\int_{-1}^{2}  x^{3} - 3x^{2} + 2x  dx$ Solution: The given definite integral = $\int_{-1}^{2}  x(x - 1)(x - 2)  dx$ $= \int_{-1}^{0}  x(x - 1)(x - 2)  dx + \int_{0}^{1}  x(x - 1)(x - 2)  dx + \int_{1}^{2}  x(x - 1)(x - 2)  dx$ $= -\int_{-1}^{0} (x^{3} - 3x^{2} + 2x) dx + \int_{0}^{1} (x^{3} - 3x^{2} + 2x) dx - \int_{1}^{2} (x^{3} - 3x^{2} + 2x) dx$		
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11.	Evaluate: $\int_{-1}^{2}  x^{3} - 3x^{2} + 2x  dx$ Solution: The given definite integral = $\int_{-1}^{2}  x(x - 1)(x - 2)  dx$ $= \int_{-1}^{0}  x(x - 1)(x - 2)  dx + \int_{0}^{1}  x(x - 1)(x - 2)  dx + \int_{1}^{2}  x(x - 1)(x - 2)  dx$ $= -\int_{-1}^{0} (x^{3} - 3x^{2} + 2x) dx + \int_{0}^{1} (x^{3} - 3x^{2} + 2x) dx - \int_{1}^{2} (x^{3} - 3x^{2} + 2x) dx$	1/2	
11.	Evaluate: $\int_{-1}^{2}  x^{3} - 3x^{2} + 2x  dx$ Solution: The given definite integral = $\int_{-1}^{2}  x(x - 1)(x - 2)  dx$ $= \int_{-1}^{0}  x(x - 1)(x - 2)  dx + \int_{0}^{1}  x(x - 1)(x - 2)  dx + \int_{1}^{2}  x(x - 1)(x - 2)  dx$ $= -\int_{-1}^{0} (x^{3} - 3x^{2} + 2x) dx + \int_{0}^{1} (x^{3} - 3x^{2} + 2x) dx - \int_{1}^{2} (x^{3} - 3x^{2} + 2x) dx$ $= -\left[\frac{x^{4}}{4} - x^{3} + x^{2}\right]_{-1}^{0} + \left[\frac{x^{4}}{4} - x^{3} + x^{2}\right]_{0}^{1} - \left[\frac{x^{4}}{4} - x^{3} + x^{2}\right]_{1}^{2}$	1/2	
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	The required area = the shaded area = $\int_0^1 \sqrt{3}x  dx + \int_1^2 \sqrt{4 - x^2}  dx$	
	· -	1
	$=\frac{\sqrt{3}}{2}[x^2]_0^1 + \frac{1}{2}[x\sqrt{4-x^2} + 4\sin^{-1}\frac{x}{2}]_1^2$	
	$=\frac{\sqrt{3}}{2} + \frac{1}{2}\left[2\pi - \sqrt{3} - 2\frac{\pi}{3}\right]$	
	$=\frac{2\pi}{3}$ square units	1
13.	Find the foot of the perpendicular from the point $(1, 2, 0)$ upon the plane $x - 3y + 2z = 9$ . Hence, find the distance of the point $(1, 2, 0)$ from the given	
	x = 3y + 2z = 9. Thence, find the distance of the point (1, 2, 0) from the given plane.	
	Solution: The equation of the line perpendicular to the plane and passing	
	through the point (1, 2, 0) is $x-1$ $y-2$ z	1
	$\frac{x}{1} = \frac{y}{-3} = \frac{z}{2}$	
	The coordinates of the foot of the perpendicular are $(\mu + 1, -3\mu + 2, 2\mu)$ for	1⁄2
	some $\mu$ These coordinates will satisfy the equation of the plane. Hence, we have	
	$\mu + 1 - 3(-3\mu + 2) + 2(2\mu) = 9$	
	$\Rightarrow \mu = 1$	1
	The foot of the perpendicular is $(2, -1, 2)$ .	1⁄2 1
	Hence, the required distance = $\sqrt{(1-2)^2 + (2+1)^2 + (0-2)^2} = \sqrt{14}$ units	

14.	CASE-BASED/DATA-BASED		
	Fig 3		
	An insurance company believes that people can be divided into two classes: those	e who are	
	accident prone and those who are not. The company's statistics show that an accid	ent-prone	
	person will have an accident at sometime within a fixed one-year period with prob	ability 0.6,	
	whereas this probability is 0.2 for a person who is not accident prone. The company k	nows that	
	20 percent of the population is accident prone.		
	Based on the given information, answer the following questions.		
	(i)what is the probability that a new policyholder will have an accident within a		
	year of purchasing a policy?		
	(ii) Suppose that a new policyholder has an accident within a year of purchasing a policy. What is the probability that he or she is accident prone?		
	Solution: Let $E_1$ = The policy holder is accident prone.		
	$E_2$ = The policy holder is not accident prone.		
	E = The new policy holder has an accident within a year of purchasing a		
		1	
	(i) $P(E) = P(E_1) \times P(E/E_1) + P(E_2) \times P(E/E_2)$ $= \frac{20}{100} \times \frac{6}{10} + \frac{80}{100} \times \frac{2}{10} = \frac{7}{25}$	1	
	$= \frac{1}{100} \times \frac{1}{10} + \frac{1}{100} \times \frac{1}{10} = \frac{1}{25}$		
	(ii) By Bayes' Theorem, $P(E_1/E) = \frac{P(E_1) \times P(E/E_1)}{P(E)}$	1	
	$=\frac{\frac{20}{100}\times\frac{6}{10}}{\frac{280}{7}}=\frac{3}{7}$	1	

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