# Sample Question Paper

## **CLASS: XII**

### **Session: 2021-22**

## Mathematics (Code-041)

### Term - 2

### Time Allowed: 2 hours

Maximum Marks: 40

#### **General Instructions:**

- 1. This question paper contains **three sections A, B and C**. Each part is compulsory.
- 2. **Section A** has 6 **short answer type (SA1) questions** of 2 marks each.
- 3. **Section B** has 4 **short answer type (SA2) questions** of 3 marks each.
- 4. **Section C** has 4 **long answer type questions (LA)** of 4 marks each.
- 5. There is an **internal choice** in some of the questions.
- 6. Q14 is a **case-based problem** having 2 sub parts of 2 marks each.

SECTION - A			
1.	Find $\int \frac{\log x}{(1+\log x)^2} dx$	2	
	OR		
	Find $\int \frac{\sin 2x}{\sqrt{9-\cos^4 x}} dx$		
2	1,7 000 %		
2.	Write the sum of the order and the degree of the following differential	2	
	equation: $\frac{d}{d} \left( \frac{dy}{dx} \right) = \frac{1}{2}$		
	$\frac{d}{dx}\left(\frac{dy}{dx}\right) = 5$		
3.	If $\hat{a}$ and $\hat{b}$ are unit vectors, then prove that	2	
	$ \hat{a} + \hat{b}  = 2\cos\frac{\theta}{2}$ , where $\theta$ is the angle between them.		
4.	Find the direction cosines of the following line:	2	
	$\frac{3-x}{-1} = \frac{2y-1}{2} = \frac{z}{4}$		
5.	A bag contains 1 red and 3 white balls. Find the probability distribution of	2	
<i>J</i> .	the number of red balls if 2 balls are drawn at random from the bag one-by-	2	
	one without replacement.		
6.	Two cards are drawn at random from a pack of 52 cards one-by-one without	2	
	replacement. What is the probability of getting first card red and second		
	card Jack?		
	<u>SECTION - B</u>		
7.	Find: $\int \frac{x+1}{(x^2+1)x} dx$	3	
8.	Find the general solution of the following differential equation:	3	
	$x\frac{dy}{dx} = y - x\sin(\frac{y}{x})$		
	OR  Find the particular solution of the following differential equation given that		
	Find the particular solution of the following differential equation, given that $y = 0$ when $y = \frac{\pi}{2}$ .		
	$y = 0 \text{ when } x = \frac{n}{4}$		
	$\frac{dy}{dx} + ycotx = \frac{2}{1 + sinx}$		
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 $\vec{b} = \vec{c}$ .	3	

10.	Find the shortest distance between the following lines: $\vec{r} = (\hat{\imath} + \hat{\jmath} - \hat{k}) + s(2\hat{\imath} + \hat{\jmath} + \hat{k})$ $\vec{r} = (\hat{\imath} + \hat{\jmath} + 2\hat{k}) + t(4\hat{\imath} + 2\hat{\jmath} + 2\hat{k})$ OR Find the vector and the cartesian equations of the plane containing the point $\hat{\imath} + 2\hat{\jmath} - \hat{k} \text{ and parallel to the lines } \vec{r} = (\hat{\imath} + 2\hat{\jmath} + 2\hat{k}) + s(2\hat{\imath} - 3\hat{\jmath} + 2\hat{k}) = 0$ and $\vec{r} = (3\hat{\imath} + \hat{\jmath} - 2\hat{k}) + t(\hat{\imath} - 3\hat{\jmath} + \hat{k}) = 0$ <b>SECTION - C</b>	3
11		1
11.	Evaluate: $\int_{-1}^{2}  x^3 - 3x^2 + 2x  dx$	4
12.	Using integration, find the area of the region in the first quadrant enclosed by the line $x + y = 2$ , the parabola $y^2 = x$ and the x-axis. OR  Using integration, find the area of the region $\{(x,y): 0 \le y \le \sqrt{3}x, x^2 + y^2 \le 4\}$	4
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 plane.	4
14.	CASE-BASED/DATA-BASED  Fig 3	
	An insurance company believes that people can be divided into two classes: the	ose who

An insurance company believes that people can be divided into two classes: those who are accident prone and those who are not. The company's statistics show that an accident-prone person will have an accident at sometime within a fixed one-year period with probability 0.6, whereas this probability is 0.2 for a person who is not accident prone. The company knows that 20 percent of the population is accident prone.

#### Based on the given information, answer the following questions.

ı	based on the given information, answer the following questions.	
	(i) what is the probability that a new policyholder will have an accident	2
	within a year of purchasing a policy?	
Ī	(ii) Suppose that a new policyholder has an accident within a year of	2
	purchasing a policy. What is the probability that he or she is accident prone?	

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# Marking Scheme CLASS: XII

Session: 2021-22 Mathematics (Code-041) Term - 2

# SECTION - A

1. Find: $\int \frac{\log x}{(1+\log x)^2} dx$	
Solution: $\int \frac{\log x}{(1 + \log x)^2} dx = \int \frac{\log x + 1 - 1}{(1 + \log x)^2} dx = \int \frac{1}{1 + \log x} dx - \int \frac{1}{(1 + \log x)^2} dx$	1/2
$= \frac{1}{1 + \log x} \times x - \int \frac{-1}{(1 + \log x)^2} \times \frac{1}{x} \times x dx - \int \frac{1}{(1 + \log x)^2} dx = \frac{x}{1 + \log x} + c$ OR	1+1/2
Find: $\int \frac{\sin 2x}{\sqrt{9-\cos^4 x}} dx$	
Solution: Put $cos^2x = t \Rightarrow -2cosxsinxdx = dt \Rightarrow sin2xdx = -dt$	1
The given integral $= -\int \frac{dt}{\sqrt{3^2 - t^2}} = -\sin^{-1}\frac{t}{3} + c = -\sin^{-1}\frac{\cos^2 x}{3} + c$	1
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 Degree = 1	1 1/2
Sum = 3	1/2
3. If $\hat{a}$ and $\hat{b}$ are unit vectors, then prove that	
$\left  \hat{a} + \hat{b} \right  = 2\cos\frac{\theta}{2}$ , 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
$\left \left \hat{a}+\hat{b}\right ^2=1+1+2cos\theta$	
$=2(1+\cos\theta)=4\cos^2\frac{\theta}{2}$	1/2
$ \hat{a} + \hat{b}  = 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>	1/2
Its direction cosines are $\langle \frac{1}{3\sqrt{2}}, \frac{1}{3\sqrt{2}}, \frac{4}{3\sqrt{2}} \rangle$	1/2

5.	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) = $\frac{1}{4} \times \frac{3}{3} + \frac{3}{4} \times \frac{1}{3} = \frac{6}{12}$	<del>-</del>		1/2
	Probability Distribution Ta	bie:	1	
	P(X)	1	1	1/2
		2	$\overline{2}$	
6.	replacement. What is the probability of getting first card red and second card Jack? Solution: The required probability = P((The first is a red jack card and The			
	second is a jack card) or ( a jack card))	The first is a red non-jack	card and The second is	1
	$= \frac{2}{52} \times \frac{3}{51} + \frac{24}{52} \times \frac{4}{51} = \frac{1}{26}$	OFOTION D		1
		SECTION - B		
7.	Find: $\int \frac{x+1}{(x^2+1)x} dx$			
	Solution: Let $\frac{x+1}{(x^2+1)x} = \frac{Ax+B}{x^2+1} + \frac{C}{x} = \frac{(Ax+B)x+C(x^2+1)}{(x^2+1)x}$			1/2
	Solution. Let $\frac{1}{(x^2+1)x} = \frac{1}{x^2+1} + \frac{1}{x} = \frac{1}{(x^2+1)x}$ $\Rightarrow x + 1 = (Ax + B)x + C(x^2 + 1)$ (An identity)			1/2
	Equating the coefficients, we get			
	B = 1, C = 1, A + C = 0 Hence, $A = -1, B = 1, C = 1$			1/2
	The given integral = $\int \frac{-x+1}{x^2+1} dx + \int \frac{1}{x} dx$			
				1/2
	$= \frac{-1}{2} \int \frac{2x-2}{x^2+1} dx + \int \frac{1}{x} dx$			1/2
	$= \frac{-1}{2} \int \frac{2x}{x^2 + 1} dx + \int \frac{1}{x^2 + 1} dx + \int \frac{1}{x} dx$			
				1+1/2
	$= \frac{-1}{2}\log(x^2 + 1) + \tan^{-1}x + \log x  + c$			
8.	Find the general solution	of the following differential	l equation:	
	$x \frac{dy}{dx} = y - x \sin(\frac{y}{x})$			
	Solution: We have the diff	erential equation:		
	$\frac{dy}{dx} = \frac{y}{x} - \sin(\frac{y}{x})$			
	$\frac{dx}{dx} = \frac{x}{x}$ The equation is a homogeneous differential equation.			
	Putting $y = vx \Rightarrow \frac{dy}{dx} = v + \frac{dy}{dx}$			1
	The differential equation becomes			
	$v + x \frac{dv}{dx} = v - \sin v$			
$\int \frac{dx}{dv} dx = dx$			1/2	
	$\Rightarrow \frac{dv}{\sin v} = -\frac{dx}{x} \Rightarrow \csc v dv = -\frac{dx}{x}$ Integrating both sides, we get		/2	
	Integrating both sides, we get			

$\begin{aligned} & \log[\csc v - \cot v] = -i \operatorname{olg} x_1 + i \operatorname{olg} x, \lambda \geq 0 \text{ (Here, log A is an arbitrary constant.)} \\ & \Rightarrow \log[(\operatorname{cose} v - \cot v) x] = \operatorname{log} x \\ & \Rightarrow ([\operatorname{cose} v - \cot v) x] = K \\ & \Rightarrow (\operatorname{cose} v - \cot v) x = \pm K \\ & \Rightarrow (\operatorname{cose} v - \frac{v}{x} - \cot v - \frac{v}{x}) x = C, \text{ which is the required general solution.} \end{aligned}$ $\begin{aligned} & \text{OR} \\ & \text{Find the particular solution of the following differential equation.} \end{aligned}$ $& \text{If } x = \frac{v}{4} \end{aligned}$ $& \text{Or } x = \frac{v}{4} \end{aligned}$ $& $				
$   \log (\csc c - \cot c ) x  = \log K $ $   (\csc c - \cot c ) x  = K $ $   (\csc c - \cot $		log cosecv - cotv  = -log x  + logK, K > 0 (Here, $logK$ is an arbitrary	1	
$\Rightarrow (cosec v - cotv)x = \pm K$ $\Rightarrow (cosec \frac{v}{x} - cot \frac{v}{x})x = C, \text{ which is the required general solution.}$ $OR$ 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 $IF = e^{\int cotx dx} = e^{\log sinx} = sinx$ The general solution is given by $ysinx = \int 2 \frac{sinx}{1 + sinx} dx$ $\Rightarrow ysinx = 2 \int \frac{sinx + 1 - 1}{1 + sinx} dx = 2 \int [1 - \frac{1}{1 + sinx}] dx$ $\Rightarrow ysinx = 2 \int [1 - \frac{1}{1 + cos(\frac{\pi}{2} - x)}] dx$ $\Rightarrow ysinx = 2 \int [1 - \frac{1}{2cos^2(\frac{\pi}{4} - \frac{x}{2})}] dx$ $\Rightarrow ysinx = 2 \int [1 - \frac{1}{2cos^2(\frac{\pi}{4} - \frac{x}{2})}] dx$ $\Rightarrow ysinx = 2 \int [1 - \frac{1}{2cos^2(\frac{\pi}{4} - \frac{x}{2})}] dx$ $\Rightarrow ysinx = 2[x + tan(\frac{\pi}{4} - \frac{x}{2})] + c$ Given that $y = 0$ , when $x = \frac{\pi}{4}$ . Hence, $0 = 2I_{4}^{\pi} + tan \frac{\pi}{4} + c$ $\Rightarrow c = -\frac{\pi}{2} - 2tan \frac{\pi}{8}$ 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 $\vec{a} \neq \vec{0}$ , $\vec{a}$ , $\vec{b} = \vec{a}$ , $\vec{c}$ , $\vec{a}$ $\vec{c}$ $\vec{b} = \vec{c}$ or $\vec{a} \perp (\vec{b} - \vec{c})$ $\Rightarrow \vec{b} = \vec{c}$ 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 $\vec{a} \parallel (\vec{b} - \vec{c})$ $\Rightarrow \vec{b} = \vec{c}$ 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 $\vec{a} \parallel (\vec{b} - \vec{c})$ $\Rightarrow \vec{b} = \vec{c}$ $\vec{c} = \vec{c} + 2tan \frac{\vec{c}}{\vec{c}} + 2$		,	•	
$ \begin{array}{c} \Rightarrow \left( cosec \frac{y}{x} - cot \frac{y}{x} \right) x = C, \text{ which is the required general solution.} \\ & OR \\ \text{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} \\ \text{Solution:} \\ \text{The differential equation is a linear differential equation} \\ \text{IF} = e^{\int cotx dx} = e^{\log sinx} = sinx \\ \text{The general solution is given by} \\ & ysinx = \int 2 \frac{sinx}{1 + sinx} dx \\ & \Rightarrow ysinx = 2 \int \frac{sinx}{1 + sinx} dx = 2 \int \left[1 - \frac{1}{1 + sinx}\right] dx \\ & \Rightarrow ysinx = 2 \int \left[1 - \frac{1}{1 + cos\left(\frac{\pi}{2} - x\right)}\right] dx \\ & \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}{2cos^2\left(\frac{\pi}{4} - \frac{x}{2}\right)}\right] dx \\ & \Rightarrow ysinx = 2 \left[1 + \tan\left(\frac{\pi}{4} - \frac{x}{2}\right)\right] + c \\ & \text{Given that y} = 0, \text{when } x = \frac{\pi}{4}, \\ & \text{Hence, } 0 = 2 \frac{1}{4}^{\pi} + \tan \frac{\pi}{8} + c \\ & \Rightarrow c = -\frac{\pi}{2} - 2\tan \frac{\pi}{8} \\ & \text{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] \end{aligned}$ $ \begin{array}{c} 9. & \text{If } \vec{a} \neq \vec{0}, \vec{a}. \vec{b} = \vec{a}. \vec{c}, \vec{a} \times \vec{b} = \vec{a} \times \vec{c}, \text{ then show that } \vec{b} = \vec{c}. \\ & \text{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} \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 $				
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 $1F=e^{\int cvtxdx}=e^{\log sinx}=sinx$ The general solution is given by $ysinx=\int 2\frac{sinx}{1+sinx}dx$ $\Rightarrow ysinx=2\int \frac{sinx+1-1}{1+sinx}dx=2\int [1-\frac{1}{1+sinx}]dx$ $\Rightarrow ysinx=2\int [1-\frac{1}{1-cos(\frac{\pi}{2}-x)}]dx$ $\Rightarrow ysinx=2\int [1-\frac{1}{2cos^2}(\frac{\pi}{4}-\frac{x}{2})]dx$ $\Rightarrow ysinx=2\int [1-\frac{1}{2cos^2}(\frac{\pi}{4}-\frac{x}{2})]dx$ $\Rightarrow ysinx=2\int [1-\frac{1}{2cos^2}(\frac{\pi}{4}-\frac{x}{2})]dx$ $\Rightarrow ysinx=2\int [1-\frac{1}{2sec^2}(\frac{\pi}{4}-\frac{x}{2})]dx$ $\Rightarrow ysinx=2[x+\tan(\frac{\pi}{4}-\frac{x}{2})]+c$ 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 $\vec{a}\neq\vec{0}$ , $\vec{a}$ , $\vec{b}$ = $\vec{a}$ , $\vec{c}$ , $\vec{a}$ × $\vec{b}$ = $\vec{a}$ × $\vec{c}$ , then show that $\vec{b}$ = $\vec{c}$ . Solution: We have $\vec{a}$ , $(\vec{b}-\vec{c})=0$ $\Rightarrow (\vec{b}-\vec{c})=\vec{0}$ or $\vec{a}$ ± $(\vec{b}-\vec{c})$ $\Rightarrow \vec{b}$ = $\vec{c}$ or $\vec{c}$ =			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 $1F=e^{\int cotxdx}=e^{icgsinx}=sinx$ The general solution is given by $ysinx=\int 2\frac{sinx}{1+sinx}dx$ $\Rightarrow ysinx=2\int \frac{sinx+1-1}{1+sinx}dx=2\int [1-\frac{1}{1+sinx}]dx$ $\Rightarrow ysinx=2\int [1-\frac{1}{1-cos(\frac{\pi}{2}-x)}]dx$ $\Rightarrow ysinx=2\int [1-\frac{1}{2coc^2(\frac{\pi}{4}-\frac{x}{2})}]dx$ $\Rightarrow ysinx=2\int [1-\frac{1}{2coc^2(\frac{\pi}{4}-\frac{x}{2})}]dx$ $\Rightarrow ysinx=2\int [1-\frac{1}{2coc^2(\frac{\pi}{4}-\frac{x}{2})}]dx$ $\Rightarrow ysinx=2\int [1-\frac{1}{2coc^2(\frac{\pi}{4}-\frac{x}{2})}]dx$ $\Rightarrow ysinx=2\left[x+\tan(\frac{\pi}{4}-\frac{x}{2})\right]+c$ 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 $y=cosecx[2\left\{x+\tan(\frac{\pi}{4}-\frac{x}{2})\right\}-(\frac{\pi}{2}+2tan\frac{\pi}{8})]$ 9. If $\vec{a}\neq\vec{0}$ , $\vec{a}$ , $\vec{b}$ = $\vec{a}$ , $\vec{c}$ , $\vec{a}$ × $\vec{b}$ = $\vec{a}$ × $\vec{c}$ , then show that $\vec{b}$ = $\vec{c}$ . Solution: We have $\vec{a}$ . ( $\vec{b}$ - $\vec{c}$ ) $\Rightarrow \vec{b} = \vec{c}$ or $\vec{a}$ ± ( $\vec{b}$ - $\vec{c}$ ) $\Rightarrow \vec{b} = \vec{c}$ or $\vec{a}$ ± ( $\vec{b}$ - $\vec{c}$ ) $\Rightarrow \vec{b} = \vec{c}$ or $\vec{a}$ ± ( $\vec{b}$ - $\vec{c}$ ) $\Rightarrow \vec{b} = \vec{c}$ or $\vec{a}$ ± ( $\vec{b}$ - $\vec{c}$ ) $\Rightarrow \vec{b} = \vec{c}$ or $\vec{a}$ ± ( $\vec{b}$ - $\vec{c}$ ) $\Rightarrow \vec{b} = \vec{c}$ or $\vec{a}$ ≡ ( $\vec{b}$ - $\vec{c}$ ) $\Rightarrow \vec{b} = \vec{c}$ or $\vec{a}$ ≡ ( $\vec{b}$ - $\vec{c}$ ) $\Rightarrow \vec{b} = \vec{c}$ or $\vec{a}$ ≡ ( $\vec{b}$ - $\vec{c}$ ) $\Rightarrow \vec{b} = \vec{c}$ or $\vec{a}$ ≡ ( $\vec{b}$ - $\vec{c}$ ) $\Rightarrow \vec{b} = \vec{c}$ or $\vec{a}$ ≡ ( $\vec{b}$ - $\vec{c}$ ) $\Rightarrow \vec{b} = \vec{c}$ or $\vec{a}$ ≡ ( $\vec{b}$ - $\vec{c}$ ) $\Rightarrow \vec{b} = \vec{c}$ or $\vec{a}$ ≡ ( $\vec{b}$ - $\vec{c}$ ) $\Rightarrow \vec{b} = \vec{c}$ or $\vec{a}$ ≡ ( $\vec{b}$ - $\vec{c}$ ) $\Rightarrow \vec{b} = \vec{c}$ or $\vec{a}$ ≡ ( $\vec{b}$ - $\vec{c}$ ) $\Rightarrow \vec{b} = \vec{c}$ or $\vec{c}$ ≡ ( $\vec{b}$ - $\vec{c}$ ) $\Rightarrow \vec{b} = \vec{c}$ or $\vec{c}$ ≡ ( $\vec{b}$ - $\vec{c}$ ) $\Rightarrow \vec{b} = \vec{c}$ or $\vec{c}$ ≡ ( $\vec{b}$ - $\vec{c}$ ) $\Rightarrow \vec{b} = \vec{c}$ or $\vec{c}$ ≡ ( $\vec{b}$ - $\vec{c}$ ) $\Rightarrow \vec{b} = \vec{c}$ or $\vec{c}$ ≡ ( $\vec{b}$ - $\vec{c}$ ) $\Rightarrow \vec{b} = \vec{c}$ or $\vec{c}$ ≡ ( $\vec{b}$ - $\vec{c}$ ) $\Rightarrow \vec{b} = \vec{c}$ or $\vec{c}$ ≡ ( $\vec{b}$ - $\vec{c}$ ) $\Rightarrow \vec{c}$ = ( $\vec{c}$ + $\vec{c}$		$\Rightarrow \left( cosec \frac{y}{x} - cot \frac{y}{x} \right) x = C, \text{ which is the required general solution.}$	1/2	
$=0 \text{ when } \mathbf{x} = \frac{\pi}{4};$ $\frac{dy}{dx} + y \cot \mathbf{x} = \frac{2}{1+\sin x}$ Solution:  The differential equation is a linear differential equation $1 \mathbf{F} = e^{\int \cot x dx} = e^{\log x \ln x} = \sin x$ The general solution is given by $y \sin x = \int 2 \frac{\sin x}{1+\sin x} dx$ $\Rightarrow y \sin x = 2 \int \frac{\sin x+1-1}{1+\sin x} dx = 2 \int [1-\frac{1}{1+\sin x}] dx$ $\Rightarrow y \sin x = 2 \int [1-\frac{1}{1+\cos(\frac{\pi}{2}-x)}] dx$ $\Rightarrow y \sin x = 2 \int [1-\frac{1}{2\cos^2(\frac{\pi}{4}-\frac{x}{2})}] dx$ $\Rightarrow y \sin x = 2 \int [1-\frac{1}{2}\sec^2(\frac{\pi}{4}-\frac{x}{2})] dx$ $\Rightarrow y \sin x = 2 [x+\tan(\frac{\pi}{4}-\frac{x}{2})] + c$ Given that $y = 0$ , when $x = \frac{\pi}{4}$ , Hence, $0 = 2[\frac{\pi}{4}+\tan \frac{\pi}{8}] + c$ $\Rightarrow c = -\frac{\pi}{2} - 2\tan \frac{\pi}{8}$ Hence, the particular solution is $y = \csc x[2\{x+\tan(\frac{\pi}{4}-\frac{x}{2})\} - (\frac{\pi}{2}+2\tan \frac{\pi}{8})]$ 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 $\vec{a}$ . $(\vec{b} - \vec{c}) = 0$ $\Rightarrow (\vec{b} - \vec{c}) = \vec{0} \text{ or } \vec{a} \perp (\vec{b} - \vec{c})$ $\Rightarrow \vec{b} = \vec{c} \text{ or } \vec{a} \perp (\vec{b} - \vec{c})$ $\Rightarrow \vec{b} = \vec{c} \text{ or } \vec{a} \parallel (\vec{b} - \vec{c})$ $\Rightarrow \vec{b} = \vec{c} \text{ or } \vec{a} \parallel (\vec{b} - \vec{c})$ $\Rightarrow \vec{b} = \vec{c} \text{ or } \vec{a} \parallel (\vec{b} - \vec{c})$ $\Rightarrow \vec{b} = \vec{c} \text{ or } \vec{a} \parallel (\vec{b} - \vec{c})$ $\Rightarrow \vec{b} = \vec{c} \text{ or } \vec{a} \parallel (\vec{b} - \vec{c})$ $\Rightarrow \vec{b} = \vec{c} \text{ or } \vec{a} \parallel (\vec{b} - \vec{c})$ $\Rightarrow \vec{b} = \vec{c} \text{ or } \vec{a} \parallel (\vec{b} - \vec{c})$ $\Rightarrow \vec{b} = \vec{c} \text{ or } \vec{a} \parallel (\vec{b} - \vec{c})$ $\Rightarrow \vec{b} = \vec{c} \text{ or } \vec{a} \parallel (\vec{b} - \vec{c})$ $\Rightarrow \vec{b} = \vec{c} \text{ or } \vec{a} \parallel (\vec{b} - \vec{c})$ $\Rightarrow \vec{b} = \vec{c} \text{ or } \vec{a} \parallel (\vec{b} - \vec{c})$ $\Rightarrow \vec{b} = \vec{c} \text{ or } \vec{a} \parallel (\vec{b} - \vec{c})$ $\Rightarrow \vec{b} = \vec{c} \text{ or } \vec{a} \parallel (\vec{b} - \vec{c})$ $\Rightarrow \vec{b} = \vec{c} \text{ or } \vec{a} \parallel (\vec{b} - \vec{c})$ $\Rightarrow \vec{b} = \vec{c} \text{ or } \vec{a} \parallel (\vec{b} - \vec{c})$ $\Rightarrow \vec{b} = \vec{c} \text{ or } \vec{a} \parallel (\vec{b} - \vec{c})$ $\Rightarrow \vec{b} = \vec{c} \text{ or } \vec{a} \parallel (\vec{b} - \vec{c})$ $\Rightarrow \vec{b} = \vec{c} \text{ or } \vec{a} \parallel (\vec{b} - \vec{c})$ $\Rightarrow \vec{b} = \vec{c} \text{ or } \vec{a} \parallel (\vec{b} - \vec{c})$ $\Rightarrow \vec{b} = \vec{c} \text{ or } \vec{a} \parallel (\vec{b} - \vec{c})$ $\Rightarrow \vec{b} = \vec{c} \text{ or } \vec{a} \parallel (\vec{b} - \vec{c})$ $\Rightarrow \vec{b} = \vec{c} \text{ or } \vec{a} \parallel (\vec{b} - \vec{c})$ $\Rightarrow \vec{b} = \vec{c} \text{ or } \vec{a} \parallel (\vec{b} - \vec{c})$ $\Rightarrow \vec{b} = \vec{c} \text{ or } \vec{c} \parallel (\vec{b} - \vec{c})$ $\Rightarrow \vec{b} = c$		OR		
$\frac{dy}{dx} + ycotx = \frac{2}{1+sinx}$ Solution: The differential equation is a linear differential equation $I = e^{\int cotxdx} = e^{\log sinx} = sinx$ The general solution is given by $ysinx = \int 2 \frac{sinx}{1+sinx} dx$ $\Rightarrow ysinx = 2 \int \frac{sinx+1-1}{1+sinx} dx = 2 \int [1-\frac{1}{1+sinx}] dx$ $\Rightarrow ysinx = 2 \int [1-\frac{1}{1-cos(\frac{\pi}{4}-\frac{x}{2})}] dx$ $\Rightarrow ysinx = 2 \int [1-\frac{1}{2cos^2}(\frac{\pi}{4}-\frac{x}{2})] dx$ $\Rightarrow ysinx = 2 \int [1-\frac{1}{2cos^2}(\frac{\pi}{4}-\frac{x}{2})] dx$ $\Rightarrow ysinx = 2[x+\tan(\frac{\pi}{4}-\frac{x}{2})] + c$ 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 $\vec{a} \neq \vec{0}$ , $\vec{a}$ , $\vec{b}$ = $\vec{a}$ , $\vec{c}$ , $\vec{d}$ \times $\vec{b}$ = $\vec{c}$ . Solution: We have $\vec{a}$ . ( $\vec{b}$ - $\vec{c}$ ) = 0 $\Rightarrow (\vec{b} - \vec{c}) = \vec{0}$ or $\vec{a} \perp (\vec{b} - \vec{c})$ Also, $\vec{a} \times (\vec{b} - \vec{c}) = \vec{0}$ $\Rightarrow \vec{b} = \vec{c}$ 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 $\vec{a} \parallel (\vec{b} - \vec{c})$ $\Rightarrow \vec{c}$ $\vec{c}$				
Solution: The differential equation is a linear differential equation $ \begin{aligned} &   F = e^{\int \cot x dx} = e^{\log x inx} = \sin x \\ & \text{The general solution is given by} \end{aligned} $ $y \sin x = \int 2 \frac{\sin x}{1 + \sin x} dx $ $\Rightarrow y \sin x = 2 \int \frac{1 - 1}{1 + \sin x} dx = 2 \int [1 - \frac{1}{1 + \sin x}] dx$ $\Rightarrow y \sin x = 2 \int [1 - \frac{1}{1 + \cos (\frac{\pi}{2} - x)}] dx$ $\Rightarrow y \sin x = 2 \int [1 - \frac{1}{2 \cos^2 (\frac{\pi}{4} - \frac{x}{2})}] dx$ $\Rightarrow y \sin x = 2 \int [1 - \frac{1}{2 \cos^2 (\frac{\pi}{4} - \frac{x}{2})}] dx$ $\Rightarrow y \sin x = 2 \int [1 - \frac{1}{2 \cos^2 (\frac{\pi}{4} - \frac{x}{2})}] dx$ $\Rightarrow y \sin x = 2 \int [1 - \frac{1}{2 \cos^2 (\frac{\pi}{4} - \frac{x}{2})}] dx$ $\Rightarrow y \sin x = 2 \int [1 - \frac{1}{2 \cos^2 (\frac{\pi}{4} - \frac{x}{2})}] dx$ $\Rightarrow y \sin x = 2 \int [1 - \frac{1}{2 \cos^2 (\frac{\pi}{4} - \frac{x}{2})}] dx$ $\Rightarrow y \sin x = 2 \int [1 - \frac{1}{2 \cos^2 (\frac{\pi}{4} - \frac{x}{2})}] dx$ $\Rightarrow y \sin x = 2 \int [1 - \frac{1}{2 \cos^2 (\frac{\pi}{4} - \frac{x}{2})}] dx$ $\Rightarrow y \sin x = 2 \int [1 - \frac{1}{2 \cos^2 (\frac{\pi}{4} - \frac{x}{2})}] dx$ $\Rightarrow y \sin x = 2 \int [1 - \frac{1}{2 \cos^2 (\frac{\pi}{4} - \frac{x}{2})}] dx$ $\Rightarrow y \sin x = 2 \int [1 - \frac{1}{2 \cos^2 (\frac{\pi}{4} - \frac{x}{2})}] dx$ $\Rightarrow y \sin x = 2 \int [1 - \frac{1}{2 \cos^2 (\frac{\pi}{4} - \frac{x}{2})}] dx$ $\Rightarrow y \sin x = 2 \int [1 - \frac{1}{2 \cos^2 (\frac{\pi}{4} - \frac{x}{2})}] dx$ $\Rightarrow y \sin x = 2 \int [1 - \frac{1}{2 \cos^2 (\frac{\pi}{4} - \frac{x}{2})}] dx$ $\Rightarrow y \sin x = 2 \int [1 - \frac{1}{2 \cos^2 (\frac{\pi}{4} - \frac{x}{2})}] dx$ $\Rightarrow y \sin x = 2 \int [1 - \frac{1}{2 \cos^2 (\frac{\pi}{4} - \frac{x}{2})}] dx$ $\Rightarrow y \sin x = 2 \int [1 - \frac{1}{2 \cos^2 (\frac{\pi}{4} - \frac{x}{2})}] dx$ $\Rightarrow y \sin x = 2 \int [1 - \frac{1}{2 \cos^2 (\frac{\pi}{4} - \frac{x}{2})}] dx$ $\Rightarrow y \sin x = 2 \int [1 - \frac{1}{2 \cos^2 (\frac{\pi}{4} - \frac{x}{2})}] dx$ $\Rightarrow y \sin x = 2 \int [1 - \frac{1}{2 \cos^2 (\frac{\pi}{4} - \frac{x}{2})}] dx$ $\Rightarrow y \sin x = 2 \int [1 - \frac{1}{2 \cos^2 (\frac{\pi}{4} - \frac{x}{2})}] dx$ $\Rightarrow y \sin x = 2 \int [1 - \frac{1}{2 \cos^2 (\frac{\pi}{4} - \frac{x}{2})}] dx$ $\Rightarrow y \sin x = 2 \int [1 - \frac{1}{2 \cos^2 (\frac{\pi}{4} - \frac{x}{2})}] dx$ $\Rightarrow y \sin x = 2 \int [1 - \frac{1}{2 \cos^2 (\frac{\pi}{4} - \frac{x}{2})}] dx$ $\Rightarrow y \sin x = 2 \int [1 - \frac{1}{2 \cos^2 (\frac{\pi}{4} - \frac{x}{2})}] dx$ $\Rightarrow y \sin x = 2 \int [1 - \frac{1}{2 \cos^2 (\frac{\pi}{4} - \frac{x}{2})}] dx$ $\Rightarrow y \sin x = 2 \int [1 - \frac{1}{2 \cos^2 (\frac{\pi}{4} - \frac{x}{2})}] dx$ $\Rightarrow y \sin x = 2 \int [1 - \frac{1}{2 \cos^2 (\frac{\pi}{4} - \frac{x}{2})}] dx$ $\Rightarrow y \sin x = 2 \int [1 - \frac{1}{2 \cos^2 (\frac{\pi}{4} - \frac{x}{2})}] dx$ $\Rightarrow y \sin x = 2 \int [1 - \frac{1}{2 \cos^2 (\frac{\pi}{4} - \frac{x}{2})}] dx$ $\Rightarrow y \sin x = 2 \int [1 - \frac{1}{$		$= 0 \text{ when } x = \frac{\pi}{4}$ :		
Solution: The differential equation is a linear differential equation $ \begin{aligned} &   F = e^{\int \cot x dx} = e^{\log x inx} = \sin x \\ & \text{The general solution is given by} \end{aligned} $ $y \sin x = \int 2 \frac{\sin x}{1 + \sin x} dx $ $\Rightarrow y \sin x = 2 \int \frac{1 - 1}{1 + \sin x} dx = 2 \int [1 - \frac{1}{1 + \sin x}] dx$ $\Rightarrow y \sin x = 2 \int [1 - \frac{1}{1 + \cos (\frac{\pi}{2} - x)}] dx$ $\Rightarrow y \sin x = 2 \int [1 - \frac{1}{2 \cos^2 (\frac{\pi}{4} - \frac{x}{2})}] dx$ $\Rightarrow y \sin x = 2 \int [1 - \frac{1}{2 \cos^2 (\frac{\pi}{4} - \frac{x}{2})}] dx$ $\Rightarrow y \sin x = 2 \int [1 - \frac{1}{2 \cos^2 (\frac{\pi}{4} - \frac{x}{2})}] dx$ $\Rightarrow y \sin x = 2 \int [1 - \frac{1}{2 \cos^2 (\frac{\pi}{4} - \frac{x}{2})}] dx$ $\Rightarrow y \sin x = 2 \int [1 - \frac{1}{2 \cos^2 (\frac{\pi}{4} - \frac{x}{2})}] dx$ $\Rightarrow y \sin x = 2 \int [1 - \frac{1}{2 \cos^2 (\frac{\pi}{4} - \frac{x}{2})}] dx$ $\Rightarrow y \sin x = 2 \int [1 - \frac{1}{2 \cos^2 (\frac{\pi}{4} - \frac{x}{2})}] dx$ $\Rightarrow y \sin x = 2 \int [1 - \frac{1}{2 \cos^2 (\frac{\pi}{4} - \frac{x}{2})}] dx$ $\Rightarrow y \sin x = 2 \int [1 - \frac{1}{2 \cos^2 (\frac{\pi}{4} - \frac{x}{2})}] dx$ $\Rightarrow y \sin x = 2 \int [1 - \frac{1}{2 \cos^2 (\frac{\pi}{4} - \frac{x}{2})}] dx$ $\Rightarrow y \sin x = 2 \int [1 - \frac{1}{2 \cos^2 (\frac{\pi}{4} - \frac{x}{2})}] dx$ $\Rightarrow y \sin x = 2 \int [1 - \frac{1}{2 \cos^2 (\frac{\pi}{4} - \frac{x}{2})}] dx$ $\Rightarrow y \sin x = 2 \int [1 - \frac{1}{2 \cos^2 (\frac{\pi}{4} - \frac{x}{2})}] dx$ $\Rightarrow y \sin x = 2 \int [1 - \frac{1}{2 \cos^2 (\frac{\pi}{4} - \frac{x}{2})}] dx$ $\Rightarrow y \sin x = 2 \int [1 - \frac{1}{2 \cos^2 (\frac{\pi}{4} - \frac{x}{2})}] dx$ $\Rightarrow y \sin x = 2 \int [1 - \frac{1}{2 \cos^2 (\frac{\pi}{4} - \frac{x}{2})}] dx$ $\Rightarrow y \sin x = 2 \int [1 - \frac{1}{2 \cos^2 (\frac{\pi}{4} - \frac{x}{2})}] dx$ $\Rightarrow y \sin x = 2 \int [1 - \frac{1}{2 \cos^2 (\frac{\pi}{4} - \frac{x}{2})}] dx$ $\Rightarrow y \sin x = 2 \int [1 - \frac{1}{2 \cos^2 (\frac{\pi}{4} - \frac{x}{2})}] dx$ $\Rightarrow y \sin x = 2 \int [1 - \frac{1}{2 \cos^2 (\frac{\pi}{4} - \frac{x}{2})}] dx$ $\Rightarrow y \sin x = 2 \int [1 - \frac{1}{2 \cos^2 (\frac{\pi}{4} - \frac{x}{2})}] dx$ $\Rightarrow y \sin x = 2 \int [1 - \frac{1}{2 \cos^2 (\frac{\pi}{4} - \frac{x}{2})}] dx$ $\Rightarrow y \sin x = 2 \int [1 - \frac{1}{2 \cos^2 (\frac{\pi}{4} - \frac{x}{2})}] dx$ $\Rightarrow y \sin x = 2 \int [1 - \frac{1}{2 \cos^2 (\frac{\pi}{4} - \frac{x}{2})}] dx$ $\Rightarrow y \sin x = 2 \int [1 - \frac{1}{2 \cos^2 (\frac{\pi}{4} - \frac{x}{2})}] dx$ $\Rightarrow y \sin x = 2 \int [1 - \frac{1}{2 \cos^2 (\frac{\pi}{4} - \frac{x}{2})}] dx$ $\Rightarrow y \sin x = 2 \int [1 - \frac{1}{2 \cos^2 (\frac{\pi}{4} - \frac{x}{2})}] dx$ $\Rightarrow y \sin x = 2 \int [1 - \frac{1}{2 \cos^2 (\frac{\pi}{4} - \frac{x}{2})}] dx$ $\Rightarrow y \sin x = 2 \int [1 - \frac{1}{2 \cos^2 (\frac{\pi}{4} - \frac{x}{2})}] dx$ $\Rightarrow y \sin x = 2 \int [1 - \frac{1}{2 \cos^2 (\frac{\pi}{4} - \frac{x}{2})}] dx$ $\Rightarrow y \sin x = 2 \int [1 - \frac{1}{$		$\frac{dy}{dy} + y_{cot} = \frac{2}{y_{cot}}$		
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$ysinx = \int 2 \frac{sinx}{1 + sinx} dx$ $\Rightarrow ysinx = 2 \int \frac{sinx + 1 - 1}{1 + sinx} dx = 2 \int [1 - \frac{1}{1 + sinx}] dx$ $\Rightarrow ysinx = 2 \int [1 - \frac{1}{1 + cos(\frac{\pi}{2} - x)}] dx$ $\Rightarrow ysinx = 2 \int [1 - \frac{1}{2cos^2(\frac{\pi}{4} - \frac{x}{2})}] dx$ $\Rightarrow ysinx = 2 \int [1 - \frac{1}{2}sec^2(\frac{\pi}{4} - \frac{x}{2})] dx$ $\Rightarrow ysinx = 2 \int [1 - \frac{1}{2}sec^2(\frac{\pi}{4} - \frac{x}{2})] dx$ $\Rightarrow ysinx = 2[x + tan(\frac{\pi}{4} - \frac{x}{2})] + c$ 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 $\vec{a} \neq \vec{0}$ , $\vec{a}$ , $\vec{b} = \vec{a}$ , $\vec{c}$ , $\vec{a} \times \vec{b} = \vec{a} \times \vec{c}$ , 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 $\vec{a} \perp (\vec{b} - \vec{c})$ $\Rightarrow \vec{b} = \vec{c}$ 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 $\vec{a} \parallel (\vec{b} - \vec{c})$ $\Rightarrow \vec{b} = \vec{c}$ 10. Find the shortest distance between the following lines: $\vec{r} = (\hat{t} + \hat{j} - \hat{k}) + s(2\hat{t} + \hat{j} + \hat{k})$				
$\Rightarrow ysinx = 2\int \frac{sinx + 1 - 1}{1 + sinx} dx = 2\int [1 - \frac{1}{1 + sinx}] dx$ $\Rightarrow ysinx = 2\int [1 - \frac{1}{1 + \cos(\frac{\pi}{2} - x)}] dx$ $\Rightarrow ysinx = 2\int [1 - \frac{1}{2\cos^2(\frac{\pi}{4} - \frac{x}{2})}] dx$ $\Rightarrow ysinx = 2\int [1 - \frac{1}{2}\sec^2(\frac{\pi}{4} - \frac{x}{2})] dx$ $\Rightarrow ysinx = 2[x + \tan(\frac{\pi}{4} - \frac{x}{2})] + c$ 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 $y = \csc x[2\{x + \tan(\frac{\pi}{4} - \frac{x}{2})\} - (\frac{\pi}{2} + 2tan\frac{\pi}{8})]$ 9. If $\vec{a} \neq \vec{0}$ , $\vec{a}$ , $\vec{b} = \vec{a}$ , $\vec{c}$ , $\vec{a} \times \vec{b} = \vec{a} \times \vec{c}$ , 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 $\vec{a} \parallel (\vec{b} - \vec{c})$ $\Rightarrow \vec{b} = \vec{c}$ or $\vec{a} \parallel (\vec{b} - \vec{c})$ $\Rightarrow \vec{b} = \vec{c}$ or $\vec{a} \parallel (\vec{b} - \vec{c})$ Hence, $\vec{b} = \vec{c}$ .  10. Find the shortest distance between the following lines: $\vec{r} = (\hat{i} + \hat{j} - \hat{k}) + s(2\hat{i} + \hat{j} + \hat{k})$			1/6	
$\Rightarrow ysinx = 2\int \left[1 - \frac{1}{1 + \cos\left(\frac{\pi}{2} - x\right)}\right] dx$ $\Rightarrow ysinx = 2\int \left[1 - \frac{1}{2\cos^2\left(\frac{\pi}{4} - \frac{x}{2}\right)}\right] dx$ $\Rightarrow ysinx = 2\int \left[1 - \frac{1}{2}\sec^2\left(\frac{\pi}{4} - \frac{x}{2}\right)\right] dx$ $\Rightarrow ysinx = 2\left[x + \tan\left(\frac{\pi}{4} - \frac{x}{2}\right)\right] + c$ Given that $y = 0$ , when $x = \frac{\pi}{4}$ , Hence, $0 = 2\left[\frac{\pi}{4} + \tan\frac{\pi}{8}\right] + c$ $\Rightarrow c = -\frac{\pi}{2} - 2\tan\frac{\pi}{8}$ Hence, the particular solution is $y = \csc \left[2\left\{x + \tan\left(\frac{\pi}{4} - \frac{x}{2}\right)\right\} - \left(\frac{\pi}{2} + 2\tan\frac{\pi}{8}\right)\right]$ 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 $\vec{a}$ . $(\vec{b} - \vec{c}) = 0$ $\Rightarrow (\vec{b} - \vec{c}) = \vec{0} \text{ or } \vec{a} \perp (\vec{b} - \vec{c})$ $\Rightarrow \vec{b} = \vec{c} \text{ or } \vec{a} \perp (\vec{b} - \vec{c})$ $\Rightarrow \vec{b} = \vec{c} \text{ or } \vec{a} \parallel (\vec{b} - \vec{c})$ $\Rightarrow \vec{b} = \vec{c} \text{ or } \vec{a} \parallel (\vec{b} - \vec{c})$ $\Rightarrow \vec{b} = \vec{c} \text{ or } \vec{a} \parallel (\vec{b} - \vec{c})$ $\Rightarrow \vec{b} = \vec{c} \text{ or } \vec{a} \parallel (\vec{b} - \vec{c})$ $\Rightarrow \vec{b} = \vec{c} \text{ or } \vec{a} \parallel (\vec{b} - \vec{c})$ $\Rightarrow \vec{b} = \vec{c} \text{ or } \vec{a} \parallel (\vec{b} - \vec{c})$ $\Rightarrow \vec{b} = \vec{c} \text{ or } \vec{a} \parallel (\vec{b} - \vec{c})$ $\Rightarrow \vec{b} = \vec{c} \text{ or } \vec{a} \parallel (\vec{b} - \vec{c})$ $\Rightarrow \vec{b} = \vec{c} \text{ or } \vec{a} \parallel (\vec{b} - \vec{c})$ $\Rightarrow \vec{b} = \vec{c} \text{ or } \vec{a} \parallel (\vec{b} - \vec{c})$ $\Rightarrow \vec{b} = \vec{c} \text{ or } \vec{a} \parallel (\vec{b} - \vec{c})$ $\Rightarrow \vec{b} = \vec{c} \text{ or } \vec{a} \parallel (\vec{b} - \vec{c})$ $\Rightarrow \vec{b} = \vec{c} \text{ or } \vec{a} \parallel (\vec{b} - \vec{c})$ $\Rightarrow \vec{b} = \vec{c} \text{ or } \vec{a} \parallel (\vec{b} - \vec{c})$ $\Rightarrow \vec{b} = \vec{c} \text{ or } \vec{a} \parallel (\vec{b} - \vec{c})$ $\Rightarrow \vec{b} = \vec{c} \text{ or } \vec{a} \parallel (\vec{b} - \vec{c})$ $\Rightarrow \vec{b} = \vec{c} \text{ or } \vec{a} \parallel (\vec{b} - \vec{c})$ $\Rightarrow \vec{b} = \vec{c} \text{ or } \vec{a} \parallel (\vec{b} - \vec{c})$ $\Rightarrow \vec{b} = \vec{c} \text{ or } \vec{a} \parallel (\vec{b} - \vec{c})$ $\Rightarrow \vec{b} = \vec{c} \text{ or } \vec{c} \parallel (\vec{b} - \vec{c})$ $\Rightarrow \vec{b} = \vec{c} \text{ or } \vec{c} \parallel (\vec{b} - \vec{c})$ $\Rightarrow \vec{b} = \vec{c} \text{ or } \vec{c} \parallel (\vec{b} - \vec{c})$ $\Rightarrow \vec{b} = \vec{c} \text{ or } \vec{c} \parallel (\vec{b} - \vec{c})$ $\Rightarrow \vec{b} = \vec{c} \text{ or } \vec{c} \parallel (\vec{b} - \vec{c})$ $\Rightarrow \vec{b} = \vec{c} \text{ or } \vec{c} \parallel (\vec{b} - \vec{c})$ $\Rightarrow \vec{b} = \vec{c} \text{ or } \vec{c} \parallel (\vec{b} - \vec{c})$ $\Rightarrow \vec{c} \parallel (\vec{c} + \vec{c}) + \vec$			/2	
$\Rightarrow ysinx = 2\int [1 - \frac{1}{2cos^2}(\frac{\pi}{4} - \frac{x}{2})]dx$ $\Rightarrow ysinx = 2\int [1 - \frac{1}{2}sec^2(\frac{\pi}{4} - \frac{x}{2})]dx$ $\Rightarrow ysinx = 2[x + \tan(\frac{\pi}{4} - \frac{x}{2})] + c$ 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 $\vec{a} \cdot (\vec{b} - \vec{c}) = 0$ $\Rightarrow (\vec{b} - \vec{c}) = \vec{0} \text{ or } \vec{a} \perp (\vec{b} - \vec{c})$ $\Rightarrow \vec{b} = \vec{c} \text{ or } \vec{a} \perp (\vec{b} - \vec{c})$ $\Rightarrow \vec{b} = \vec{c} \text{ or } \vec{a} \parallel (\vec{b} - \vec{c})$ $\Rightarrow \vec{b} = \vec{c} \text{ or } \vec{a} \parallel (\vec{b} - \vec{c})$ $\Rightarrow \vec{b} = \vec{c} \text{ or } \vec{a} \parallel (\vec{b} - \vec{c})$ $\Rightarrow \vec{b} = \vec{c} \text{ or } \vec{a} \parallel (\vec{b} - \vec{c})$ $\Rightarrow \vec{b} = \vec{c} \text{ or } \vec{a} \parallel (\vec{b} - \vec{c})$ $\Rightarrow \vec{b} = \vec{c} \text{ or } \vec{a} \parallel (\vec{b} - \vec{c})$ $\Rightarrow \vec{b} = \vec{c} \text{ or } \vec{a} \parallel (\vec{b} - \vec{c})$ $\Rightarrow \vec{b} = \vec{c} \text{ or } \vec{a} \parallel (\vec{b} - \vec{c})$ $\Rightarrow \vec{b} = \vec{c} \text{ or } \vec{a} \parallel (\vec{b} - \vec{c})$ $\Rightarrow \vec{b} = \vec{c} \text{ or } \vec{a} \parallel (\vec{b} - \vec{c})$ $\Rightarrow \vec{b} = \vec{c} \text{ or } \vec{a} \parallel (\vec{b} - \vec{c})$ $\Rightarrow \vec{b} = \vec{c} \text{ or } \vec{a} \parallel (\vec{b} - \vec{c})$ $\Rightarrow \vec{b} = \vec{c} \text{ or } \vec{a} \parallel (\vec{b} - \vec{c})$ $\Rightarrow \vec{b} = \vec{c} \text{ or } \vec{a} \parallel (\vec{b} - \vec{c})$ $\Rightarrow \vec{b} = \vec{c} \text{ or } \vec{a} \parallel (\vec{b} - \vec{c})$ $\Rightarrow \vec{b} = \vec{c} \text{ or } \vec{a} \parallel (\vec{b} - \vec{c})$ $\Rightarrow \vec{b} = \vec{c} \text{ or } \vec{a} \parallel (\vec{b} - \vec{c})$ $\Rightarrow \vec{b} = \vec{c} \text{ or } \vec{a} \parallel (\vec{b} - \vec{c})$ $\Rightarrow \vec{b} = \vec{c} \text{ or } \vec{a} \parallel (\vec{b} - \vec{c})$ $\Rightarrow \vec{b} = \vec{c} \text{ or } \vec{a} \parallel (\vec{b} - \vec{c})$ $\Rightarrow \vec{b} = \vec{c} \text{ or } \vec{a} \parallel (\vec{b} - \vec{c})$ $\Rightarrow \vec{b} = \vec{c} \text{ or } \vec{a} \parallel (\vec{b} - \vec{c})$ $\Rightarrow \vec{b} = \vec{c} \text{ or } \vec{a} \parallel (\vec{b} - \vec{c})$ $\Rightarrow \vec{b} = \vec{c} \text{ or } \vec{c} \parallel (\vec{b} - \vec{c})$ $\Rightarrow \vec{b} = \vec{c} \text{ or } \vec{c} \parallel (\vec{b} - \vec{c})$ $\Rightarrow \vec{b} = \vec{c} \text{ or } \vec{c} \parallel (\vec{b} - \vec{c})$ $\Rightarrow \vec{b} = \vec{c} \text{ or } \vec{c} \parallel (\vec{b} - \vec{c})$ $\Rightarrow \vec{c} = \vec{c} \text{ or } \vec{c} \parallel (\vec{c} - \vec{c})$ $\Rightarrow \vec{c} = \vec{c} \text{ or } \vec{c} \parallel (\vec{c} - \vec{c})$				
$\Rightarrow ysinx = 2\int \left[1 - \frac{1}{2}sec^2\left(\frac{\pi}{4} - \frac{x}{2}\right)\right]dx$ $\Rightarrow ysinx = 2\left[x + \tan\left(\frac{\pi}{4} - \frac{x}{2}\right)\right] + c$ 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 $\vec{a} \neq \vec{0}$ , $\vec{a} \cdot \vec{b} = \vec{a} \cdot \vec{c}$ , $\vec{a} \times \vec{b} = \vec{a} \times \vec{c}$ , then show that $\vec{b} = \vec{c}$ .  Solution: We have $\vec{a} \cdot (\vec{b} - \vec{c}) = 0$ $\Rightarrow (\vec{b} - \vec{c}) = \vec{0} \text{ or } \vec{a} \perp (\vec{b} - \vec{c})$ $\Rightarrow \vec{b} = \vec{c} \text{ or } \vec{a} \perp (\vec{b} - \vec{c})$ $\Rightarrow \vec{b} = \vec{c} \text{ or } \vec{a} \parallel (\vec{b} - \vec{c})$ $\Rightarrow \vec{b} = \vec{c} \text{ or } \vec{a} \parallel (\vec{b} - \vec{c})$ $\Rightarrow \vec{b} = \vec{c} \text{ or } \vec{a} \parallel (\vec{b} - \vec{c})$ $\Rightarrow \vec{b} = \vec{c} \text{ or } \vec{a} \parallel (\vec{b} - \vec{c})$ $\Rightarrow \vec{b} = \vec{c} \text{ or } \vec{a} \parallel (\vec{b} - \vec{c})$ $\Rightarrow \vec{b} = \vec{c} \text{ or } \vec{a} \parallel (\vec{b} - \vec{c})$ $\Rightarrow \vec{b} = \vec{c} \text{ or } \vec{a} \parallel (\vec{b} - \vec{c})$ $\Rightarrow \vec{b} = \vec{c} \text{ or } \vec{a} \parallel (\vec{b} - \vec{c})$ $\Rightarrow \vec{b} = \vec{c} \text{ or } \vec{a} \parallel (\vec{b} - \vec{c})$ $\Rightarrow \vec{b} = \vec{c} \text{ or } \vec{a} \parallel (\vec{b} - \vec{c})$ $\Rightarrow \vec{b} = \vec{c} \text{ or } \vec{a} \parallel (\vec{b} - \vec{c})$ $\Rightarrow \vec{b} = \vec{c} \text{ or } \vec{a} \parallel (\vec{b} - \vec{c})$ $\Rightarrow \vec{b} = \vec{c} \text{ or } \vec{a} \parallel (\vec{b} - \vec{c})$ $\Rightarrow \vec{b} = \vec{c} \text{ or } \vec{a} \parallel (\vec{b} - \vec{c})$ $\Rightarrow \vec{b} = \vec{c} \text{ or } \vec{a} \parallel (\vec{b} - \vec{c})$ $\Rightarrow \vec{b} = \vec{c} \text{ or } \vec{a} \parallel (\vec{b} - \vec{c})$ $\Rightarrow \vec{b} = \vec{c} \text{ or } \vec{a} \parallel (\vec{b} - \vec{c})$ $\Rightarrow \vec{b} = \vec{c} \text{ or } \vec{a} \parallel (\vec{b} - \vec{c})$ $\Rightarrow \vec{b} = \vec{c} \text{ or } \vec{c} \parallel (\vec{b} - \vec{c})$ $\Rightarrow \vec{b} = \vec{c} \text{ or } \vec{c} \parallel (\vec{b} - \vec{c})$ $\Rightarrow \vec{b} = \vec{c} \text{ or } \vec{c} \parallel (\vec{b} - \vec{c})$ $\Rightarrow \vec{b} = \vec{c} \text{ or } \vec{c} \parallel (\vec{b} - \vec{c})$ $\Rightarrow \vec{b} = \vec{c} \text{ or } \vec{c} \parallel (\vec{b} - \vec{c})$ $\Rightarrow \vec{b} = \vec{c} \text{ or } \vec{c} \parallel (\vec{b} - \vec{c})$ $\Rightarrow \vec{c} = (\hat{c} + \hat{c}) - \hat{c}) + s(\hat{c} + \hat{c}) + s(\hat{c} + \hat{c}) + s(\hat{c} + \hat{c}) + s(\hat{c} + \hat{c})$ $\Rightarrow \vec{c} = (\hat{c} + \hat{c}) + s(\hat{c} + \hat{c}) + s(\hat{c} + \hat{c}) + s(\hat{c} + \hat{c}) + s(\hat{c} + \hat{c})$		$\Rightarrow y \sin x = 2 \int \left[1 - \frac{1}{1 + \cos\left(\frac{\pi}{2} - x\right)}\right] dx$		
$\Rightarrow ysinx = 2\int \left[1 - \frac{1}{2}sec^2\left(\frac{\pi}{4} - \frac{x}{2}\right)\right]dx$ $\Rightarrow ysinx = 2\left[x + \tan\left(\frac{\pi}{4} - \frac{x}{2}\right)\right] + c$ 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 $\vec{a} \neq \vec{0}$ , $\vec{a} \cdot \vec{b} = \vec{a} \cdot \vec{c}$ , $\vec{a} \times \vec{b} = \vec{a} \times \vec{c}$ , then show that $\vec{b} = \vec{c}$ .  Solution: We have $\vec{a} \cdot (\vec{b} - \vec{c}) = 0$ $\Rightarrow (\vec{b} - \vec{c}) = \vec{0} \text{ or } \vec{a} \perp (\vec{b} - \vec{c})$ $\Rightarrow \vec{b} = \vec{c} \text{ or } \vec{a} \perp (\vec{b} - \vec{c})$ $\Rightarrow \vec{b} = \vec{c} \text{ or } \vec{a} \parallel (\vec{b} - \vec{c})$ $\Rightarrow \vec{b} = \vec{c} \text{ or } \vec{a} \parallel (\vec{b} - \vec{c})$ $\Rightarrow \vec{b} = \vec{c} \text{ or } \vec{a} \parallel (\vec{b} - \vec{c})$ $\Rightarrow \vec{b} = \vec{c} \text{ or } \vec{a} \parallel (\vec{b} - \vec{c})$ $\Rightarrow \vec{b} = \vec{c} \text{ or } \vec{a} \parallel (\vec{b} - \vec{c})$ $\Rightarrow \vec{b} = \vec{c} \text{ or } \vec{a} \parallel (\vec{b} - \vec{c})$ $\Rightarrow \vec{b} = \vec{c} \text{ or } \vec{a} \parallel (\vec{b} - \vec{c})$ $\Rightarrow \vec{b} = \vec{c} \text{ or } \vec{a} \parallel (\vec{b} - \vec{c})$ $\Rightarrow \vec{b} = \vec{c} \text{ or } \vec{a} \parallel (\vec{b} - \vec{c})$ $\Rightarrow \vec{b} = \vec{c} \text{ or } \vec{a} \parallel (\vec{b} - \vec{c})$ $\Rightarrow \vec{b} = \vec{c} \text{ or } \vec{a} \parallel (\vec{b} - \vec{c})$ $\Rightarrow \vec{b} = \vec{c} \text{ or } \vec{a} \parallel (\vec{b} - \vec{c})$ $\Rightarrow \vec{b} = \vec{c} \text{ or } \vec{a} \parallel (\vec{b} - \vec{c})$ $\Rightarrow \vec{b} = \vec{c} \text{ or } \vec{a} \parallel (\vec{b} - \vec{c})$ $\Rightarrow \vec{b} = \vec{c} \text{ or } \vec{a} \parallel (\vec{b} - \vec{c})$ $\Rightarrow \vec{b} = \vec{c} \text{ or } \vec{a} \parallel (\vec{b} - \vec{c})$ $\Rightarrow \vec{b} = \vec{c} \text{ or } \vec{a} \parallel (\vec{b} - \vec{c})$ $\Rightarrow \vec{b} = \vec{c} \text{ or } \vec{a} \parallel (\vec{b} - \vec{c})$ $\Rightarrow \vec{b} = \vec{c} \text{ or } \vec{c} \parallel (\vec{b} - \vec{c})$ $\Rightarrow \vec{b} = \vec{c} \text{ or } \vec{c} \parallel (\vec{b} - \vec{c})$ $\Rightarrow \vec{b} = \vec{c} \text{ or } \vec{c} \parallel (\vec{b} - \vec{c})$ $\Rightarrow \vec{b} = \vec{c} \text{ or } \vec{c} \parallel (\vec{b} - \vec{c})$ $\Rightarrow \vec{b} = \vec{c} \text{ or } \vec{c} \parallel (\vec{b} - \vec{c})$ $\Rightarrow \vec{b} = \vec{c} \text{ or } \vec{c} \parallel (\vec{b} - \vec{c})$ $\Rightarrow \vec{c} = (\hat{c} + \hat{c}) - \hat{c}) + s(\hat{c} + \hat{c}) + s(\hat{c} + \hat{c}) + s(\hat{c} + \hat{c}) + s(\hat{c} + \hat{c})$ $\Rightarrow \vec{c} = (\hat{c} + \hat{c}) + s(\hat{c} + \hat{c}) + s(\hat{c} + \hat{c}) + s(\hat{c} + \hat{c}) + s(\hat{c} + \hat{c})$		$\Rightarrow y \sin x = 2 \int \left[1 - \frac{1}{2\cos^2\left(\frac{\pi}{x} - \frac{x}{x}\right)}\right] dx$		
$\Rightarrow ysinx = 2[x + \tan\left(\frac{\pi}{4} - \frac{x}{2}\right)] + c$ Given that $y = 0$ , when $x = \frac{\pi}{4}$ ,  Hence, $0 = 2[\frac{\pi}{4} + \tan\frac{\pi}{8}] + c$ $\Rightarrow c = -\frac{\pi}{2} - 2\tan\frac{\pi}{8}$ Hence, the particular solution is $y = cosecx[2\{x + \tan\left(\frac{\pi}{4} - \frac{x}{2}\right)\} - \left(\frac{\pi}{2} + 2\tan\frac{\pi}{8}\right)]$ $y = \frac{\pi}{2} + \frac$				
Given that $y=0$ , when $x=\frac{\pi}{4}$ , Hence, $0=2[\frac{\pi}{4}+\tan\frac{\pi}{8}]+c$ $\Rightarrow c=-\frac{\pi}{2}-2\tan\frac{\pi}{8}$ Hence, the particular solution is $y=cosecx[2\left\{x+\tan\left(\frac{\pi}{4}-\frac{x}{2}\right)\right\}-\left(\frac{\pi}{2}+2\tan\frac{\pi}{8}\right)]$ $y_2$ 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 $\vec{a}.(\vec{b}-\vec{c})=0$ $\Rightarrow (\vec{b}-\vec{c})=\vec{0}$ or $\vec{a}\perp(\vec{b}-\vec{c})$ 1 Also, $\vec{a}\times(\vec{b}-\vec{c})=\vec{0}$ or $\vec{a}\parallel(\vec{b}-\vec{c})$ $\Rightarrow \vec{b}=\vec{c}$ or $\vec{a}\parallel(\vec{b}-\vec{c})$ 1 Also, $\vec{a}\times(\vec{b}-\vec{c})=\vec{0}$ or $\vec{a}\parallel(\vec{b}-\vec{c})$ 1 $\vec{a}$ can not be both perpendicular to $(\vec{b}-\vec{c})$ and parallel to $(\vec{b}-\vec{c})$ Hence, $\vec{b}=\vec{c}$ . 1 Find the shortest distance between the following lines: $\vec{r}=(\hat{i}+\hat{j}-\hat{k})+s(2\hat{i}+\hat{j}+\hat{k})$			4	
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$\vec{r} = (\hat{\imath} + \hat{\jmath} + 2\hat{k}) + t(4\hat{\imath} + 2\hat{\jmath} + 2\hat{k})$		I		
		$\vec{r} = (\hat{\imath} + \hat{\jmath} + 2\hat{k}) + t(4\hat{\imath} + 2\hat{\jmath} + 2\hat{k})$		

Solution: Here, the lines are parallel. The shortest distance = $\frac{ (\overrightarrow{a_2} - \overrightarrow{a_1}) \times \overrightarrow{b} }{ \overrightarrow{b} }$	
$= \frac{\left  (3\hat{k}) \times (2\hat{i} + \hat{j} + \hat{k}) \right }{\sqrt{4 + 1 + 1}}$	1+1/2
Y = 1 = 1 =	
$ \begin{vmatrix} (3\hat{k}) \times (2\hat{i} + \hat{j} + \hat{k}) = \begin{vmatrix} \hat{i} & \hat{j} & \hat{k} \\ 0 & 0 & 3 \\ 2 & 1 & 1 \end{vmatrix} = -3\hat{i} + 6\hat{j} $	1
	1/2
Hence, the required shortest distance = $\frac{3\sqrt{5}}{\sqrt{6}}$ units	
OR	
Find the vector and the cartesian equations of the plane containing the point $\hat{\imath} + 2\hat{\jmath} - \hat{k}$ and parallel to the lines $\vec{r} = (\hat{\imath} + 2\hat{\jmath} + 2\hat{k}) + s(2\hat{\imath} - 3\hat{\jmath} + 2\hat{k}) = 0$ and $\vec{r} = (3\hat{\imath} + \hat{\jmath} - 2\hat{k}) + t(\hat{\imath} - 3\hat{\jmath} + \hat{k}) = 0$	
Solution: Since, the plane is parallel to the given lines, the cross product of	
the vectors $2\hat{i} - 3\hat{j} + 2\hat{k}$ and $\hat{i} - 3\hat{j} + \hat{k}$ will be a normal to the plane	
	1
The vector equation of the plane is $\vec{r} \cdot (3\hat{\imath} - 3\hat{k}) = (\hat{\imath} + 2\hat{\jmath} - \hat{k}) \cdot (3\hat{\imath} - 3\hat{k})$	1
or, $\vec{r}$ . $(\hat{\imath} - \hat{k}) = 2$	

1

## **SECTION - C**

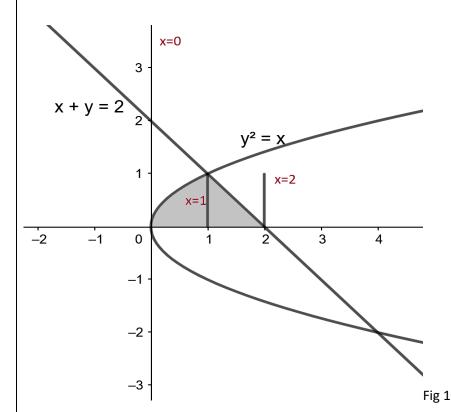
and the cartesian equation of the plane is x - z - 2 = 0

11. Evaluate: 
$$\int_{-1}^{2} |x^3 - 3x^2 + 2x| dx$$
  
Solution: The given definite integral  $= \int_{-1}^{2} |x(x-1)(x-2)| dx$   
 $= \int_{-1}^{0} |x(x-1)(x-2)| dx + \int_{0}^{1} |x(x-1)(x-2)| dx + \int_{1}^{2} |x(x-1)(x-2)| dx$   
 $= -\int_{-1}^{0} (x^3 - 3x^2 + 2x) dx + \int_{0}^{1} (x^3 - 3x^2 + 2x) dx - \int_{1}^{2} (x^3 - 3x^2 + 2x) dx$   
 $= -\left[\frac{x^4}{4} - x^3 + x^2\right]_{-1}^{0} + \left[\frac{x^4}{4} - x^3 + x^2\right]_{0}^{1} - \left[\frac{x^4}{4} - x^3 + x^2\right]_{1}^{2}$   
 $= \frac{9}{4} + \frac{1}{4} + \frac{1}{4} = \frac{11}{4}$ 

Using integration, find the area of the region in the first quadrant enclosed by 12. the line x + y = 2, the parabola  $y^2 = x$  and the x-axis. Solution: Solving x + y = 2 and  $y^2 = x$  simultaneously, we get the points of

intersection as (1, 1) and (4, -2).





1

The required area = the shaded area =  $\int_0^1 \sqrt{x} \, dx + \int_1^2 (2-x) dx$  $= \frac{2}{3} \left[ x^{\frac{3}{2}} \right]_0^1 + \left[ 2x - \frac{x^2}{2} \right]_1^2$  $=\frac{2}{3}+\frac{1}{2}=\frac{7}{6}$  square units

## 1

1

#### OR

Solution: Solving  $y = \sqrt{3}x$  and  $x^2 + y^2 = 4$ , we get the points of intersection as  $(1, \sqrt{3})$  and  $(-1, -\sqrt{3})$ 



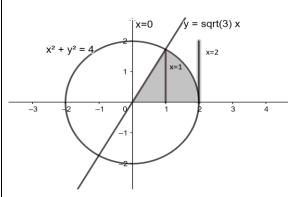


Fig 2

	The required area – the shaded area – $\int_{-1}^{1} \sqrt{2} x  dx + \int_{-1}^{2} \sqrt{4 - x^2}  dx$	
	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	
10.	x - 3y + 2z = 9. Hence, 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	
	$\begin{vmatrix} x-1 & y-2 & z \end{vmatrix}$	1
	$\frac{1}{1} = \frac{1}{-3} = \frac{1}{2}$ The coordinates of the foot of the perpendicular are $(\mu + 1, -3\mu + 2, 2\mu)$ for	1/2
	some $\mu$	/2
	These coordinates will satisfy the equation of the plane. Hence, we have	
		1
	The foot of the perpendicular is (2, -1, 2).	1/2
	Hence, the required distance = $\sqrt{(1-2)^2 + (2+1)^2 + (0-2)^2} = \sqrt{14} \text{ units}$	1



### CASE-BASED/DATA-BASED



Fig 3

An insurance company believes that people can be divided into two classes: those who are accident prone and those who are not. The company's statistics show that an accident-prone person will have an accident at sometime within a fixed one-year period with probability 0.6, whereas this probability is 0.2 for a person who is not accident prone. The company knows 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 <sub>1</sub> = The policy holder is accident prone. E <sub>2</sub> = The policy holder is not accident prone. E = The new policy holder has an accident within a year of purchasing a policy. (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 1
(ii) By Bayes' Theorem, $P(E_1/E) = \frac{P(E_1) \times P(E/E_1)}{P(E)}$ $= \frac{\frac{20}{100} \times \frac{6}{10}}{\frac{280}{7}} = \frac{3}{7}$	1 1

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