ANSWERS (AS 1 - Maths - Class 12 - 23.09.2025)

1	c) symmetric and transitive but not reflecxive	11	c) $\pm 2\sqrt{2}$
2	b) injective only	12	a) tan x + cot x + c
3	d) $\frac{3\pi}{4}$	13	c) 110
4	b) $\frac{-1}{2}$	14	a) 1
5	a) -3	15	d) 0
6	d) 3	16	a) ± 3
7	c) - e^{y-x}	17	D) skew-symmetric matrix
8	b) - y	18	b) $\tan^{-1}(x+1) + C$
9	b) 6 cm/s	19	(C) A is true but R is false
10	a) $\frac{1}{3}e^{x^3}$ + c	20	(D) A is false and R is True

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$CD - AB = 0 \quad \Rightarrow \quad CD = AB$

$AB = \begin{bmatrix} 2 & -1 \\ 3 & 4 \end{bmatrix} \cdot \begin{bmatrix} 5 & 2 \\ 7 & 4 \end{bmatrix} = \begin{bmatrix} 3 & 0 \\ 43 & 22 \end{bmatrix}$

$CD = AB = \begin{bmatrix} 3 & 0 \\ 43 & 22 \end{bmatrix}$

$\det(C) = (2)(8) - (5)(3) = 16 - 15 = 1$

$C^{-1} = \frac{1}{1} \cdot \begin{bmatrix} 8 & -5 \\ -3 & 2 \end{bmatrix} = \begin{bmatrix} 8 & -5 \\ -3 & 2 \end{bmatrix}$

$D = \begin{bmatrix} 8 & -5 \\ -3 & 2 \end{bmatrix} \cdot \begin{bmatrix} 3 & 0 \\ 43 & 22 \end{bmatrix} \begin{bmatrix} -191 & -110 \\ 77 & 44 \end{bmatrix}$

22

$\frac{1}{\cos(x-a)\cos(x-b)}$

$= \frac{1}{\sin(a-b)}\left[\frac{\sin(a-b)}{\cos(x-a)\cos(x-b)}\right]$

$= \frac{1}{\sin(a-b)} \frac{[\sin(x-b)\cos(x-a) - \cos(x-b)\sin(x-a)]}{\cos(x-a)\cos(x-b)}$

$= \frac{1}{\sin(a-b)}[\tan(x-b) - \tan(x-a)]$

$= \frac{1}{\sin(a-b)}[-\log|\cos(x-b)| + \log|\cos(x-a)|] +$

$= \frac{1}{\sin(a-b)}\left[\log\left|\frac{\cos(x-a)}{\cos(x-b)}\right|\right] + C$

$\int \sqrt{x^2+2x+5}\, dx = \int \sqrt{(x+1)^2+4}\, dx$

Put $x + 1 = y, \quad dx = dy.$

$\int \sqrt{x^2+2x+5}\, dx = \int \sqrt{y^2+2^2}\, dy$

$\int \sqrt{x^2+a^2}dx = \frac{1}{2}x\sqrt{x^2+a^2} + \frac{a^2}{2}\log\left| x + \sqrt{x^2+a^2}\right| + C$

$= \frac{1}{2}y\sqrt{y^2+4} + \frac{4}{2}\log\left| y + \sqrt{y^2+4}\right| + C$

$= \frac{1}{2}(x+1)\sqrt{x^2+2x+5} + 2\log\left| x+1+\sqrt{x^2+2x+5}\right| + C$

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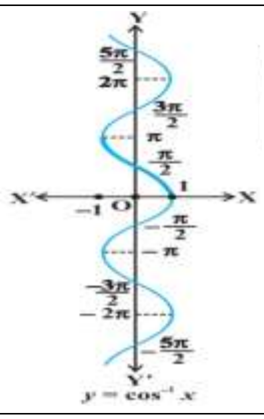

$\sin^{-1}\left(\sin\frac{3\pi}{4}\right) + \cos^{-1}(\cos\pi) + \tan^{-1}(1)$

$= \sin^{-1}\left(\sin\pi - \frac{\pi}{4}\right) + \cos^{-1}(\cos\pi) + \tan^{-1}(\frac{\pi}{4})$

$= \sin^{-1}\left(\sin\frac{\pi}{4}\right) + \pi + \frac{\pi}{4}$ $[\because \sin(\pi - \theta) = \sin\theta]$

$= \frac{\pi}{4} + \pi + \frac{\pi}{4}$

$= \frac{3\pi}{2}$

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Reflexive ∵

· a – a = 0, divisible by 2, ∀ a ∈ A (a , a) ∈ A, ∀ a ∈ A ⇒ R is reflexive.

<u>Symmetric</u>

Let (a , b) ∈ R ⇒ 2 divides a – b , say a – b = 2m

⇒ b – a = –2m ⇒ 2 divides b – a ⇒ (b , a) ∈ R ⇒ R is symmetric.

<u>Transitive:</u> Let (a , b) , (b , c) ∈ R

⇒ 2 divides a – b, say a – b = 2m ⇒ 2 divides b – c, say a – b = 2n

a – b + b – c = 2m + 2n

	$\Rightarrow a - c = 2(m + n)$ $\Rightarrow$ 2 divides $a - c$. $\Rightarrow$ R is Transitive. $\because$ R is reflexive, symmetric and transitive $\therefore$ R is an equivalence relation. . R = {(a, b): 2 divides (a − b)} $\Rightarrow$ (a − b) is a multiple of 2. So, (a − 0) is a multiple of 2 $\Rightarrow$ a is a multiple of 2 So, in set Z of integers, all the multiple of 2 will come in equivalence class {0} Hence, equivalence class {0} = {2x} where x = integer (Z).
25	$\frac{dy}{dx} = -\frac{b\sec^2\theta}{a\sin\theta}$ $\frac{d}{d\theta}\left(-\frac{b\sec^2\theta}{a\sin\theta}\right) = -\frac{(2b\sec^3\theta\tan\theta)(a\sin\theta) - (b\sec^2\theta)(a\cos\theta}{(a\sin\theta)^2}$ $\frac{d^2y}{dx^2} = \frac{2ab\sec^3\theta\tan\theta\sin\theta - ab\sec^2\theta\cos\theta}{a^3\sin^3\theta}$ $\frac{d^2y}{dx^2} = \frac{\frac{8ab}{9} - \frac{2ab\sqrt{3}}{3}}{\frac{1}{8}a^3} = \left(\frac{8ab}{9} - \frac{2ab\sqrt{3}}{3}\right)\cdot\frac{8}{a^3} = \frac{8b}{a^2}\cdot\frac{8 - 6\sqrt{3}}{9}$ $\sec^2\theta = \left(\frac{2}{\sqrt{3}}\right)^2 = \frac{4}{3}$ $\sec^3\theta = \left(\frac{2}{\sqrt{3}}\right)^3 = \frac{8}{3\sqrt{3}}$ $\tan\theta = \frac{1}{\sqrt{3}}$ $\sin\theta = \frac{1}{2}$ $\cos\theta = \frac{\sqrt{3}}{2}$
26	$y\sqrt{1-x^2} + x\sqrt{1-y^2} = 1$ $\frac{dy}{dx}\cdot\sqrt{1-x^2} - \frac{xy}{\sqrt{1-x^2}} + \sqrt{1-y^2} - \frac{xy}{\sqrt{1-y^2}}\cdot\frac{dy}{dx} = 0$ $\frac{dy}{dx}\left(\sqrt{1-x^2} - \frac{xy}{\sqrt{1-y^2}}\right) = \frac{xy}{\sqrt{1-x^2}} - \sqrt{1-y^2}$ $\frac{dy}{dx} = \frac{\frac{xy}{\sqrt{1-x^2}} - \sqrt{1-y^2}}{\sqrt{1-x^2} - \frac{xy}{\sqrt{1-y^2}}}$ $\frac{dy}{dx} = -\sqrt{\frac{1-y^2}{1-x^2}}$
27	Let $I = \int 1\cdot\tan^{-1}x\,dx$ $I = \tan^{-1}x\int 1\,dx - \int\left\{\left(\frac{d}{dx}\tan^{-1}x\right)\int 1\cdot dx\right\}dx$ $= \tan^{-1}x\cdot x - \int\frac{1}{1+x^2}\cdot x\,dx$ $= x\tan^{-1}x - \frac{1}{2}\int\frac{2x}{1+x^2}dx$ $= x\tan^{-1}x - \frac{1}{2}\log\lvert 1+x^2\rvert + C$ $= x\tan^{-1}x - \frac{1}{2}\log(1+x^2) + C$ $\tan^{-1}x = x\tan^{-1}x - \frac{1}{2}\log(1+x^2) + C$ $e^x\left(\frac{1+\sin x}{1+\cos x}\right) = e^x\left(\frac{\sin^2\left(\frac{x}{2}\right) + \cos^2\left(\frac{x}{2}\right) + 2\sin\frac{x}{2}.\cos\frac{x}{2}}{2\cos^2\left(\frac{x}{2}\right)}\right)$ $= e^x\left(\frac{\left(\sin\frac{x}{2} + \cos\frac{x}{2}\right)^2}{2\cos^2\left(\frac{x}{2}\right)}\right) = \frac{e^x}{2}\left(\frac{\sin\frac{x}{2} + \cos\frac{x}{2}}{\cos\frac{x}{2}}\right)^2$ $= \frac{e^x}{2}\left(\tan\frac{x}{2} + 1\right)^2 = \frac{e^x}{2}\left(\tan^2\frac{x}{2} + 1 + 2\tan\frac{x}{2}\right)$ $e^x\left(\frac{1+\sin x}{1+\cos x}\right) = \frac{e^x}{2}\left(\sec^2\frac{x}{2} + 2\tan\left(\frac{x}{2}\right)\right)$ $= e^x\left(\tan\left(\frac{x}{2}\right) + \frac{1}{2}\sec^2\left(\frac{x}{2}\right)\right)$ $\int e^x\left(\frac{1+\sin x}{1+\cos x}\right)dx = \int e^x\left(\tan\left(\frac{x}{2}\right) + \frac{1}{2}\sec^2\left(\frac{x}{2}\right)\right)dx$ $\int e^x\left(\frac{1+\sin x}{1+\cos x}\right)dx = e^x\tan\frac{x}{2} + C$

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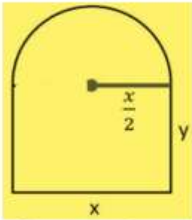
Let Length of rectangle be x & breadth of rectangle be y

Diameter of semicircle = x ∴ Radius of semicircle = $\frac{x}{2}$

Perimeter of window = 10 m



$$x + 2y + \pi\left(\frac{x}{2}\right) = 10$$

$$2y = 10 - x - \frac{\pi x}{2}$$

$$y = 5 - x\left(\frac{1}{2} + \frac{\pi}{4}\right)$$

Area of window = Area of rectangle + Area of Semicircle

$$A = xy + \frac{1}{2}\times\pi\left(\frac{x}{2}\right)^2 = x\left(5 - x\left(\frac{1}{2}+\frac{\pi}{4}\right)\right) + \frac{1}{2}\times\frac{\pi x^2}{4}$$

$$A = 5x - \frac{1}{2}x^2 - \frac{\pi x^2}{4} + \frac{\pi x^2}{8} = 5x - \frac{1}{2}x^2 - \frac{\pi x^2}{8}$$

$$\frac{dA}{dx} = \frac{d\left(5x - \frac{1}{2}x^2 - \frac{\pi x^2}{8}\right)}{dx} = 5 - x - \frac{\pi x}{4}$$

Putting $\frac{dA}{dx} = 0$ ⇒ $0 = 5 - x - \frac{\pi x}{4}$

$x + \frac{\pi x}{4} = 5$ ⇒ $\left(1 + \frac{\pi}{4}\right)x = 5$

$$x = \frac{20}{\pi + 4}$$

$$\frac{d^2A}{dx^2} = \frac{d\left(5 - x - \frac{\pi x}{4}\right)}{dx} = -1 - \frac{\pi}{4} < 0$$

$\frac{d^2A}{dx^2} < 0$ at $x = \frac{20}{\pi+4}$; A is maximum when $x = \frac{20}{\pi+4}$

$y = 5 - x\left(\frac{1}{2}+\frac{\pi}{4}\right) = 5 - \frac{20}{\pi+4}\left(\frac{1}{2}+\frac{\pi}{4}\right)$ ⇒ $y = \frac{10}{\pi+4}$

Hence, for maximum area,

Length = $x = \frac{20}{\pi+4}$ m & Breadth = $y = \frac{10}{\pi+4}$ **m**

- OR -

$V = x^2y$ ......(i)

$S = x^2 + 4xy$ ....(ii)

On putting $y = \frac{V}{x^2}$ $\quad S = x^2 + 4x.\frac{V}{x^2}$

On differentiating both side w.r.t x, we get

$$\frac{dS}{dx} = 2x - \frac{4V}{x^2}$$

put $\frac{dS}{dx} = 0$

$$2x - \frac{4V}{x^2} = 0$$

$$2y = x \text{ or } y = \frac{x}{2}$$

Also, $\frac{d^2S}{dx^2} = \frac{d}{dx}\left(\frac{dS}{dx}\right) = \frac{d}{dx}\left(2x - \frac{4V}{x^2}\right) = 2 + \frac{8y}{x} > 0,$

or S is minimum. Hence, total surface area of the tank is least, when depth is half of its width

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$$f(\alpha) = \begin{bmatrix}\cos\alpha & -\sin\alpha & 0\\ \sin\alpha & \cos\alpha & 0\\ 0 & 0 & 1\end{bmatrix}, \quad f(\beta) = \begin{bmatrix}\cos\beta & -\sin\beta & 0\\ \sin\beta & \cos\beta & 0\\ 0 & 0 & 1\end{bmatrix}$$

$$\begin{bmatrix}\cos\alpha & -\sin\alpha & 0\\ \sin\alpha & \cos\alpha & 0\\ 0 & 0 & 1\end{bmatrix}\cdot\begin{bmatrix}\cos\beta & -\sin\beta & 0\\ \sin\beta & \cos\beta & 0\\ 0 & 0 & 1\end{bmatrix} = \begin{bmatrix}\cos\alpha\cos\beta - \sin\alpha\sin\beta & -\cos\alpha\sin\beta - \sin\alpha\cos\beta & 0\\ \sin\alpha\cos\beta + \cos\alpha\sin\beta & -\sin\alpha\sin\beta + \cos\alpha\cos\beta & 0\\ 0 & 0 & 1\end{bmatrix}$$

$$f(\alpha)\cdot f(\beta) = \begin{bmatrix}\cos(\alpha+\beta) & -\sin(\alpha+\beta) & 0\\ \sin(\alpha+\beta) & \cos(\alpha+\beta) & 0\\ 0 & 0 & 1\end{bmatrix} = f(\alpha+\beta)$$

$$\cos\alpha\cos\beta - \sin\alpha\sin\beta = \cos(\alpha+\beta)$$

$$\sin\alpha\cos\beta + \cos\alpha\sin\beta = \sin(\alpha+\beta)$$

$$A = \begin{bmatrix}3 & 1\\ -1 & 2\end{bmatrix}$$

$$LHS = A^2 - 5A + 7I$$

$$= \begin{bmatrix}3 & 1\\ -1 & 2\end{bmatrix}\begin{bmatrix}3 & 1\\ -1 & 2\end{bmatrix} - 5\begin{bmatrix}3 & 1\\ -1 & 2\end{bmatrix} + 7\begin{bmatrix}1 & 0\\ 0 & 1\end{bmatrix}$$

$$= \begin{bmatrix}9-1 & 3+2\\ -3-2 & -1+4\end{bmatrix} - \begin{bmatrix}15 & 5\\ -5 & 10\end{bmatrix} + \begin{bmatrix}7 & 0\\ 0 & 7\end{bmatrix}$$

$$= \begin{bmatrix}8-15+7 & 5-5+0\\ -5+5+0 & 3-10+7\end{bmatrix}$$

$$= \begin{bmatrix}0 & 0\\ 0 & 0\end{bmatrix} = O = RHS$$

$$\Rightarrow A^2 - 5A + 7I = O \quad \Rightarrow AI - 5I = -7A^{-1}$$

$$\Rightarrow 7A^{-1} = 5I - A = 5\begin{bmatrix}1 & 0\\ 0 & 1\end{bmatrix} - \begin{bmatrix}3 & 1\\ -1 & 2\end{bmatrix}$$

$$= \begin{bmatrix}5 & 0\\ 0 & 5\end{bmatrix} - \begin{bmatrix}3 & 1\\ -1 & 2\end{bmatrix} = \begin{bmatrix}2 & -1\\ 1 & 3\end{bmatrix}$$

$$\Rightarrow A^{-1} = \frac{1}{7}\begin{bmatrix}2 & -1\\ 1 & 3\end{bmatrix}$$

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$$A=\begin{bmatrix}2&-2&-4\\-1&3&4\\1&-2&-3\end{bmatrix}\quad A^T=\begin{bmatrix}2&-1&1\\-2&3&-2\\-4&4&-3\end{bmatrix}$$

$$A+A^T=\begin{bmatrix}2+2&-2+(-1)&-4+1\\-1+(-2)&3+3&4+(-2)\\1+(-4)&-2+4&-3+(-3)\end{bmatrix}=\begin{bmatrix}4&-3&-3\\-3&6&2\\-3&2&-6\end{bmatrix}$$

$$S=\frac{1}{2}\begin{bmatrix}4&-3&-3\\-3&6&2\\-3&2&-6\end{bmatrix}=\begin{bmatrix}2&-1.5&-1.5\\-1.5&3&1\\-1.5&1&-3\end{bmatrix}$$

$$A-A^T=\begin{bmatrix}2-2&-2-(-1)&-4-1\\-1-(-2)&3-3&4-(-2)\\1-(-4)&-2-4&-3-(-3)\end{bmatrix}=\begin{bmatrix}0&-1&-5\\1&0&6\\5&-6&0\end{bmatrix}$$

$$K=\frac{1}{2}\begin{bmatrix}0&-1&-5\\1&0&6\\5&-6&0\end{bmatrix}=\begin{bmatrix}0&-0.5&-2.5\\0.5&0&3\\2.5&-3&0\end{bmatrix}$$

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$$f(x)=\frac{x^4}{4}-x^3-5x^2+24x+12$$

$$f'(x)=x^3-3x^2-10x+24$$

$$f'(x)=(x-2)(x-4)(x+3)$$

$f(x)$ is **increasing** when $f'(x)>0$:

- On intervals: $(-3,2)\cup(4,\infty)$

$f(x)$ is **decreasing** when $f'(x)<0$:

- On intervals: $(-\infty,-3)\cup(2,4)$

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$$A=\begin{bmatrix}1&1&1\\4&3&2\\6&2&3\end{bmatrix},\quad X=\begin{bmatrix}x\\y\\z\end{bmatrix},\quad B=\begin{bmatrix}21\\60\\70\end{bmatrix}$$

$$\det(A)=1(3\cdot3-2\cdot2)-1(4\cdot3-2\cdot6)+1(4\cdot2-3\cdot6)$$
$$=1(9-4)-1(12-12)+1(8-18)$$
$$=1(5)-1(0)+1(-10)$$
$$=5-0-10$$
$$=-5$$

$$\text{adj}(A)=\begin{bmatrix}5&-1&-1\\0&-3&2\\-10&4&-1\end{bmatrix}$$

$$X=\frac{1}{-5}\begin{bmatrix}5&-1&-1\\0&-3&2\\-10&4&-1\end{bmatrix}\cdot\begin{bmatrix}21\\60\\70\end{bmatrix}=\begin{bmatrix}-25\\-40\\-40\end{bmatrix}$$

$$X=\begin{bmatrix}-25\div-5\\-40\div-5\\-40\div-5\end{bmatrix}=\begin{bmatrix}5\\8\\8\end{bmatrix}$$

33

$f(x)=\sqrt{16-x^2}$

$x=2,\ f(x)=\sqrt{12}$ $\qquad x=-2, f(x)=\sqrt{12}$

Since, for x = 2 and -2, the function has same image

∴ The given function is not one-one.

$y=\sqrt{16-x^2}$

$y^2=16-x^2$

$x=\sqrt{16-y^2}$ $\qquad (4-y)(4+y)\geq0$

∴ For every $y\in[0,4]\ \exists\ x\in[-4,4]$ such that y = f(x

∴ The given function is onto

$f(a)=\sqrt{12}$

$\sqrt{16-y^2}=\sqrt{7}$

$16-a^2=7$

$a^2=9$

$a=\pm3$

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Given that $y=Ae^{mx}+Be^{nx}$, therefore,

$$\frac{dy}{dx}=\frac{d}{dx}(Ae^{mx}+Be^{nx})=mAe^{mx}+nBe^{nx}$$

$$\Rightarrow\frac{d^2y}{dx^2}=\frac{d}{dx}(mAe^{mx}+nBe^{nx})=m^2Ae^{mx}+n^2Be^{nx}$$

$$\text{LHS}=(m^2Ae^{mx}+n^2Be^{nx})-(m+n)(mAe^{mx}+nBe^{nx})+mny$$

$$=m^2Ae^{mx}+n^2Be^{nx}-(m^2Ae^{mx}+mnBe^{nx}+mnAe^{mx}+n^2Be^{nx})+mny$$

$$=-(mnAe^{mx}+mnBe^{nx})+mny\ =-mn(Ae^{mx}+Be^{nx})+mny\ =-mny+mny=0=\text{RHS}$$

34 OR	$u = (\log x)^x$ $\frac{du}{dx} = u\left[\frac{1}{\log x} + \log(\log x)\right] = (\log x)^x\left[\frac{1}{\log x} + \log(\log x)\right]$ $v = x^{\log x}$ $\frac{1}{v}\frac{dv}{dx} = 2\log x\frac{d}{dx}(\log x) = 2\log x \times \frac{1}{x}$ $\Rightarrow \frac{dv}{dx} = v\left[\frac{2\log x}{x}\right] = x^{\log x}\left[\frac{2\log x}{x}\right]$ $\frac{dy}{dx} = (\log x)^x\left[\frac{1}{\log x} + \log(\log x)\right] + x^{\log x}\left[\frac{2\log x}{x}\right]$ $\Rightarrow \frac{dy}{dx} = (\log x)^{x-1}\left[1 + \log x \log(\log x)\right] + 2x^{\log x - 1}.\log x$	
35	Let $5x - 2 = A\frac{d}{dx}(1 + 2x + 3x^2) + B$ $\Rightarrow 5x - 2 = A(2 + 6x) + B$ $5 = 6A \Rightarrow A = \frac{5}{6}$ $2A + B = -2 \Rightarrow B = -\frac{11}{3}$ $\therefore 5x - 2 = \frac{5}{6}(2 + 6x) + \left(-\frac{11}{3}\right)$ $\Rightarrow \int \frac{5x-2}{1+2x+3x^2}dx = \int \frac{\frac{5}{6}(2+6x) - \frac{11}{3}}{1+2x+3x^2}dx$ $= \frac{5}{6}\int \frac{2+6x}{1+2x+3x^2}dx - \frac{11}{3}\int \frac{1}{1+2x+3x^2}dx$	$I_1 = \int \frac{2+6x}{1+2x+3x^2}dx$ $I_1 = \log\|1 + 2x + 3x^2\|$ $I_2 = \int \frac{1}{1+2x+3x^2}dx$ $I_2 = \frac{1}{3}\int \frac{1}{\left[\left(x+\frac{1}{3}\right)^2 + \left(\frac{\sqrt{2}}{3}\right)^2\right]}dx$ $= \frac{1}{3}\left[\frac{1}{\frac{\sqrt{2}}{3}}\tan^{-1}\left(\frac{x+\frac{1}{3}}{\frac{\sqrt{2}}{3}}\right)\right]$ $= \frac{1}{3}\left[\frac{3}{\sqrt{2}}\tan^{-1}\left(\frac{3x+1}{\sqrt{2}}\right)\right]$ $\int \frac{5x-2}{1+2x+3x^2}dx$ $= \frac{5}{6}\log\|1 + 2x + 3x^2\| - \frac{11}{3\sqrt{2}}\tan^{-1}\left(\frac{3x+1}{\sqrt{2}}\right) + C$
	Let $t = x^2$ $\frac{(x^2+1)(x^2+2)}{(x^2+3)(x^2+4)} = \frac{(t+1)(t+2)}{(t+3)(t+4)}$ $= \frac{t^2+3t+2}{t^2+7t+12}$ $\frac{t^2+3t+2}{t^2+7t+12} = 1 + \frac{-4t-10}{t^2+7t+12}$ $= 1 + \frac{-(4t+10)}{(t+3)(t+4)}$ $\frac{4t+10}{(t+3)(t+4)} = \frac{A}{(t+3)} + \frac{B}{(t+4)}$ $\frac{4t+10}{(t+3)(t+4)} = \frac{A(t+4)+B(t+3)}{(t+3)(t+4)}$ $4t - 10 = A(t+4) + B(t+3)$ ⇒ $A = -2 \quad B = 6$	$\frac{4t+10}{(t+3)(t+4)} = \frac{-2}{(t+3)} + \frac{6}{(t+4)}$ $\frac{4x^2-10}{(x^2+3)(x^2+4)} = \frac{-2}{(x^2+3)} + \frac{6}{(x^2+4)}$ $\int \frac{(x^2+1)(x^2+2)}{(x^2+3)(x^2+4)} = \int 1 - \left[\frac{-2}{(x^2+3)} + \frac{6}{(x^2+4)}\right]dx$ $= \int 1.dx + \int \frac{2}{(x^2+3)}dx - \int \frac{6}{(x^2+4)}dx$ $= \int 1.dx + 2\int \frac{1}{x^2+(\sqrt{3})^2}dx - 6\int \frac{1}{(x^2+2^2)}dx$ $= x + 2\times\frac{1}{\sqrt{3}}\tan^{-1}\frac{x}{\sqrt{3}} - 6\times\frac{1}{2}\tan^{-1}\frac{x}{2} + C$ $= x + \frac{2}{\sqrt{3}}\tan^{-1}\left(\frac{x}{\sqrt{3}}\right) - 3\tan^{-1}\left(\frac{x}{2}\right) + C$
36	1. **Symmetric Relation**: A relation R on a set A is symmetric if for every $(a, b) \in R$, $(b, a) \in R$. **Checking Symmetry**: ● Given $(l_1, l_2) \in R$ l implies 1 is parallel to l_2. ● Parallelism is symmetric: If is parallel to , then $l2$ is also parallel to $l1$ ● Hence, $(l_2, l_1) \in R$ whenever $(l_1, l_2) \in R$. Therefore, the relation R is symmetric.	

	Set of Rail Lines Related to the Given Line: If one of the rail lines on the railway track is represented by the equation 2, we need to find the set of rail lines in R related to it. **Equation of the Given Line**: ● The given line is y = 3x + 2. **Finding Related Lines**: ● Lines related to this one are parallel lines with the same slope, which is . ● The general equation of lines parallel to $y = 3x + 2$ is $y = 3x + c$, where c is any real number. Therefore, the set of rail lines in R related to $y = 3x + 2$ is: $\{y = 3x + c \mid c \in R\}$		
37	$F = \frac{40^2}{500} - \frac{40}{4} + 14$ $F = \frac{1600}{500} - 10 + 14$ $F = 3.2 - 10 + 14$ $F = 7.2$ $\frac{dF}{dV} = \frac{d}{dV}\left(\frac{V^2}{500} - \frac{V}{4} + 14\right)$ $\frac{dF}{dV} = \frac{2V}{500} - \frac{1}{4}$ $\frac{dF}{dV} = \frac{V}{250} - \frac{1}{4}$	$\frac{V}{250} - \frac{1}{4} = 0$ $\frac{V}{250} = \frac{1}{4}$ $V = \frac{250}{4}$ $V = 62.5$	Given: $\frac{V}{250} - \frac{1}{4} = -0.01$ $V = 60$ Now, find F when $V = 60$: $F = \frac{60^2}{500} - \frac{60}{4} + 14$ $F = 6.2$ $\text{Fuel required} = \frac{6.2}{100} \times 600$ $\text{Fuel required} = 6.2 \times 6$ $\text{Fuel required} = 37.2$
38	$3x - 5y = 15000$ $4x - 7y = 15000$ $\begin{bmatrix} 3 & -5 \\ 4 & -7 \end{bmatrix} \begin{bmatrix} x \\ y \end{bmatrix} = \begin{bmatrix} 15000 \\ 15000 \end{bmatrix}$ $A^{-1} = \frac{1}{-1}\begin{bmatrix} -7 & 5 \\ -4 & 3 \end{bmatrix} = \begin{bmatrix} 7 & -5 \\ 4 & -3 \end{bmatrix}$		X = 30000 & y = 15000 **Monthly income of Rita** = ₹3x = ₹3 × 30,000 = ₹**90,000** **Monthly income of Ritika** = ₹4x = ₹4 × 30,000 = ₹**1,20,000**