

Q1

a)

$$(i) \frac{(x+5)}{3} - \frac{(x-1)}{4} = \frac{x+3}{5}$$

$$3 \times 4 \times 5 = 60$$

$$\frac{60(x+5)}{3} - \frac{60(x-1)}{4} = \frac{60(x+3)}{5}$$

20 15 12

$$20(x+5) - 15(x-1) = 12(x+3)$$

$$20x + 100 - 15x + 15 = 12x + 36$$

$$100 + 15 - 36 = 12x - 15x + 20x$$

$$79 = 7x$$

$$x = \frac{79}{7} = 11.29$$

$$(ii) 2 \ln(2x+4) = \ln(2x+1) + \ln(4x+3)$$

$$\ln(2x+4)^2 = \ln(2x+1)(4x+3)$$

$$(2x+4)(2x+4) = (2x+1)(4x+3)$$

$$4x^2 + 8x + 8x + 16 = 8x^2 + 6x + 4x + 3$$

$$4x^2 + 16x + 16 = 12x + 3$$

$$4x^2 + 6x + 13 = 0$$

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

$$= \frac{-6 \pm \sqrt{6^2 - 4 \times 4 \times 13}}{2 \times 4} = \frac{-6 \pm \sqrt{36 - 208}}{8}$$

$$x =$$

$$x =$$

* Math error on calculator

$$\begin{aligned}
 \text{(iii)} \quad 5^{x+3} &= 2 \times 4^x \\
 \log 5^{x+3} &= \log 2 + \log 4^x \\
 (x+3) \log 5 &= \log 2 + x \log 4 \\
 (x+3) 0.70 &= 0.30 + 0.60x \\
 0.70x + 2.10 &= 0.30 + 0.60x \\
 0.70x - 0.60x &= 0.30 - 2.10 \\
 0.10x &= -1.8 \\
 x &= \frac{-1.8}{0.10} = -18
 \end{aligned}$$

Q2

$$\begin{aligned}
 \text{a)} \quad 11x^2 &= -6x + 17 \\
 11x^2 + 6x - 17 &= 0 \\
 x &= \frac{-b \pm \sqrt{b^2 - 4ac}}{2a} \\
 &= \frac{-6 \pm \sqrt{6^2 - 4 \times 11 \times -17}}{2 \times 11}
 \end{aligned}$$

$$x = 1$$

$$x = -1.55$$

b)

$$\begin{aligned}
 \text{(i)} \quad x^2 + 6x + 8 &= 0 \\
 (x+2)(x+4) & \\
 x = -2 \quad x = -4 &
 \end{aligned}$$

$$\begin{aligned}
 \text{(ii)} \quad x^2 - 10x + 24 &= 0 \\
 (x-6)(x-4) &= \\
 x = 6 \quad x = 4 &
 \end{aligned}$$

$$\begin{aligned}
 \text{(iii)} \quad x^2 - 64 &= 0 \\
 (x+8)(x-8) & \\
 x = -8 \quad x = +8 &
 \end{aligned}$$

(iii)

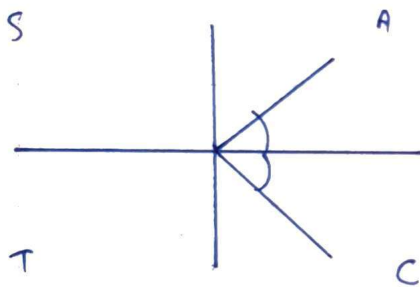
2 b)

$$\begin{aligned} \text{(iv)} \quad 2x^2 + 3x &= 14 \\ 2x^2 + 3x - 14 &= 0 \\ (2x + 7)(x - 2) \\ x &= -7 \quad x = +2 \end{aligned}$$

Q3

a)

$$\begin{aligned} \text{(i)} \quad \cos x &= 0.24 \\ x &= \cos^{-1}(0.24) \\ &= 76.11 \end{aligned}$$

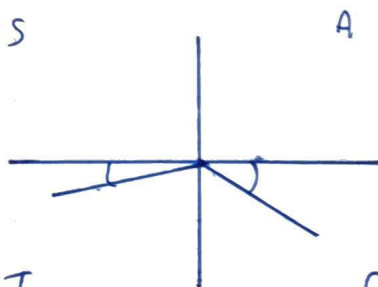


$$x = 76.11^\circ$$

$$x = 360 - 76.11 = 283.89^\circ$$

$$\begin{aligned} \text{(ii)} \quad -7 \sin x &= 4 \\ \sin x &= \frac{4}{-7} = -0.57 \end{aligned}$$

$$\begin{aligned} x &= \sin^{-1}(0.57) = \\ &= 34.75 \end{aligned}$$



$$x = 360 - 34.75 = 325.25$$

$$x = 180 + 34.75 = 214.75$$

Q 3c)

$$(iii) \tan^2 x - 7 \tan x + 10 = 0$$

$$x^2 - 7x + 10 = 0$$

$$(x-2)(x-5)$$

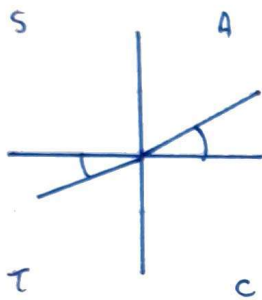
$$(\tan x - 2)(\tan x - 5) = 0$$

$$\tan x - 2 = 0 \quad | \quad \tan x - 5 = 0$$

$$\tan x = 2 \quad | \quad \tan x = 5$$

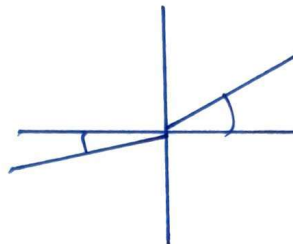
$$x = \tan^{-1}(2) \quad | \quad x = \tan^{-1}(5)$$

$$= 63.43 \quad | \quad = 78.69$$



$$x = 63.43$$

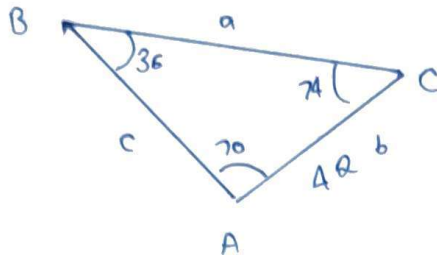
$$x = 180 + 63.43 = 243.43$$



$$x = 78.69$$

$$x = 180 + 78.69 = 258.69$$

Q4



$$(i) \angle C = 180 - 70 - 36 \\ = 74^\circ$$

$$(ii) \frac{a}{\sin A} = \frac{c}{\sin C}$$

$$\frac{42}{\sin 36} = \frac{c}{\sin 74}$$

$$\frac{42}{\sin 36} \times \sin 74 = c$$

$$c = 68.69 \text{ m}$$

$$(iii) a^2 = b^2 + c^2 - 2bc \cos A \\ a = \sqrt{42^2 + 68.69^2 - 2 \times 42 \times 68.69 \times \cos(70)} \\ = 67.15 \text{ m}$$

Q5)

a)

$$(i) y = 3x^2 - 5x + e^{2x} \\ \frac{dy}{dx} = 6x - 5 + 2e^{2x}$$

$$(ii) y = (x^2 + 5)^2 \\ y = (x^2 + 5)(x^2 + 5) \\ = 2x^4 + 5x^2 + 5x^2 + 25 \\ = 2x^4 + 10x^2 + 25$$

$$\frac{dy}{dx} = 8x^3 + 20x$$

Q5a)

$$(iii) y = \sqrt[3]{x} - \frac{2}{x^5}$$
$$= x^{\frac{1}{3}} - 2x^{-5}$$

$$\frac{dy}{dx} = 0.33x^{-0.67} + 10x^{-6}$$

$$(iv) y = 2\sin 4x + \cos 5x - \tan \frac{x}{5}$$
$$y = 2\sin 4x + \cos 5x - \tan x^{-5}$$
$$\frac{dy}{dx} = 8\cos 4x + 5\sin 5x - 5\sec^2 5x$$

$$(v) y = x^5 e^{3x}$$
$$\frac{dy}{dx} = V \frac{du}{dx} + U \frac{dv}{dx}$$
$$V = e^{3x} \quad U = x^5$$
$$\frac{du}{dx} = 5x^4 \quad \frac{dv}{dx} = 3e^{3x}$$
$$\frac{dy}{dx} = (e^{3x})(5x^4) + (x^5)(3e^{3x})$$

$$(vi) y = \frac{\sin 3x}{e^{2x}}$$
$$\frac{dy}{dx} = \frac{V \frac{du}{dx} - U \frac{dv}{dx}}{V^2}$$
$$V = e^{2x} \quad U = \sin 3x$$
$$\frac{du}{dx} = 3\cos 3x \quad \frac{dv}{dx} = 2e^{2x}$$
$$\frac{dy}{dx} = \frac{(e^{2x})(3\cos 3x) - (\sin 3x)(2e^{2x})}{(e^{2x})^2}$$

Q5a)

$$(vii) \quad y = (x^3 - 2x + 5)^5$$

$$\frac{dy}{dx} = \frac{dy}{du} \times \frac{du}{dx}$$

$$y = (x^3 - 2x + 5)^5$$

$$\frac{dy}{dx} = 5(x^3 - 2x + 5)^4 (3x^2 - 2)$$

$$(viii) \quad y = \sin^{-1}\left(\frac{x}{4}\right)$$

$$b) \quad y = x^2 + 9x - 2$$

$$y = 2x^2 + 13x - 7$$

2-1

$$0 = x^2 + 4x - 7$$

$$= (x \quad)(x \quad)$$

Q5)

c) $z = x^3 - 2x^2y^3 + y^4$

$x \rightarrow \frac{\partial z}{\partial x} = 3x^2 - 4xy^3$

$y \rightarrow \frac{\partial^2 z}{\partial x^2} = 6x - 4y^3$

$\frac{\partial^2 z}{\partial y \partial x} = -12xy^2$

$z = x^3 - 2x^2y^3 + y^4$

$y \rightarrow \frac{\partial z}{\partial y} = -6x^2y^2 + 4y^3$

$x \rightarrow \frac{\partial^2 z}{\partial y^2} = -12x^2y + 12y^2$

$\frac{\partial^2 z}{\partial x \partial y} = -12xy^2$