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

$$\begin{array}{r|rr} 2x & 4 \\ \hline 2x & 4x^2 & 8x \\ \hline 4 & 8x & 16 \end{array}$$

$$\begin{array}{r|rr} 2x & 1 \\ \hline 4x & 8x^2 & 4x \\ \hline 3 & 6x & 3 \end{array}$$

$$4x^2 + 16x + 16 = 8x^2 + 10x + 3$$

~~$$4x^2 - 6x - 13 = 0$$~~

~~$$(\quad)(\quad) = 0$$~~

$$\begin{array}{ccc} 4x^2 & -6x & -13 = 0 \\ a & b & c \end{array}$$

$$x = \frac{6 \pm \sqrt{(-6)^2 - 4 \times 4 \times (-13)}}{2 \times 4}$$

$$x = \frac{6 + \sqrt{244}}{8}$$

$$x = \underline{2.7}$$

$$x = \frac{6 - \sqrt{244}}{8}$$

$$x = \underline{-1.2}$$

$$b) i) x^2 + 6x + 8 = 0$$

$$(x+2)(x+4) = 0$$

$$\underline{x = -2} \quad \underline{x = -4}$$

$$ii) x^2 - 10x + 24 = 0$$

$$(x-6)(x-4) = 0$$

$$\underline{x = 6} \quad \underline{x = 4}$$

$$iii) x^2 - 64 = 0$$

$$(x-8)(x+8) = 0$$

$$\underline{x = 8} \quad \underline{x = -8}$$

$$iv) 2x^2 + 3x = 14$$

$$2x^2 + 3x - 14 = 0$$

$$(x-2)(2x+7) = 0$$

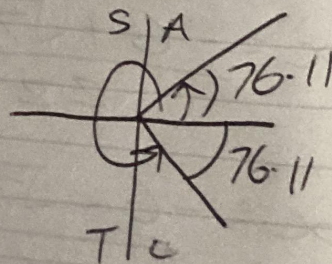
$$\underline{x = 2} \quad \underline{x = -\frac{7}{2}}$$

③ a) $0^\circ \leq x \leq 360^\circ$

i) $\cos x = 0.24$

$$\underline{x = 76.11^\circ}$$

$$\underline{x = 76.11^\circ, 283.89^\circ}$$



$$\text{iii)} \quad 5^{x+3} = 2 \times 4^x$$

$$\log 5^{x+3} = \log(2 \times 4^x)$$

$$\log 5^{x+3} = \log 2 + \log 4^x$$

$$(x+3)\log 5 = \log 2 + x\log 4$$

$$(x+3)0.6990 = 0.3010 + 0.6021x$$

$$0.6990x + 2.097 = 0.3010 + 0.6021x$$

$$0.0969x = -1.796$$

$$\underline{x = -18.53}$$

②

$$\text{a)} \quad 11x^2 = -6x + 17$$

$$11x^2 + 6x - 17 = 0$$

a b c

$$x = \frac{-6 \pm \sqrt{(-6)^2 - 4 \times 11 \times (-17)}}{2 \times 11}$$

$$x = \frac{-6 \pm \sqrt{784}}{22}$$

$$x = \frac{-6 + \sqrt{784}}{22}$$

$$\underline{x = 1}$$

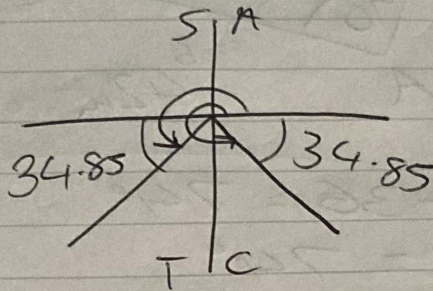
$$x = \frac{-6 - \sqrt{784}}{22}$$

$$\underline{x = \frac{-17}{11}}$$

$$\text{ii) } -7\sin x = 4$$

$$\sin x = -\frac{4}{7}$$

$$x = -34.85^\circ$$



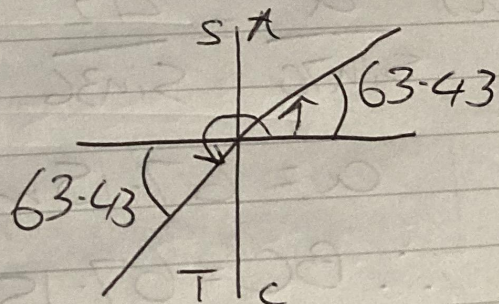
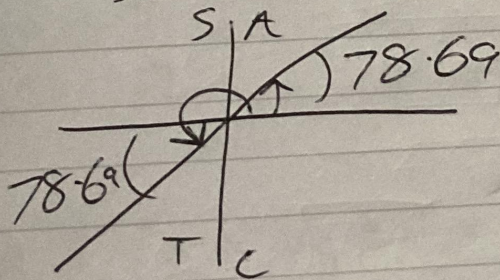
$$x = 214.85^\circ, 325.15^\circ$$

$$\text{iii) } \tan^2 x - 7\tan x + 10 = 0$$

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

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

$$x = 78.69^\circ \quad x = 63.43^\circ$$



$$x = 78.69^\circ, 258.69^\circ, 63.43^\circ, 243.43^\circ$$

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Nathan Skyrme

①

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

~~x+3~~

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

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

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

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

$$5x + 115 = 12x + 36$$

$$7x = 79$$

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

$$\underline{x = 11.29}$$

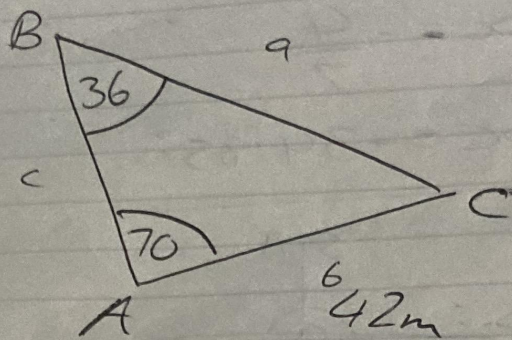
ii) $2 \ln(2x+4) = \ln(2x+1) + \ln(4x+3)$

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

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

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④



$$\begin{aligned} \text{i) } 180 - 70 - 36 &= 74^\circ \\ \therefore C &= 74^\circ \end{aligned}$$

$$\text{ii) } \frac{c}{\sin 74} = \frac{42}{\sin 36}$$

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

$$\therefore AB = 68.69\text{m}$$

$$\text{iii) } \frac{a}{\sin 70} = \frac{42}{\sin 36}$$

$$a = 67.15\text{m}$$

$$\therefore BC = 67.15\text{m}$$

⑤ a) i) $y = 3x^2 - 5x + e^{2x}$

$$\frac{dy}{dx} = 6x - 5 + 2e^{2x}$$

ii) $y = (x^2 + 5)^2$

	x^2	5
x^2	x^4	$5x^2$
5	$5x^2$	25

$$y = x^4 + 10x^2 + 25$$

$$\frac{dy}{dx} = 4x^3 + 20x$$

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

$$y = x^{\frac{1}{3}} - 2x^{-5}$$

$$\frac{dy}{dx} = \frac{1}{3}x^{-\frac{2}{3}} + 10x^{-6}$$

iv) $y = 2\sin 4x + \cos 5x - \tan^{\frac{x}{5}}$

$$\frac{dy}{dx} = 8\cos 4x - 5\sin 5x - \frac{1}{5}\sec^{\frac{x}{5}}$$

$$V) y = x^5 e^{3x}$$

$$u = x^5$$

$$v = e^{3x}$$

$$du = 5x^4$$

$$dv = 3e^{3x}$$

$$\frac{dy}{dx} = \frac{x^5 3e^{3x} + e^{3x} 5x^4}{}$$

$$Vi) y = \frac{\sin 3x}{e^{2x}}$$

$$u = \sin 3x$$

$$v = e^{2x}$$

$$du = 3\cos 3x$$

$$dv = 2e^{2x}$$

$$\frac{dy}{dx} = \frac{e^{2x} 3\cos 3x - \sin 3x 2e^{2x}}{(e^{2x})^2}$$

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

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

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

$$\frac{dy}{dx} = \frac{1}{\sqrt{4^2 - x^2}}$$

$$\frac{dy}{dx} = \frac{1}{\sqrt{4^2 - x^2}}$$

$$\frac{dy}{dx} = \frac{1}{\sqrt{16 - x^2}}$$

$$V) y = x^5 e^{3x}$$

$$u = x^5$$

$$v = e^{3x}$$

$$du = 5x^4$$

$$dv = 3e^{3x}$$

$$\frac{dy}{dx} = \underline{x^5 3e^{3x} + e^{3x} 5x^4}$$

$$vi) y = \frac{\sin 3x}{e^{2x}}$$

$$u = \sin 3x$$

$$v = e^{2x}$$

$$du = 3\cos 3x$$

$$dv = 2e^{2x}$$

$$\frac{dy}{dx} = \frac{e^{2x} 3\cos 3x - \sin 3x 2e^{2x}}{(e^{2x})^2}$$

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

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

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

$$\frac{dy}{dx} = \frac{1}{\sqrt{1 - \frac{x^2}{16}}}$$

$$\frac{dy}{dx} = \frac{1}{\sqrt{4^2 - x^2}}$$

$$\frac{dy}{dx} = \frac{1}{\sqrt{16 - x^2}}$$

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

$$y = 2x^2 + 13x - 7 \quad (1)$$

$$(1) - (2)$$

$$x^2 + 4x - 5 = 0$$

$$(x-1)(x+5) = 0$$

$$\underline{x=1} \quad \underline{x=-5}$$

$$y = (1)^2 + 9 \times (1) - 2$$

$$\underline{y = 8}$$

$$y = (-5)^2 + 9 \times (-5) - 2$$

$$\underline{y = -22}$$

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

$$\frac{dz}{dx} = 3x^2 - 4xy^3$$

$$\frac{dz}{dy} = -6x^2y^2 + 4y^3$$

$$\frac{d^2z}{dx^2} = 6x - 4y^3$$

$$\frac{d^2z}{dy^2} = -12x^2y + 12y^2$$

$$\frac{d^2z}{dydx^2} = -12xy^2$$

$$\frac{d^2z}{dydx^2} = -12xy^2$$