

Q1)

a)

$$\Delta x = \left(\frac{V + V_0}{2} \right) t \quad [V_0]$$

$$\frac{\Delta x}{t} = \frac{V + V_0}{2}$$

$$\frac{2\Delta x}{t} = V + V_0$$

$$\frac{2\Delta x}{t} - V = V_0$$

$$\Delta x = 500$$

$$t = 10$$

$$V = 30$$

$$\frac{2(500)}{10} - 30 = V_0$$

$$100 - 30 = V_0$$

$$70.0 = V_0$$

$$\uparrow$$

$$\underline{1dp}$$

$$b) \quad (i) \quad \frac{5x-2}{3} = \frac{7x+6}{2}$$

$$2(5x-2) = 3(7x+6)$$

$$10x-4 = 21x+18$$

$$-4-18 = 21x-10x$$

$$-22 = 11x$$

$$\frac{-22}{11} = x$$

$$\boxed{-2 = x}$$

$$(ii) \quad \frac{x+5}{3} = \frac{x}{6} - \frac{5x-1}{12} \quad \times 12$$

$$12 \frac{(x+5)}{3} = \frac{12x}{6} - \frac{12(5x-1)}{12}$$

$$4x+20 = 2x-5x+1$$

$$4x+5x-2x = 1-20$$

$$7x = -19$$

$$\boxed{x = \frac{-19}{7} = -2.71}$$

$$(iii) \quad 2\ln(2x+3) = \ln(x+3) + \ln(x+2)$$

$$\cancel{\ln}(2x+3)^2 = \cancel{\ln}(x+3)(x+2)$$

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

$$4x^2 + 6x + 6x + 9 = x^2 + 2x + 3x + 6$$

$$4x^2 + 12x + 9 = x^2 + 5x + 6$$

$$3x^2 + 7x + 3 = 0$$

using formula gives $x = -1.77$
 $x = -0.57$

$$(iv) \quad \cancel{8x} \quad 5^x \times 8 = 3^{x+4}$$

$$\ln(5^x \times 8) = \ln 3^{x+4}$$

$$x \ln 5 + \ln 8 = (x+4) \ln 3$$

$$1.61x + 2.08 = 1.10x + 4.40$$

$$1.61x - 1.10x = 4.40 - 2.08$$

$$0.51x = 2.32$$

$$x = 4.55$$

c)

$$(i) (8x+3)(x-1)$$

/ /

$$(ii) (3x+7y)(3x-7y)$$

/ /

$$(iii) xt - xr + yt - yr$$

$$x(t-r) + y(t-r)$$

/

$$(x+y)(t-r)$$

/ /

$$d) (i) 3x^2 - 5x = 2$$

$$3x^2 - 5x - 2 = 0$$

$$(3x+1)(x-2) = 0$$

/ /

$$x = -\frac{1}{3} \quad x = 2$$

/

$$(ii) x^2 + 5x + 6 = 0$$

$$(x+2)(x+3) = 0$$

/

$$x = -2 \quad x = -3$$

/ /

$$(iii) x^2 - 81 = 0$$

$$(x+9)(x-9)$$

$$x = \pm 9$$

$$(iv) 4x^2 + 9x + 5$$

$$(4x+5)(x+1) = 0$$

$$x = -\frac{5}{4} \quad x = -1$$

/ / / /

$$e) (3x+1)(2x-1) - (x+2)^2 = 5$$

$$6x^2 - 3x + 2x - 1 - [x^2 + 4x + 4] = 5$$

$$6x^2 - x - 1 - x^2 - 4x - 4 = 5$$

$$5x^2 - 5x - 5 = 5$$

$$5x^2 - 5x - 10 = 0$$

$$\therefore x^2 - x - 2 = 0$$

$$(x-2)(x+1) = 0$$

$$\boxed{x=2} \quad \boxed{x=-1}$$

Q2)

$$a) \begin{array}{ccc} a & b & c \\ \downarrow & \downarrow & \downarrow \\ 16x^2 & + 3x & - 8 = 0 \end{array}$$

$$x = \frac{-3 \pm \sqrt{(3)^2 - 4(16)(-8)}}{2(16)}$$

$$x = \frac{-3 \pm \sqrt{9 + 512}}{32}$$

$$x = \frac{-3 \pm \sqrt{521}}{32}$$

$$x = \frac{-3 \pm 22.83}{32}$$

$$\boxed{x = 0.62}$$

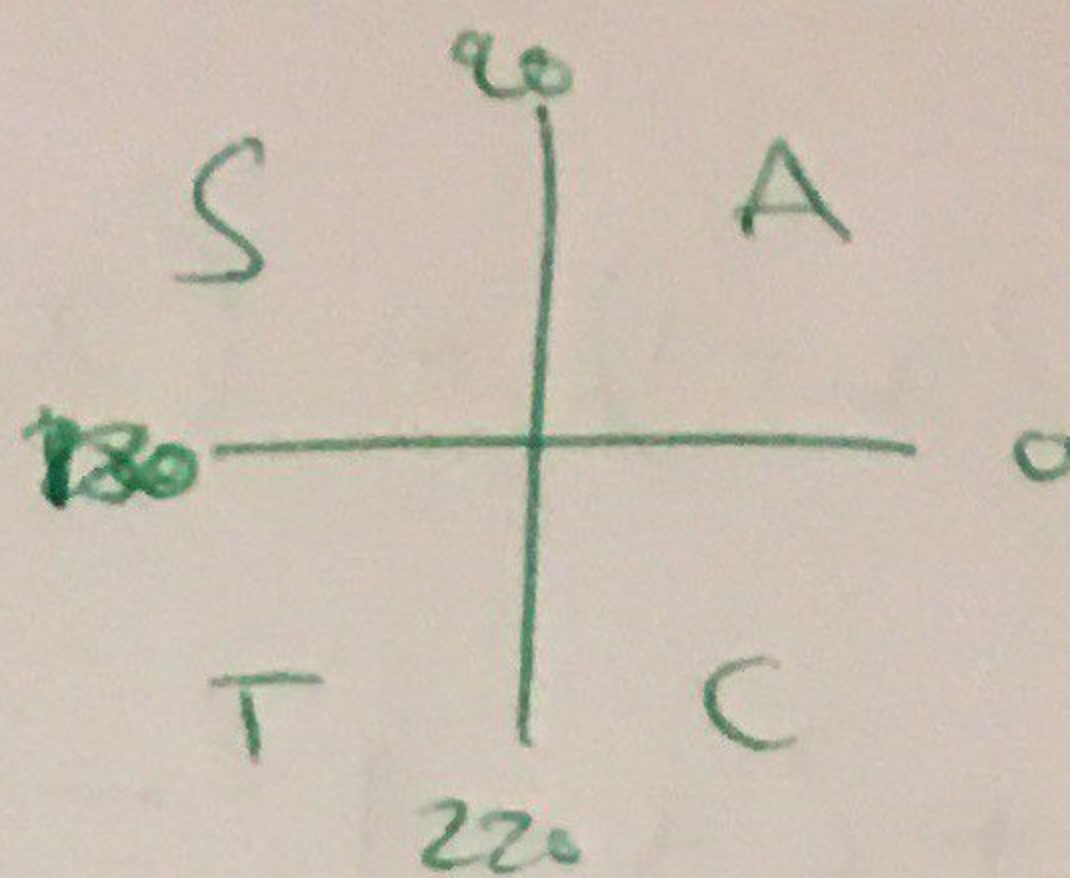
$$\boxed{x = -0.81}$$

$$b) (i) \tan x = 0.7$$

$$x = \tan^{-1}(0.7)$$

$$x = 35^\circ$$

$$x = 215$$



$$(ii) -\frac{2}{3} \cos x = 2$$

$$\cos x = -\frac{2}{3}$$

$$\cos x = \frac{2}{3} \quad x \rightarrow 48.19 \text{ (ref angle)}$$

$$x = 131.81^\circ$$

$$x = 228.19^\circ$$

$$(iii) 5 \sin x = 4$$

$$\sin x = \frac{4}{5}$$

$$x = 53.13^\circ$$

$$x = 126.87^\circ$$

$$c) \quad (x+5)(x+2)$$

$$\therefore (\tan x + 5)(\tan x + 2)$$

$$\tan x = -5$$

$$\tan x = -2$$

$$\tan x = 5$$

$$\tan x = 2$$

$$x = 78.69 \leftarrow \text{not answer}$$

$$x = 63.43 \leftarrow \text{not answer}$$

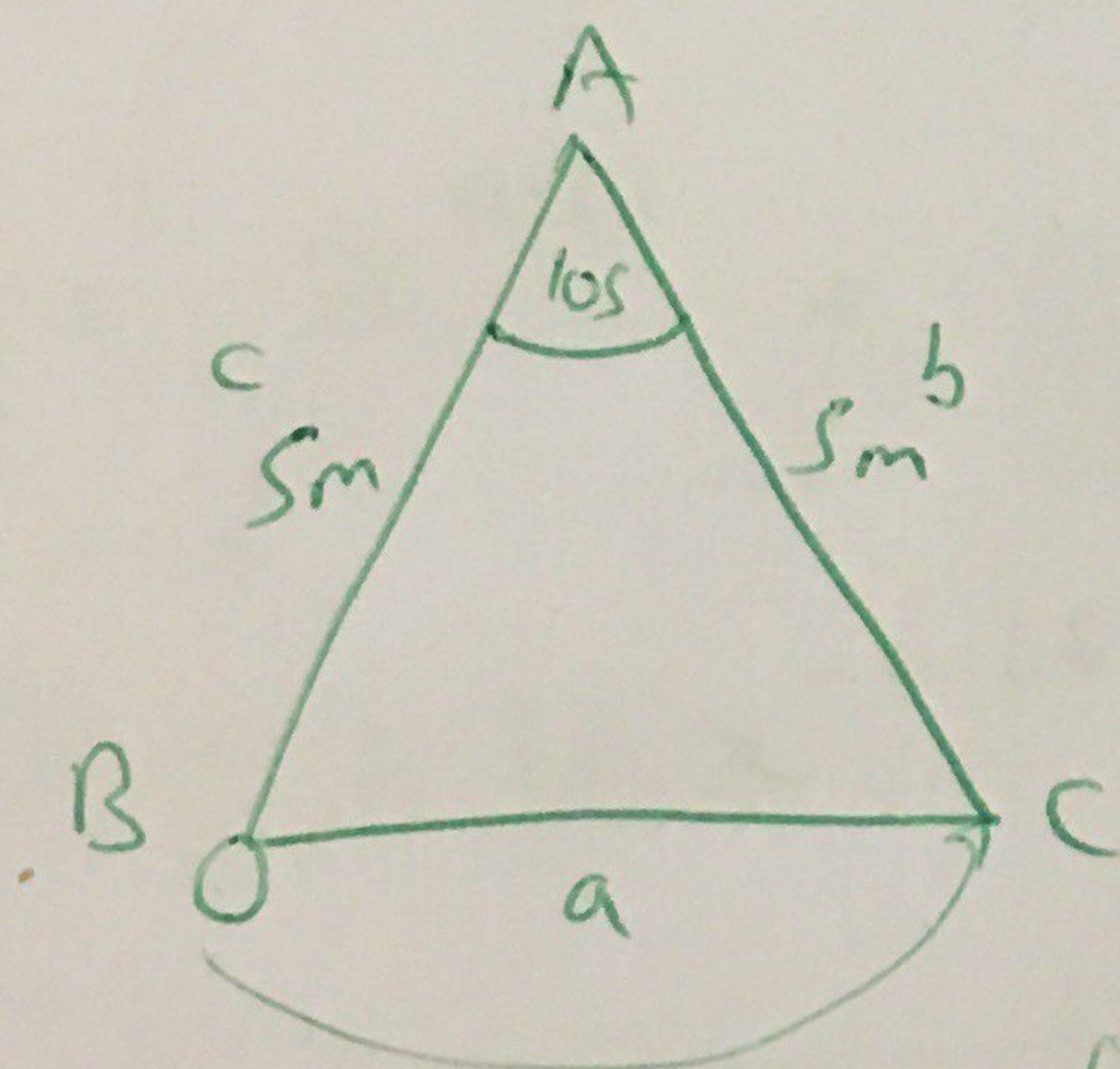
$$x = 101.31^\circ$$

$$x = 281.31^\circ$$

$$x = 116.57^\circ$$

$$x = 296.57^\circ$$

d)



cosine rule

$$BC^2 = (5)^2 + (5)^2 - 2(5)(5)\cos 105$$

$$BC^2 = 25 + 25 + 12.94$$

$$BC^2 = 62.94$$

$$BC = 7.93m$$

$$e) \quad \frac{3 \sin x + 5}{\cot x} = 2$$

$$\frac{3 \sin x + 5}{2} = \cot x$$

$$\left[\cot x = \frac{1}{\tan x} \right]$$

$$\frac{3 \sin x + 5}{2} = \frac{1}{\tan x}$$

$$\tan x = \frac{2}{3 \sin x + 5}$$

Q3)

(i) $\frac{dy}{dx} = 24x^2 - 4x + 5$

1 1 1

(ii) $y = 3(2x+1)^2$

$$y = 3[4x^2 + 4x + 1]$$

$$y = 12x^2 + 12x + 3$$

$\frac{dy}{dx} = 24x + 12$ (or use chain rule)

1 1

(iii) $y = x^{0.33} + 2x^{-1}$

$\frac{dy}{dx} = 0.33x^{-0.66} - 2x^{-2}$

1 1

(iv) $\frac{dy}{dx} = 12 \cos 3x - 2 \sin x + 6 \sec^2 6x$

1 1 1

(v) $\frac{dy}{dx} = (\tan x)(10x^4) + (2x^5)(\sec^2 x)$

1 1 1 1

$$(vi) \quad \frac{dy}{dx} = \frac{(e^{3x})(10 \cos 2x) - (5 \sin 2x)(3e^{3x})}{(e^{3x})^2}$$

$$(vii) \quad y = (5x^6 - 2x + 1)^{1/2}$$

$$\frac{dy}{dx} = \frac{1}{2} (5x^6 - 2x + 1)^{-1/2} (30x^5 - 2)$$

$$\text{or} \quad = (15x^5 - 1)(5x^6 - 2x + 1)^{-1/2}$$

$$b) \quad y = \sin 3x$$

$$\frac{dy}{dx} = 3 \cos 3x$$

$$\frac{d^2y}{dx^2} = -9 \sin 3x$$

$$\frac{d^3y}{dx^3} = -27 \cos 3x$$

$$\frac{d^4y}{dx^4} = 81 \sin 3x$$

$$c) \quad y = 4x^2 + 5$$

$$\frac{dy}{dx} = 8x$$

$$\frac{d^2y}{dx^2} = 8$$

$$2(8) + 3(8x) - 2 = 14 + 24x$$

$$16 + 24x - 2 = 14 + 24x$$

$$\underline{14 + 24x = 14 + 24x}$$

hence Proven .

d)

$$y = -4x + 1 \quad \textcircled{1}$$

$$\textcircled{2} - \textcircled{1}$$

$$y = x^2 + 6x + 10 \quad \textcircled{2}$$

$$0 = x^2 + 10x + 9$$

$$0 = (x+9)(x+1)$$

$$\underline{x = -9}$$

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

$$\underline{y = 37}$$

$$\underline{y = 5}$$

e) $z = x^5 + 2x^2y^3 - y^7$

$$\frac{\partial z}{\partial x} = 5x^4 + 4xy^3$$

$$\frac{\partial^2 z}{\partial x^2} = 20x^3 + 4y^3$$

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

$$\frac{\partial z}{\partial y} = 6x^2y^2 - 7y^6$$

$$\frac{\partial^2 z}{\partial y^2} = 12x^2y - 42y^5$$

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