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ACHA 4000

Question 1

a i) $\frac{3x-1}{5} = \frac{6x+5}{9}$

$$\begin{aligned} 9(3x-1) &= 5(6x+5) \\ 27x-9 &= 30x+25 \\ -9-25 &= 30x-27x \\ -34 &= 3x \\ \frac{-34}{3} &= x \end{aligned}$$

a ii) $1 + \frac{5}{x} = \frac{-6}{x^2}$

$$\begin{aligned} x^2(1+5) &= -6x \\ x^2 + 5x^2 &= -6x \\ 6x^2 &= -6x \\ \frac{6x^2}{6x} &= \frac{-6x}{6x} \\ x &= -1 \end{aligned}$$

a iii) $2 \log(3x+1) = \log(x+3) + \log(x+7)$

$$\frac{(x+3)(x+7)}{x^2+10x+21}$$

$$\log(3x+1)^2 = 9x^2+6x+1$$

$$9x^2+6x+1 = x^2+10x+21$$

$$8x^2-4x-20=0$$

$$x = 1.85078$$

$$x = -1.35078$$

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Question 1

b.i) $P^2Q(8PQ - 4Q^2 + 2P)$

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Question 1

C i) $x^2 + 12x + 20 = 0$
 $x^2 + 10x + 2x + 20 = 0$
 $x(x+10) + 2(x+10) = 0$
 $(x+10)(x+2) = 0$
 $x+10 = 0$
 $x = -10$ $x = -2$

C ii) ~~$2x^2 + 2x - 15 = 0$~~
 ~~$2x^2 + 2x - 15 = 0$~~
 ~~$2x^2 + 2x - 15 = 0$~~
 $2x^2 + 15 - 15 = 0$
 $2x^2 + x - 3 = 0$
 $2x(x+3) - 5(x+3) = 0$
 $(x+3)(2x-5) = 0$
 $x = -3$
 $x = \frac{5}{2}$

C iii)

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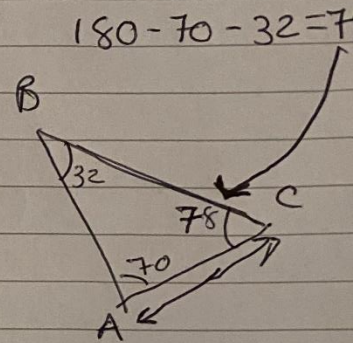
Question 2

$$i) \frac{\sin 78}{AB} = \frac{\sin 32}{35}$$

$$ii) AB = 32.623 \text{ m}$$

$$iii) \frac{\sin 32}{35} = \frac{\sin 70}{BC}$$

$$BC = 49.120 \text{ m}$$

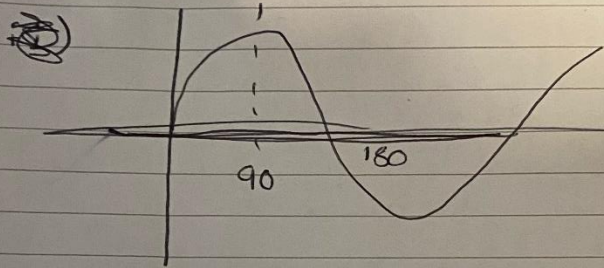


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Question 3

i) $\sin x = 0.67$
 $x = \sin^{-1}(0.67)$
 $x = 42.0670698^\circ$



$\therefore x = 42.067, 137.933^\circ$

ii) $\tan \theta = x$

$$x^2 + 7x + 10 = 0$$
$$(x+5)(x+2) = 0$$

$$x = -5 \quad x = -2$$

$$\theta = -78.69^\circ, -63.4399^\circ$$

$$\theta = 101.31^\circ, 116.5656^\circ, 281.31^\circ, 296.57^\circ$$

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Question 6

i) $y = 9x^3 + 7x^2 - x + 4$

$$\frac{dy}{dx} = 27x^2 + 14x - 1$$

ii) $y = (2x+3)(3x-5)$
 $y = 6x^2 - x - 15$

$$\frac{dy}{dx} = 12x - 1$$

iii) $y = 2 \ln x + \frac{5}{x}$

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

iv) $y = 7 \sin 2x + 3 \cos 2x + \frac{1}{2} \sec \frac{2x}{2}$

~~vi)~~

v) $y = x^5 \sin 2x$

$$\frac{dy}{dx} = 5x^4 + 2x^5 \cos 2x$$

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$$\text{vi)} \quad y = \frac{e^{3x}}{x^3}$$

$$f(x) = e^{3x}$$

$$f_1(x) = 3e^{3x}$$

$$g(x) = x^3$$

$$g_1(x) = 3x^2$$

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

$$\frac{dy}{dx} = 3x^3 e^{3x} - 3e^{3x} x^2$$

$$\frac{dy}{dx} = \frac{3xe^{3x} - 3e^{3x}}{x^4}$$

$$\frac{dy}{dx} = 3e^{3x} \left(\frac{x-3}{x^4} \right)$$

$$\text{vii)} \quad (5x^2 - 2x + 1)^5$$

$$5x^2 - 2x + 1 = z$$

$$y = z^5$$

$$\frac{dy}{dz} = 5z^4$$

$$\frac{dz}{dx} = 10x - 2$$

$$\frac{dy}{dz} \times \frac{dz}{dx} = 5(10x - 2)(5x^2 - 2x + 1)^4$$

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Question 7

a.i) $\frac{x^6}{6} + \frac{2x^3}{3} + \frac{x^2}{2} - 10x + c$

ii) $\int (2x+5)(x^2-1)$

$$\int 2x^3 + 5x^2 - 2x - 5$$

$$= \frac{2x^4}{4} + \frac{5x^3}{3} - \frac{2x^2}{2} - 5x + c$$

$$= \frac{x^4}{2} + \frac{5x^3}{3} - x^2 - 5x + c$$

iii) $\int_2^5 2x^4 + 6x^2$

$$\left[\frac{2x^5}{5} + \frac{6x^3}{3} \right]_2^5 = 1471.2$$

iv) $\int 5 \sin 3x - \cos \frac{x}{3}$

$$= -5 \cos 3x - 3 \sin \left(\frac{x}{3} \right) + c$$

