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ACHA4000/ACMA4006

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## Analytical Methods

Exam

Question 1

$$a) V_{min} = \sqrt{\frac{W \times 2 \times 1}{S \times p \times C_L}}$$

~~sub in values~~

~~$$200 = \sqrt{\frac{490332 \times 2 \times 1}{S \times 0.41 \times 0.52}}$$~~

$$V_{min}^2 = \frac{W \times 2 \times 1}{S \times p \times C_L}$$

$$V_{min}^2 S = \frac{W \times 2 \times 1}{p \times C_L}$$

$$S = \left( \frac{W \times 2 \times 1}{p \times C_L \times V_{min}^2} \right)$$

Sub in

$$S = \left( \frac{490332 \times 2 \times 1}{0.41 \times 0.52 \times 200^2} \right)$$

$$S = 114.993 m^2$$

$$b) i) \frac{8x-3}{5} = \frac{-5x+6}{-3}$$

$$-3(8x-3) = 5(-5x+6)$$

$$-24x+9 = -25x+30$$

$$-24x+25x = 30-9$$

$$x = 21$$

$$(ii) \frac{(4x-1)}{3} - \frac{x}{4} = \frac{(4x+3)}{2}$$

$$12 \frac{(4x-1)}{3} - \frac{12x}{4} = \frac{12(4x+3)}{2}$$

$$4(4x-1) - 3x = 6(4x+3)$$

$$16x-4-3x = 24x+18$$

$$13x-4 = 24x+18$$

~~$$24 \times 12 = 24$$~~  

$$CF = 24 \times 12$$

$$-4 - 18 = 24x + 13x$$

$$-22 = 37x$$

$$\frac{-22}{37} = x$$

$$-0.594 = x$$

$$\underline{-0.594 = x}$$

$$(iii) 2 \log(5x+3) = \log(x+1) \log(x+2)$$

$$\log(5x+3)^2 = \log(x+1)(x+2)$$

$$(5x+3)(5x+3) = (x+1)(x+2)$$

$$25x^2 + 15x + 15x + 9 = x^2 + 2x + x + 2$$

$$25x^2 + 30x + 9 = x^2 + 3x + 2$$

$$24x^2 + 27x + 7 = 0$$

$$\begin{matrix} a & b & c \\ x = \frac{(27) \pm \sqrt{(27)^2 - 4(24)(7)}}{2(24)} \end{matrix}$$

$$x = \frac{(27) \pm \sqrt{(729) - (672)}}{48}$$

$$x = \frac{(27) \pm \sqrt{57}}{48}$$

$$\cancel{x = \frac{(27) \pm \sqrt{57}}{48}}$$

$$x = \frac{27 \pm 7.55}{48}$$

$$x = \frac{27 + 7.55}{48}$$

$$= \underline{0.72}$$

$$x = \frac{27 - 7.55}{48}$$

$$= \underline{0.41}$$

(iv)

$$c) (i) \cancel{21R^2 + 24R + 5}$$

$$21R + 8R - 3R + 5$$

$$(21R + 8)(R - 3)$$

$$21R^2$$

$$27r^2 + 24r + 5$$

$$(9r + 5)(3r + 1)$$

$$\text{check} = 27r^2 + 9r + 15r + 5$$

$$27r^2 + 24r + 5 \checkmark$$

$$(ii) 81Q^2 - 144U^2$$

$$9(3Q + 4U)(3Q - 4U)$$

$$\text{check} = (27Q + 36U)(3Q - 4U)$$

$$81Q^2 - 144U^2 \checkmark$$

$$(iii) tr - ty + ur - uy$$

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

$$d) i) x^2 + 9x + 8 = 0 \quad 1 \times 8$$

$$(x + 8)(x + 1)$$

$$x^2 + x + 8x + 8$$

$$x^2 + 9x + 8 = 0 \checkmark$$

|             |             |
|-------------|-------------|
| $x + 8 = 0$ | $x + 1 = 0$ |
| $x = -8$    | $x = -1$    |

$$ii) 12x^2 - 5x - 3 = 0 \quad 1 \times 3$$

$$(4x - 3)(3x + 1)$$

$$12x^2 - 5x - 3 = 0$$

|                   |                    |
|-------------------|--------------------|
| $4x - 3 = 0$      | $3x + 1 = 0$       |
| $x = \frac{3}{4}$ | $x = -\frac{1}{3}$ |

$$(iii) 2x^2 + 17x = -30$$

$$2x^2 + 17x + 30 = 0$$

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

$$2x + 5 = 0 \quad x + 6 = 0$$

$$x = -\frac{5}{2} \quad x = -6$$

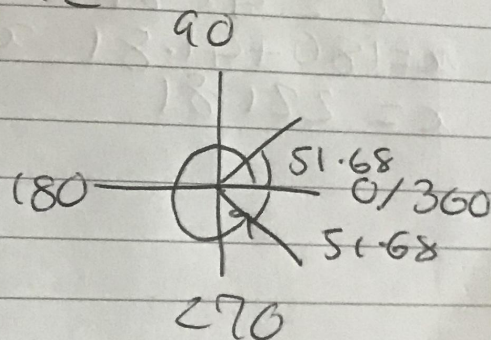
$$\begin{aligned}
 \text{(iv)} \quad x^2 - 256 &= 0 \\
 x^2 - 256 + 256 &= 0 + 256 \\
 x^2 &= 256 \\
 x &= \pm \sqrt{256} \\
 x &= 16 \text{ or } x = -16
 \end{aligned}$$

Question 3

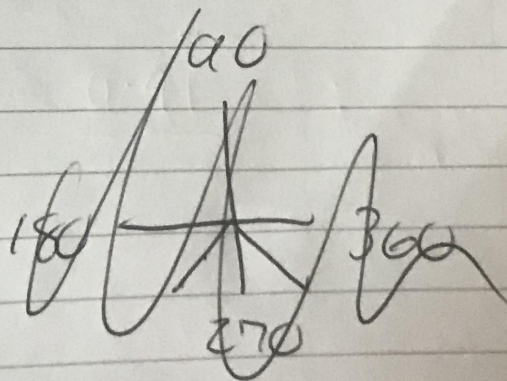
$$\begin{aligned}
 \text{a)} \quad 12x^2 &= 31x + 15 \\
 12x^2 - 31x - 15 &= 0 \\
 \text{a} \quad \text{b} \quad \text{c}
 \end{aligned}$$

$$\begin{aligned}
 x &= \frac{-31 \pm \sqrt{31^2 + 4 \times 12 \times -15}}{2 \times 12} \\
 x &= \frac{-31 + \sqrt{31^2 + 4 \times 12 \times -15}}{2 \times 12} \quad \text{or} \quad x = \frac{-31 - \sqrt{31^2 + 4 \times 12 \times -15}}{2 \times 12} \\
 x &= 3 \quad \text{or} \quad x = -\frac{5}{12} \\
 &= -0.42
 \end{aligned}$$

$$\begin{aligned}
 \text{b) i)} \quad \cos x &= 0.62 \\
 x &= \cos^{-1}(0.62) \\
 x &= 51.68^\circ \\
 x &= 360 - 51.68 \\
 x &= 308.32^\circ
 \end{aligned}$$



$$\begin{aligned}
 \text{ii)} \quad 7 \sin x &= 4 \\
 \sin x &= \frac{4}{7} \\
 x &= \sin^{-1}\left(\frac{4}{7}\right)
 \end{aligned}$$



$$\begin{aligned}
 x &= 34.85^\circ \\
 x &= 360 - 34.85 \\
 x &= 325.15^\circ
 \end{aligned}$$

$$\text{iii) } -5 \tan x = 4$$

$$\tan x = \frac{4}{-5}$$

$$x = \tan^{-1} \frac{4}{-5}$$

$$\underline{x = 38.66^\circ}$$

$$x = 180 + 38.66$$

$$\underline{x = 218.66^\circ}$$

$$\text{iv) } -3 \sin x = -2$$

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

$$x \sin^{-1} \frac{2}{3}$$

$$x = 41.81$$

$$x = 180 + 41.81 \quad x = 360 - 41.81$$

$$x = 221.81$$

$$x = 318.19$$