

UWTSD

WISA



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Analytical Methods ACHA4000

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Analytical methods ACHA4000

$$i) (x+6)^2 + 2x = x^2 - 5$$

$$(x+6)(x+6) + 2x = x^2 - 5$$

$$x^2 + 12x + 36 + 2x = x^2 - 5$$

$$14x + 31 = 0$$

$$14x = -31$$

$$x = \frac{-31}{14}$$

$$\frac{14}{14}$$

$$\text{Answer}$$

$$ii) 2 \log(x+3) = \log(x+5) + \log(x+8)$$

$$\log(x+3)^2 = \log(x+5)(x+8)$$

$$x^2 + 6x + 9 = x^2 + 13x + 40$$

$$-31 = 7x$$

$$x = \frac{-31}{7}$$

$$ii) 2^{x+5} = 6^x$$

$$(x+5) \log 2 = x \log 6$$

$$0.301x + 1.51 = 0.778x$$

$$1.51 = 0.477x$$

$$x = 3.16$$

$$10) \frac{x+1-\frac{6x}{5}}{5} = \frac{4-\frac{x}{3}}{12} \quad \times 12$$

$$12x - 9\left(1 - \frac{6x}{5}\right) = 4 - \frac{x}{3} + 15 \quad \times 15$$

$$180x - 60\left(15 - \frac{3}{5}(6x)\right) = 60 - 5x + 225$$

$$180x - 900 + 180x = 60 - 5x + 225$$

$$1265x = -675$$

$$x = \frac{-135}{253}$$

$$\begin{aligned} 2x + 4y - 3z &= 120 \\ 5x + 12y + z &= 140 \\ x - 3y + 5z &= 100 \end{aligned}$$

$$\begin{aligned} 10x + 8y - 6z &= 240 \\ 6x + 12y - 3z &= 120 \\ 30x + 12y + 6z &= 300 \\ 4x - 12y + 20z &= 600 \end{aligned}$$

22x

2

$$(1) 2x + 4y - 3z = 120$$

$$(2) 5x + 12y + z = 140$$

$$(3) x - 3y + 5z = 100$$

$$(1) 2x + 4y - 3z = 120$$

$$(2) 10x + 4y + 2z = 280$$

$$-8x - 5z = -160$$

$$3(2) \quad 15x + 6y + 3z = 420$$

$$(3) \quad 2x - 6y + 10z = 200$$

$$17x + 13z = 620$$

$$-8x - 5z = -160 \quad \times 13$$

$$17x + 13z = 620 \quad \times 5$$

$$-104x - 65z = -2080$$

$$85x + 65z = 3100$$

$$-19x - 1720$$

$$(x = -53.68)$$

$$17(-53.68) + 13z = 620$$

$$z = 620 - 17(-53.68)$$

$$z = 117.89$$

$$2(-53.68) + 4y - 3(117.89) = 120$$

$$y = 120 + 3(117.89) - 2(-53.68)$$

$$y = 145.26$$

$$3. 0.6x^2 + 3.4x = 7.4$$

$$0.6x^2 + 3.4x - 7.4 = 0$$

$$x = 1.68$$

$$x = -7.35$$

4.

a)

$$i) y = 5x^3 - 7x^2 + 3x - 1$$

$$\frac{dy}{dx} = 15x^2 - 14x + 3$$

$$ii) y = \frac{-1}{x^5}$$

$$y = -x^{-5}$$

$$\frac{dy}{dx} = 5x^{-4}$$

$$iii) y = e^{\frac{x}{2}} + \cos \frac{x}{6} + \sin 2x$$

$$\frac{dy}{dx} = \frac{1}{2}e^{\frac{x}{2}} - \frac{1}{6}\sin \frac{x}{6} + 2\cos 2x$$

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$$iv) y = (x^2 + 4)^5 (3x^2 - 1)^4$$

$$u = (x^2 + 4)^5 \quad v = (3x^2 - 1)^4$$

$$\frac{du}{dx} = 5(x^2 + 4)^4 (2x) \quad \frac{dv}{dx} = 4(3x^2 - 1)^3 (6x)$$

$$\frac{dy}{dx} = (3x^2 - 1)^4 [5(x^2 + 4)^4 (2x)] + (x^2 + 4)^5 [4(3x^2 - 1)^3 (6x)]$$

$$v) y = \frac{(5x^2 + 3x + 1)^5}{e^x}$$

$$u = (5x^2 + 3x + 1)^5 \quad v = e^x$$

$$\frac{du}{dx} = 5(5x^2 + 3x + 1)^4 (10x + 3) \quad \frac{dv}{dx} = e^x$$

$$\frac{dy}{dx} = \frac{e^x [5(5x^2 + 3x + 1)^4 (10x + 3) - (5x^2 + 3x + 1)^5]}{(e^x)^2}$$

$$vi) y = \sqrt{\frac{5x-1}{8x+5}}$$

$$y = \left(\frac{5x-1}{8x+5} \right)^{\frac{1}{2}}$$

$$u = 5x - 1 \quad v = 8x + 5$$

$$\frac{du}{dx} = 5 \quad \frac{dv}{dx} = 8$$

$$\frac{dy}{dx} = \frac{1}{2} \left(\frac{5x-1}{8x+5} \right)^{-\frac{1}{2}} \left(\frac{5(8x+5) - (5x-1)(8)}{(8x+5)^2} \right)$$

4 $y = (10x + \sqrt{x^5 + 1})^5$

$y = (10x + (x^5 + 1)^{\frac{1}{2}})^5$

~~$y = (10x + \sqrt{x^5 + 1})^5$~~

~~$y = (10x + \sqrt{x^5 + 1})^5$~~

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

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

$\frac{dx}{dt} = \text{velocity}$

$\frac{d^2x}{dt^2} = \text{Acceleration}$

$\frac{d^3x}{dt^3} = \text{Jerk}$

$\frac{d^4x}{dt^4} = \text{Snap}$

$\frac{d^5x}{dt^5} = \text{Crackle}$

$\frac{d^6x}{dt^6} = \text{Pop}$

6 a)

i) $9 \sin x = 2$

$x = \sin^{-1}(\frac{2}{9})$

$x = 12.84^\circ$

$x = 180 - 12.84$

$x = 167.16^\circ$

ii) $5 \sin^2 x - 0.3 \cos x = 2$ $\sin^2 x = 1 - \cos^2 x$

$5(1 - \cos^2 x) - 0.3 \cos x - 2 = 0$

$5 - 5 \cos^2 x - 0.3 \cos x - 2 = 0$

$-5 \cos^2 x - 0.3 \cos x + 3 = 0$

$\cos x = 0.745$ $\cos x = -0.805$

$x = \cos^{-1}(0.745)$

$x = 41.84^\circ$

$x = 360 - 41.84$

$x = 318.16^\circ$

$x = \cos^{-1}(-0.805)$

$x = 143.61^\circ$

$x = 180 - 143.61$

$x = 36.39^\circ$

$x = 180 + 143.61$

$x = 326.39^\circ$

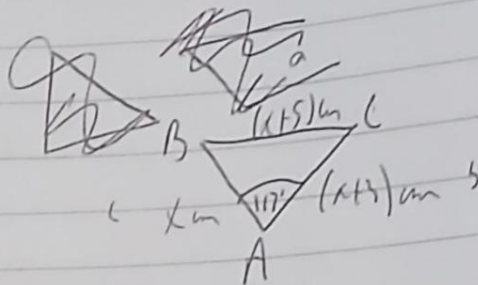
7.

i) $AB = x \text{ cm}$

$AC = (x+3) \text{ cm}$

$BC = (x+5) \text{ cm}$

$\angle BAC = 117^\circ$



$$a^2 = b^2 + c^2 - 2bc \cos A$$

$$(x+5)^2 = (x+3)^2 + x^2 - 2(x+3)(x) \cos 117$$

$$x^2 + 10x + 25 = x^2 + 6x + 9 + x^2 - 2(x^2 + 3x) \cos 117$$

~~$$x^2 + 10x + 25 = x^2 + 6x + 9 + x^2 - 2(x^2 + 3x) \cos 117$$~~

$$x^2 + 10x + 25 = x^2 + 6x + 9 + x^2 + 0.91(x^2 + 3x)$$

$$x^2 + 10x + 25 = 2.91x^2 + 8.73x + 9$$

$$1.91x^2 - 1.27x - 16 = 0$$

$$x = 3.25$$

$$x = -2.58$$

$$\therefore x = 3.25$$

ii) $\text{Area} = \frac{1}{2} ab \sin C$

$AB = 3.25 \text{ cm}$

$AC = 6.25 \text{ cm}$

$BC = 8.25 \text{ cm}$

$$\text{Area} = \frac{1}{2} \times 3.25 \times 6.25 \times \sin 117$$

$$\text{Area} = 9.05 \text{ cm}^2$$

I have added this sentence to be above turnitin's word count.