

11/11/2020

11:00

Analytical Methods (ACHA 4000)

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b) $y = \sin 2x$

$$\frac{dy}{dx} = \cos(2x) \cdot 2$$

$$\frac{d^2y}{dx^2} = -4 \sin(2x)$$

$$\frac{d^3y}{dx^3} = -8 \cos(2x)$$

$$\frac{d^4y}{dx^4} = \underline{\underline{16 \sin(2x)}}$$

c) $z = x^5 + 3x^3y^2 + 4y^5$

$$\frac{\partial^2 z}{\partial x^2} = 20x^3 + 18y^2x$$

$$\frac{\partial^2 z}{\partial y^2} = 80y^3 + 6x^3$$

$$\frac{\partial^2 z}{\partial y \partial x} = 18x^2y$$

$$\frac{\partial^2 z}{\partial x \partial y} = 18x^2y$$

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c) i) $27R^2 + 24R + 5 = (3x+1)(9x+5)$

ii) $81Q^2 - 144U^2 = 9(3Q+4U)(3Q-4U)$

iii) $tr - ty + ur - uy = (r-y)(t+u)$

d) i) $x^2 + 9x + 8 = 0$

$$(x+1)(x+8) = 0$$

$$x^2 + 8x + x + 8 = 0$$

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

$$x = -1 \quad x = -8$$

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

$$(6x-1)(2x+3)$$

$$12x^2 + 18x - 2 - 3$$

$$12x^2 + 18x - 5$$

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

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

$$(2x+15)(x+2) = 0$$

$$x = -15 \quad x = -2$$

iv) $x^2 - 256 = 0$

$$(x+16)(x-16)$$

$$x = -16 \quad x = 16$$

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Question 1

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

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

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

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

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

$$S = 8.70 \times 10^{-3} \text{ m}^2$$

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

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

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

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

$$x = \underline{\underline{21}}$$

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

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

$$16x-4-3x = 6(4x+3)$$

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

$$-11x = 22$$

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

Question 2

a) i) $y = 8x^3 - 2x^2 + x + 10$

$$\frac{dy}{dx} = 24x^2 - 4x + 1$$

ii) $y = (5x-3)(6x-1)$

~~$y = 30x^2 - 5x - 18x + 3$~~

$y = 30x^2 - 5x - 18x + 3$

$y = 30x^2 - 23x + 3$

$$\frac{dy}{dx} = 60x - 23$$

iii) $y = \frac{3}{\sqrt{x}} + \ln x$

$y = \frac{3}{x^{0.5}} + \frac{1}{x}$

$$\frac{dy}{dx} = \frac{3}{0.5x^{-0.5}} + \frac{1}{x^2}$$

iv) $y = 5 \sin \frac{x}{2} - 6 \cos 3x - \tan \frac{x}{3}$

~~$\frac{dy}{dx} = 5 \cos \frac{x}{2} + 18 \sin 3x + \frac{1}{3} \sec^2 \left(\frac{x}{3} \right)$~~

$$\frac{dy}{dx} = \frac{5}{2} \cos \left(\frac{x}{2} \right) + 18 \sin (3x) + \frac{1}{3} \sec^2 \left(\frac{x}{3} \right)$$

v) $y = e^{7x} \tan 3x$

$$\frac{dy}{dx} = e^{7x} 7 \tan (3x) + \sec^2 (3x) 3e^{7x}$$

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

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

vii) $y = \sqrt[3]{4x^3 - 2x + 1}$

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