

Question 2.

a.

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

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

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

$$y = \cancel{30x^2} = 30x^2 - 23x + 3$$

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

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

$$y = 3x^{-\frac{1}{2}} + \ln x$$

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

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

$$\frac{dy}{dx} = \underline{\frac{5}{2} \cos \frac{x}{2} + 18 \sin 3x + \frac{1}{3} \sec^2 \frac{x}{3}}$$

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

$$\frac{dy}{dx} = u \frac{dv}{dx} + v \frac{du}{dx}$$

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

sin

$$Vi. \quad y = \frac{\sin 2x}{e^{3x}}$$

$$\frac{dy}{dx} = \frac{u \frac{dv}{dx} - v \frac{du}{dx}}{v^2}$$

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

$$/ii \quad y = \sqrt[3]{4x^3 - 2x + 1}$$

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

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

$$b. \quad y = \sin 2x$$

$$\frac{dy}{dx} = 2\cos 2x$$

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

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

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

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

$$\frac{\partial z}{\partial x} = 5x^4 + 2(3x^2)y^2 + 4y^5$$

$$= 5x^4 + 6x^2y^2 + 4y^5$$

$$\frac{\partial^2 z}{\partial x^2} = 20x^3 + 12xy^2 + 4y^5$$

$$= \underline{20x^3 + 12xy^2 + 4y^5}$$

$$\frac{\partial^2 z}{\partial y \partial x} = 5x^4 + 12x^2y + 20y^4$$

$$= \underline{5x^4 + 12x^2y + 20y^4}$$

$$\frac{\partial z}{\partial y} = x^5 + 3x^3(2y) + 20y^4$$

$$= x^5 + 6x^3y + 20y^4$$

$$\frac{\partial^2 z}{\partial y^2} = \underline{x^5 + 6x^3 + 80y^3}$$

$$\underline{\underline{\frac{\partial^2 z}{\partial x \partial y} = 5x^4 + 12x^2y + 20y^4}}}$$

$$d. \quad y = 3x^2 + 16x + 30 \quad (1)$$

$$y = 2x^2 + 4x + 3 \quad (2)$$

$$(1) - (2) = x^2 + 12x + 27$$

$$\therefore x^2 + 12x + 27 = 0$$

$$\therefore x = -3, x = -9$$

$$I_f x = -3, y = 2(-3)^2 + 4(-3) + 3$$

$$y = 9$$

$$I_f x = -9, y = 2(-9)^2 + 4(-9) + 3$$

$$y = 129$$

$$\therefore \underline{\underline{I_f x = -3, y = 9 \text{ and } x = -9, y = 129.}}$$

Q.

e. ~~1/2~~ $y = 5x^2 + 4x - 1$

$$\therefore \frac{dy}{dx} = 10x + 4$$

$$\therefore \frac{d^2y}{dx^2} = 10$$

$$\therefore 6(10) - 5(10x + 4) + 7x - 1$$

$$\therefore 60 - 50x - 20 + 7x - 1$$

$$\therefore \underline{\underline{39 - 43x}}$$

Question 3.

a.

i. $12x^2 = 31x + 15$

$$12x^2 - 31x - 15 = 0$$

$$(12x + 5)(x - 3) = 0$$

$$\therefore x = -\frac{5}{12}, x = 3 \quad \therefore \underline{\underline{x = -0.42, x = 3}}$$

b

i. $\cos x = 0.62$

$$\therefore x = \cos^{-1}(0.62)$$

$$= 51.683 \dots = 51.68 \text{ (2dp)}$$

$$180 - 51.68 = 308.32$$

$$\therefore \underline{\underline{x = 51.68, x = 308.32}}$$

ii $7 \sin x = 4$

$$\therefore x = \sin^{-1}\left(\frac{4}{7}\right)$$

$$= 34.8499 \dots = 34.85 \text{ (2dp)}$$

$$180 - 34.85 = 145.15$$

$$\therefore \underline{\underline{x = 34.85, x = 145.15}}$$

iii $-9 \tan x = 4$

$$x = \tan^{-1}\left(-\frac{4}{9}\right)$$

$$= -38.66$$

$$-38.66 + 180 = 141.34$$

$$141.34 + 180 = 321.34$$

$$\therefore \underline{\underline{x = 141.34, x = 321.34}}$$

iv. $-3 \sin x = -2$

$$x = \sin^{-1}\left(\frac{-2}{-3}\right) = \sin^{-1}\left(\frac{2}{3}\right)$$

$$= 41.81$$

$$180 - 41.81 = 138.19$$

$$\therefore \underline{\underline{x = 41.81, x = 138.19}}$$

c. $x^2 + 3x + 10$

$$(x + 5)(x - 2) = 0 \quad \therefore \tan x = -5, \tan x = 2$$

$$\therefore x = \tan^{-1}(-5), x = \tan^{-1}(2)$$

$$\swarrow$$

$$\searrow$$

$$x = -78.69, 101.31, 281.31$$

$$x = 63.43, 243.43$$

$$\text{Between } 0^\circ \leq x \leq 360^\circ$$

$$\underline{\underline{x = 101.31, 281.31, 63.43, 243.43}}$$

d. $y = \sin^2\left(\frac{30}{2}\right)$

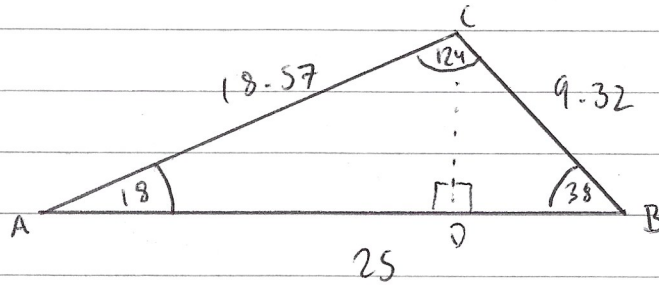
$$\left(\frac{30}{2}\right) y = \sin^2(x)$$

$$\sqrt{y} = \sin\left(\frac{30}{2}\right)$$

$$\therefore \frac{\sqrt{y}}{\sin} \times \frac{2}{3} = \theta$$

$$\therefore \underline{\underline{\left(\frac{2}{3}\right)\left(\frac{\sqrt{y}}{\sin(1)}\right) = \theta}}$$

e.



$$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$$

$$\therefore \frac{a}{\sin(18)} = \frac{b}{\sin(38)} = \frac{25}{\sin(124)}$$

$$\therefore \frac{a}{\sin(18)} = 30.16$$

$$\therefore a = 30.16 \times \sin(18) = 9.32$$

$$b = \sin(38) \times 30.16 = 18.57$$

~~90 + 108 = 198~~

~~180 - 108 = 72~~

$$90 + 18 = 108$$

$$180 - 108 = 72$$

$$\therefore \frac{a}{\sin(18)} = \frac{18.57}{\sin 72} = \frac{18.57}{1}$$

$$\therefore a = \sin(18) \times 18.57 = 5.74$$

$$\therefore \underline{\underline{AC = 18.57 \text{ miles}}}$$

$$\underline{\underline{BC = 9.32 \text{ miles}}}$$

$$\underline{\underline{Alt. = 5.74 \text{ miles}}}$$