

OMOLUABI SEAN SEREMI

MAT 104

$$1) (4x^2 - \sin x) / x^3 \text{ as } x \rightarrow 0$$

$$\lim_{x \rightarrow 0} (4x^2 - \sin x) / x^3 = \lim_{x \rightarrow 0} \frac{4x^2}{x^3} - \frac{\sin x}{x^3} = \lim_{x \rightarrow 0} \frac{4}{x} - \frac{\sin x}{x^3}$$

$$\text{* differentiate } \lim_{x \rightarrow 0} \frac{-4}{x^2} = \left[\frac{x^3 \cos x - 3x^2 \sin x}{x^6} \right]$$

still undefined

$$2) y = (7x^2 \cos 8x) / e^{3x}, \text{ ~~u} = 7x^2, w = \cos 8x, v = e^{3x}~~ u = 7x^2, w = \cos 8x, v = e^{3x}$$

$$dy/dx = \left[\frac{d}{dx}(u \cdot w) \cdot v - \frac{d}{dx}v \cdot (u \cdot w) \right] / v^2$$

$$d/dx(u \cdot w) = 14 \cos 8x - 7x^2 \sin 8x \cdot 8 = 112 \cos 8x - 56x^2 \sin 8x$$

$$dv/dx = 3e^{3x}$$

$$dy/dx = \frac{e^{3x} [112 \cos 8x - 56x^2 \sin 8x] - 3e^{3x} [7x^2 \cos 8x]}{e^{6x}}$$

$$3) y = \cos(5x^2 + 6x) dx$$

$$\text{let } u = 5x^2 + 6x \therefore du/dx = 10x + 6$$

$$dx = (10x + 6) du$$

$$dy/dx = \cos u \cdot (10x + 6) du$$

$$dy/dx = -(10x + 6) \sin u$$

$$\therefore dy/dx = -(10x + 6) \sin(5x^2 + 6x)$$

$$4) a) \int \frac{3}{(4x+1)} dx = 3 \int \frac{dx}{(4x+1)}$$

$$\text{let } u = 4x+1$$

$$\therefore 3 \int \frac{dx}{4x+1}$$

$$\frac{du}{dx} = 4$$

$$dx = \frac{1}{4} du$$

$$\therefore \frac{3}{4} \int \frac{du}{u} = \frac{3}{4} \ln(4x+1) + C_1$$

$$b) \int \frac{dx}{(x^2+49)} = \int \frac{dx}{(x^2+7^2)}$$

$$\text{let } x = 7 \tan \theta$$

$$x^2 = 49 \tan^2 \theta$$

$$\int \frac{dx}{(x^2+7^2)} = \int \frac{dx}{(49 \tan^2 \theta + 49)} = \int \frac{dx}{49 (\tan^2 \theta + 1)}$$

$$dx = 7 \sec^2 \theta d\theta$$

$$\int \frac{7 \sec^2 \theta}{49 (\tan^2 \theta + 1)}$$

$$\tan^2 \theta + 1 = \sec^2 \theta$$

$$\int \frac{7 \sec^2 \theta}{49 \sec^2 \theta} d\theta = \frac{7}{49} \cdot d\theta + C$$

$$\theta = \tan^{-1} x/7$$

$$\therefore \frac{1}{7} (\tan^{-1} x/7) + C$$

$$c) \int (e^{6x} + 9x^3 - \sin 7x + \cos 8x) dx$$

$$= \frac{e^{6x}}{6} + \frac{9x^4}{4} + \frac{1}{7} \cos 7x - \frac{1}{8} \cos 8x + C_{11}$$

$$d) \int dx \sqrt{9+x^2}$$