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AYOMIDE
PRECIOUS

MATRIC NO: | 9 | sci 04 | 001 |

$$b) y = \frac{4}{x^3}$$

$$\therefore \Delta y + y = \lim_{\Delta x \rightarrow 0} \frac{4}{(x^3 + 3x^2 \Delta x + 3x \Delta x^2 + \Delta x^3)^3}$$

$$\Delta y + y = \lim_{\Delta x \rightarrow 0} \left(\frac{4}{x^3 + 3x^2 \Delta x + 3x \Delta x^2 + \Delta x^3} \right)$$

$$\Delta y + y = \lim_{\Delta x \rightarrow 0} \frac{4}{x^3 + 3x^2 \Delta x + 3x \Delta x^2 + \Delta x^3}$$

$$\Delta y = \lim_{\Delta x \rightarrow 0} \frac{4}{x^3 + 3x^2 \Delta x + 3x \Delta x^2 + \Delta x^3} - y$$

$$\text{Substitute } y = \frac{4}{x^3}$$

$$\Delta y = \lim_{\Delta x \rightarrow 0} \frac{4}{x^3 + 3x^2 \Delta x + 3x \Delta x^2 + \Delta x^3} - \frac{4}{x^3}$$

$$\Delta y = \lim_{\Delta x \rightarrow 0} \frac{4x^3 - 4(x^3 + 3x^2 \Delta x + 3x \Delta x^2 + \Delta x^3)}{x^3 \cdot (x^3 + 3x^2 \Delta x + 3x \Delta x^2 + \Delta x^3)}$$

$$\Delta y = \lim_{\Delta x \rightarrow 0} \frac{4x^3 - 4x^3 - 12x^2 \Delta x - 12x \Delta x^2 - 4\Delta x^3}{x^3 + 3x^2 \Delta x + 3x \Delta x^2 + \Delta x^3}$$

Divide both sides by Δx

$$\frac{\Delta y}{\Delta x} = \lim_{\Delta x \rightarrow 0} \frac{-12x^2 \Delta x - 12x \Delta x^2 - 4\Delta x^3}{x^3 + 3x^2 \Delta x + 3x \Delta x^2 + \Delta x^3} \quad \Delta x$$

$$\frac{\Delta y}{\Delta x} = \lim_{\Delta x \rightarrow 0} \frac{-12x^2 \Delta x - 12x \Delta x^2 - 4\Delta x^3}{x^3 + 3x^2 \Delta x + 3x \Delta x^2 + \Delta x^3} \quad \Delta x$$

$$\frac{\Delta y}{\Delta x} = \lim_{\Delta x \rightarrow 0} \frac{-12x^2 - 12x \Delta x - 4\Delta x^2}{x^2 + 3x \Delta x + 3\Delta x^2} \quad \Delta x$$

Take $\Delta x \rightarrow 0$

$$\frac{\Delta y}{\Delta x} = \lim_{\Delta x \rightarrow 0} \frac{-12x^2 - 12x(0) - 4(0)^2}{x^2 + 3x(0) + 3(0)^2 + 0^2}$$

Therefore, $\frac{dy}{dx} = -\frac{12x^2}{x^2}$

$$\frac{dy}{dx} = -\frac{12}{x^0}$$

$$2b) \int \frac{dx}{x^2+13}$$

$$= \int \frac{dx}{13\left(\frac{x^2}{13} + 1\right)}$$

$$= \int \frac{dx}{13\left(\left(\frac{x}{\sqrt{13}}\right)^2 + 1\right)}$$

$$= \frac{1}{13} \int \frac{dx}{\left(\left(\frac{x}{\sqrt{13}}\right)^2 + 1\right)}$$

$$\text{Let } u = \frac{x}{\sqrt{13}} \quad \therefore \frac{du}{dx} = \frac{1}{\sqrt{13}}$$

$$dx = \sqrt{13} du$$

$$= \frac{1}{13} \int \frac{1 \cdot \sqrt{13} du}{u^2 + 1}$$

$$= \frac{\sqrt{13}}{13} \int \frac{1}{u^2 + 1}$$

$$= \frac{1}{\sqrt{13}} \tan^{-1} u$$

$$= \frac{\sqrt{13}}{13} \tan^{-1}(u) + C$$

$$= \frac{\sqrt{13}}{13} \tan^{-1}\left(\frac{x}{\sqrt{13}}\right) + C$$

$$2.) \int \frac{dx}{x^2+36}$$

$$= \int \frac{1}{x^2+36} dx$$

$$= \int \frac{1}{36(\frac{x^2}{36}+1)} dx$$

$$= \int \frac{1}{36(\left(\frac{x}{6}\right)^2+1)} dx$$

$$= \frac{1}{36} \int \frac{1}{\left(\frac{x}{6}\right)^2+1} dx$$

$$\text{Let } u = \frac{x}{6} \quad \therefore \quad \frac{du}{dx} = \frac{1}{6}$$

$$\text{Then } dx = 6 du$$

$$= \frac{1}{36} \int \frac{1}{1+u^2} \cdot 6 du$$

$$= \frac{1}{36} \cdot 6 \int \frac{1}{1+u^2} du$$

$$= \frac{1}{6} \arctan(u)$$

$$= \frac{1}{6} \arctan\left(\frac{x}{6}\right) + C$$