

$$1 \quad f(x) = \frac{1}{x^3}$$

$$f(x + dx) = \frac{1}{(x+dx)^3} \checkmark$$

$$(f(x+dx) - f(x)) = \frac{1}{(x+dx)^3} - \frac{1}{x^3} \checkmark$$

$$f(x+dx) - f(x) = \frac{x^3 - (x+dx)^3}{x^3(x+dx)^3} \checkmark$$

$$f(x+dx) - f(x) = \frac{x^3 - [(x+dx)(x^2 + dx\sqrt{x^2} + 2x dx)]}{x^3(x+dx)^3}$$

could use binomial expansion

$$f(x+dx) - f(x) = \frac{x^3 - (x^3 + dx\sqrt{x^3} + 3x^2 dx + 3x dx^2)}{x^3(x+dx)^3}$$

$$f(x+dx) - f(x) = \frac{x^{\cancel{3}} - x^{\cancel{3}} - dx^3 - 3x^2 dx + 3x dx^2}{x^3(x+dx)^3} \checkmark$$

$$f(x+dx) - f(x) = \frac{-dx^3 - 3x^2 dx - 3x dx^2}{x^3(x+dx)^3} \checkmark$$

$$f(x+dx) - f(x) = \frac{dx(-dx^2 - 3x^2 - 3x dx)}{x^3(x+dx)^3} \checkmark$$

$$\frac{f(x+dx) - f(x)}{dx} = \frac{dx(-dx^2 - 3x^2 - 3x dx)}{x^3(x+dx)^3} \times \frac{1}{dx} \checkmark$$

$$= \frac{-dx^2 - 3x^2 - 3x dx}{x^3(x+dx)^3} \checkmark$$

$$\frac{dy}{dx} = \lim_{dx \rightarrow 0} \left(\frac{-dx^2 - 3x^2 - 3xdx}{x^3(x+dx)^3} \right) \checkmark$$

limit taken as $dx \rightarrow 0$, \checkmark

$$\frac{dy}{dx} = \frac{-3x^2}{x^3 x^3} \checkmark$$

$$= \frac{-3x^2}{x^6} \checkmark$$

$$= \frac{-3}{x^4} \checkmark$$

Well Done!

A nice clear answer