# Calculus Assignment 1

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## Compute the derivative of the function

$$x(t) = t^3 \tag{1}$$

$$\begin{aligned}\lim_{\Delta t \to 0} \frac{x(t+\Delta t) - x(t)}{\Delta t} = \lim_{\Delta t \to 0} \frac{(t+\Delta t)^3 - t^3}{\Delta t} = \lim_{\Delta t \to 0} \frac{t^3 + 3t^2\Delta t + 3t\Delta t^2 + \Delta t^3 - t^3}{\Delta t} = \\ = \lim_{\Delta t \to 0} 3t^2 + 3t\Delta t + \Delta t^2 = 3t^2 + 0 + 0 = 3t^2\end{aligned} \tag{2}$$

## Compute the derivative of the function

$$x(t) = \frac{1}{t} \tag{3}$$

$$\begin{aligned}\lim_{\Delta t \to 0} \frac{x(t+\Delta t) - x(t)}{\Delta t} = \lim_{\Delta t \to 0} \frac{\frac{1}{t+\Delta t} - \frac{1}{t}}{\Delta t} = \lim_{\Delta t \to 0} \frac{t - t - \Delta t}{(t+\Delta t)\Delta t} = \\ = \lim_{\Delta t \to 0} -\frac{1}{t(t+\Delta t)} = \lim_{\Delta t \to 0} -\frac{1}{t^2 + t\Delta t} = -\frac{1}{t^2}\end{aligned} \tag{4}$$