

Question 1

Evaluate the limit:

$$\lim_{x \rightarrow 0} \frac{\sin(3x)}{x}$$

- (a) Verify that the limit results in an indeterminate form.
- (b) Use L'Hospital's Rule to evaluate the limit.

Question 1 - Solution

(a) As $x \rightarrow 0$:

- $\sin(3x) \rightarrow 0$, and $x \rightarrow 0$ - So, the limit is of the indeterminate form $\frac{0}{0}$

(b) Apply L'Hospital's Rule:

$$\begin{aligned}\lim_{x \rightarrow 0} \frac{\sin(3x)}{x} &= \lim_{x \rightarrow 0} \frac{\frac{d}{dx}[\sin(3x)]}{\frac{d}{dx}[x]} \\ &= \lim_{x \rightarrow 0} \frac{3 \cos(3x)}{1} = 3 \cos(0) = 3(1) = \boxed{3}\end{aligned}$$