

1. Use the limit definition of derivative

$$f'(x) = \lim_{h \rightarrow 0} \frac{f(x+h) - f(x)}{h}$$

to calculate the following limits:

$$f(x) = 2x + 1$$

$$g(x) = x^2 - 1$$

$$h(x) = x\sqrt{x}$$

2. Sketch the graph of each of the below functions, then determine if the derivative at $x = 0$ exists.

$$f(x) = |x|$$

$$g(x) = \begin{cases} -1 & x \leq 0 \\ 1 & x > 0 \end{cases}$$

$$h(x) = x^3$$