Calculus BC
Lesson 3.1

The derivative $f'(a)$ is the instantaneous rate of change of $y = f(x)$ with respect to x when $x = a$.

1. One definition of the derivative is $f'(a) = \lim_{h \to 0} \frac{f(a+h) - f(a)}{h}$.

   a) Using $f(x) = (2x+1)^2$, use the definition to evaluate $f'(1)$.

   b) Using $f(x) = 2^x$, write a limit that represents $f'(2)$.
   Use a graph to estimate the value of the limit.

2. A second definition of the derivative is $f'(a) = \lim_{x \to a} \frac{f(x) - f(a)}{x - a}$.

   a) Use this definition of the derivative to evaluate $f'(3)$ if $f(x) = \sqrt{x}$.

   b) Use this definition of the derivative to evaluate $f'(1)$ if $f(x) = \frac{1}{2x}$.

3. Each limit shown represents a derivative. Identify the function and the value of x at which the derivative is being calculated.

a) $\lim\limits_{h\to 0}\dfrac{\log(10+h)-1}{h}$

b) $\lim\limits_{h\to 0}\dfrac{\sin(\pi+h)}{h}$

c) $\lim\limits_{x\to 2}\dfrac{3^x-9}{x-2}$

d) $\lim\limits_{x\to \frac{\pi}{4}}\dfrac{\tan(x)-1}{x-\frac{\pi}{4}}$

e) $\lim\limits_{h\to 0}\dfrac{(3+h)^2-9}{h}$

4. Use the definition of the derivative to find a rule for $f'(x)$ if $f(x)=\dfrac{1}{3x}$.