

WRITE CLEARLY AND SHOW ALL YOUR WORK. YOU MAY USE A CALCULATOR.

1. Explain why $\frac{(x-1)(x+5)}{x-1}$ is *not* equal to $x+5$ when $x=1$.

2. For the function f below, evaluate $\lim_{x \rightarrow 1^+} f(x)$, $\lim_{x \rightarrow 1^-} f(x)$, and $\lim_{x \rightarrow 1} f(x)$. Determine if f is continuous at $x=1$, and if it isn't, state what type of discontinuity occurs there.

$$f(x) = \begin{cases} \frac{x^2-1}{x-1} & \text{if } x < 1 \\ 2 & \text{if } x = 1 \\ 5x-1 & \text{if } x > 1 \end{cases}$$

3. True or False:

(a) _____ The limit of a function $f(x)$ as $x \rightarrow c$ is equal to $f(c)$.

(b) _____ If f is continuous on the interval $(2, 4)$, then f must have a maximum value and a minimum value on $(2, 4)$.

(c) _____ If f is a continuous function with $f(-2) = 3$ and $f(1) = -2$, then there is some $c \in (-2, 1)$ with $f(c) = 0$.

(d) _____ If f changes sign at $x = 2$ and $f(2) \neq 0$, then f is discontinuous at $x = 2$.

4. Use the *definition* of the derivative to show that if $f(x) = 3x + 1$, then $f'(c) = 3$ for any value of c .