

This test consists of 5 pages, none of which is intentionally left blank. Take a few seconds right now to be sure you have all the pages. The point value of each question is to the left of the question number. Show all your work in the space provided. If you run out of room for an answer, continue working on the back of the page. Your answers must be justified by your work.

- (10) 1. Using the ε - δ definition of the limit, prove

$$\lim_{x \rightarrow -2} (4x + 5) = -3$$

- (10) 2. What value of c will make the following function continuous at $x = 1$?

$$f(x) = \begin{cases} x^2 + cx & \text{if } x \leq 1 \\ x - c & \text{if } x > 1 \end{cases}$$

3. Use the limit laws and algebra to evaluate the following limits:

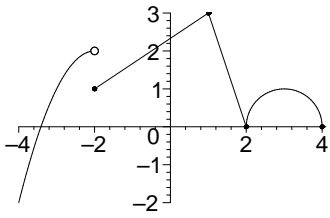
(5) (a) $\lim_{x \rightarrow 4} \frac{|x+2|}{x+2}$

(5) (b) $\lim_{x \rightarrow 1} \frac{x^2 - 3x + 2}{x - 1}$

(5) (c) $\lim_{x \rightarrow 3} \frac{\sqrt{x^2 + 16} - 5}{x - 3}$

(5) (d) $\lim_{x \rightarrow \infty} \frac{2x^2 + 4x - 5}{x^2 - 6x + 2}$

4. The graph of a function g is shown.



(5) (a) What is $\lim_{x \rightarrow -2^-} g(x)$?

(5) (b) What is $\lim_{x \rightarrow -2^+} g(x)$?

(5) (c) Where does g fail to be continuous?

(5) (d) Where does g fail to be differentiable?

(10) 5. Use either the “ $x \rightarrow a$ ” or the “ $h \rightarrow 0$ ” definition of the derivative to find $f'(2)$ if $f(x) = \sqrt{2x + 5}$.

(10) 6. Sketch the graph of a function f satisfying the following: $f(-2) = -2$, $f'(0) = \frac{1}{2}$, $\lim_{x \rightarrow 1^-} f(x) = 2$, $\lim_{x \rightarrow 1^+} f(x) = -1$, and $f(1) = 0$.

- (10) 7. Use the intermediate value theorem to show that $\sin(x) + x = 1$ has a solution in the interval $[0, \pi/6]$

- (10) 8. The graph of a function f has the line $y = 3x + 4$ as a tangent when $x = 5$. What are the values of $f(5)$ and $f'(5)$?