

This is a Take-Home Quiz. You may use your book and course notes, and you may work with other members of the class, but you may not consult with outside tutors (at least not on these specific problems).

1. (2 points each) Find the indicated limits, if they exist, or justify the fact that they don't exist:

(a) $\lim_{x \rightarrow \infty} \frac{2x^2 - 12x + 3}{5x^3 - 16x^2 - 3x + 7}$

(b) $\lim_{x \rightarrow \infty} \frac{3x^3 - 2x - 1}{5x^3 + 12x^2 - 4}$

(c) $\lim_{x \rightarrow 3} \frac{x^2 - 2x - 3}{x^2 - 3x}$

2. Given the function

$$f(x) = \begin{cases} x + 1 & \text{if } x < 3 \\ 2 & \text{if } x = 3 \\ 7 - x & \text{if } x > 3 \end{cases}$$

- (a) (3 points) Sketch the graph of $f(x)$.

- (b) (1 point) Find $\lim_{x \rightarrow 3} f(x)$.

- (c) (2 points) Is $f(x)$ continuous at $x = 3$? Justify your answer.

3. (4 points) Use the limit definition of the derivative to compute the derivative function $f'(x)$ if $f(x) = 3x^2 - 2x + 5$

4. (4 points) Use the derivative you found above to find the equation for the tangent line to $f(x) = 3x^2 - 2x + 5$ at the point $(1, 6)$. Then, sketch the graph of $f(x)$ and the tangent line you found on the same axes.