

Show all work. Arithmetic expressions do not need to be simplified in your final answer.

1. (4 points) Determine a value of k such that the function $f(x) = \begin{cases} kx^2 & \text{if } x \leq 3 \\ k - 5x & \text{if } x > 3 \end{cases}$ is continuous everywhere.

2. (5 points) Prove, using the epsilon-delta definition of a limit, that $\lim_{x \rightarrow -1} -3x + 4 = 7$.

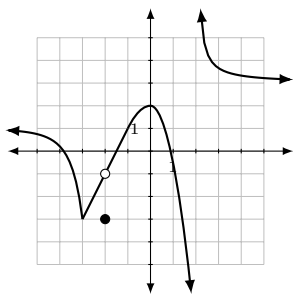
3. (6 points) Evaluate each of the following infinite limits or demonstrate that the limit does not exist.

(a) $\lim_{r \rightarrow +\infty} \frac{3r - 5r^3}{100r^2 - 2r + 1}$

(b) $\lim_{x \rightarrow -\infty} \frac{x^2}{2 - 18x^5}$

(c) $\lim_{u \rightarrow -\infty} \frac{u^4 - 7u^2 + 3u}{6u^4 + 2u - 1}$

4. (5 points) Below is the graph of a function $f(x)$. Answer the questions asked.



What is $\lim_{x \rightarrow -\infty} f(x)$?

What is $\lim_{x \rightarrow +\infty} f(x)$?

At what values of x is the function $f(x)$ discontinuous?

5. (2 point bonus) Prove (formally) that the equation $x = \tan x$ has infinitely many solutions.