Quiz 1  
Math 180 Section 102  

Name: SOLUTIONS  
ID:  

Answer the following questions. Work individually. No electronic devices or notes are permitted.

1. Evaluate

\[
\lim_{x \to \infty} \frac{\sqrt{x^4 - 4x^3 + 5}}{8x^2 + 9} = \lim_{x \to \infty} \frac{\sqrt{x^4(1 - \frac{4}{x} + \frac{5}{x^4})}}{x^2(8 + \frac{9}{x^2})} \\
= \lim_{x \to \infty} \frac{\sqrt{1 - \frac{4}{x} + \frac{5}{x^4}}}{8 + \frac{9}{x^2}} = \frac{1}{8}.
\]

2. Identify any horizontal and vertical asymptotes of

\[f(x) = \frac{4x^2 + 8x + 16}{2x^2 + 6x - 56}.\]

If you find any asymptotes, support your work by showing an appropriate limit calculation for each asymptote.

Since \(\lim_{x \to \infty} f(x) = 2\), there is a horizontal asymptote at \(y = 2\). (The same is true as \(x \to -\infty\).

The domain of \(f(x)\) is \(x \neq -7\) and 4, so there are possible vertical asymptotes at \(x = -7\) and \(x = 4\).

To check, calculate \(\lim_{x \to -7^-} f(x)\), \(\lim_{x \to -7^+} f(x)\),  \(\lim_{x \to 4^-} f(x)\) and \(\lim_{x \to 4^+} f(x)\).