

Limits and Continuity: math test, College – download the PDF

Suggested time: 45 minutes. Out of 20 points. Calculator allowed only when the problem says so.

1 Computing limits

/ 4 pts

Compute: (a) $\lim_{x \rightarrow 5} \frac{x^2 - 25}{x - 5}$; (b) $\lim_{x \rightarrow 0} \frac{\sqrt{x+4} - 2}{x}$; (c) $\lim_{x \rightarrow \infty} \frac{7x^2 - x}{2x^2 + 9}$; (d) $\lim_{x \rightarrow 1} \frac{x^2 + x - 2}{x - 1}$.

2 A jump

/ 3 pts

Let $g(x) = 2x - 1$ for $x < 3$ and $g(x) = 10 - x$ for $x \geq 3$. (a) Find $\lim_{x \rightarrow 3^-} g(x)$ and $\lim_{x \rightarrow 3^+} g(x)$. (b) Does $\lim_{x \rightarrow 3} g(x)$ exist? (c) Find $g(3)$ and classify the discontinuity at 3.

3 Asymptotes and a hole

/ 3 pts

Let $r(x) = \frac{2x + 6}{x^2 - 9}$. (a) Find the vertical asymptote. (b) Find the location of the hole. (c) Find the horizontal asymptote.

4 Squeeze

/ 3 pts

For all $x > 0$, $\frac{3}{x^2} \leq \frac{4 + \sin x}{x^2} \leq \frac{5}{x^2}$. Use this to find $\lim_{x \rightarrow +\infty} \frac{4 + \sin x}{x^2}$. Justify.

5 Continuity at a point

/ 4 pts

Let $f(x) = \frac{x^2 - x - 6}{x - 3}$ for $x \neq 3$ and $f(3) = k$. (a) Find $\lim_{x \rightarrow 3} f(x)$. (b) If $k = 1$, what type of discontinuity does f have at 3? (c) Find k so that f is continuous at 3.

6 Intermediate Value Theorem

/ 3 pts

Let $h(x) = x^3 + 2x - 5$. (a) Show that h has a root in $(1, 2)$. (b) Given that $h(1.5) = 1.375$, find a shorter interval containing a root.



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