Derivatives

1. True or false: Let $f(x) = |x|$. There is some number c in $[-1/2, 2]$ such that

$$f'(c) = \frac{f(2) - f(-1/2)}{2 - (-1/2))}.$$

Justify your answer.

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2. Approximate the value of $83^{1/4}$ by using a linear approximation.

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3. Use L'Hôpital's rule to compute the limit.

(a) $\lim_{x\to\infty} \dfrac{x^3 + 3x}{2x + 1}$ (b) $\lim_{x\to 1} \dfrac{\sin(x)}{x}$ (c) $\lim_{x\to\pi/2} \dfrac{2\tan(x)}{\sec^2(x)}$

(d) $\lim_{x\to 0} x\csc(x)$ (e) $\lim_{x\to\infty} \left(1 + \dfrac{3}{x}\right)^x$

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4. Let $f(x) = e^{0.5x}$ and $g(x) = x^{2014}$. Compute:

$$\lim_{x\to\infty} \frac{f(x)}{g(x)}.$$

Which of these functions grows faster?