Review for quiz 2

2025-09-29

We'll have our second quiz this Friday, October 3rd. There will probably be four questions on the quiz that will be a lot like the problems you see here.

In problem 1, there are some problems involving fractions, where you might consider using the quotient rule. There are also some questions involving the tangent function, which is itself a fraction. We'll talk about these things in class on Wednesday.

Problems

1. Use the differentiation rules to compute the derivatives of the following functions.

   a. $f(x) = \sqrt{x} - \dfrac{1}{x^2}$

   b. $f(x) = \dfrac{x^4 - x^3 + x - 1}{x^2}$

   c. $f(x) = \sin(x) - \cos(x) + \tan(x)$

   d. $f(x) = x^3 \sin(x)$

   e. $f(x) = \sqrt{x}(x^2 + x + 1)$

   f. $f(x) = \sqrt{x}e^x \cos(x)$

   g. $f(x) = \dfrac{\sin(x)}{x^2 + 1}$

2. Compute the following limits involving trig functions.
   If you use the fact that $\lim\limits_{\theta \to 0} \sin(\theta)/\theta = 1$, be sure to clearly indicate how it arises.

   a. $\lim\limits_{x \to 0} \dfrac{\sin(3x)}{x}$

   b. $\lim\limits_{x \to 0} \dfrac{\sin(2x)}{\tan(x)}$

   c. $\lim\limits_{x \to 0} \dfrac{\sin(2x)}{\cos(x)}$

3. Sketch the graph of

$$f(x) = 2\cos\left(\frac{\pi}{2}x\right).$$

   Be sure to clearly indicate the x and y intercepts, as well as the maximum and minimum values.

4. Supposing that f and g are differentiable functions, use the definition of the derivative to show that

$$\frac{d}{dx}(2f(x) - g(x)) = 2f'(x) - g'(x).$$