Calculus I **Fall 2014**

More derivatives

Discussion session 7 - 16 September 2014

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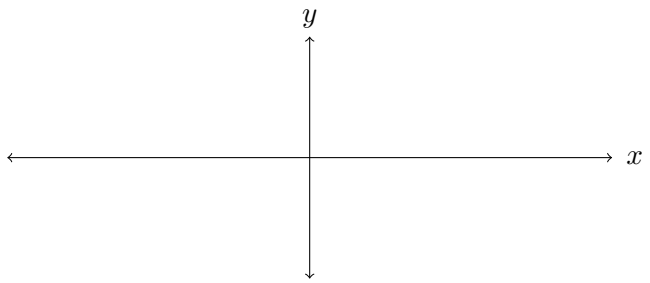
1. (a) Write in your own words, what it means for a function to be *differentiable*.

   (b) Write in your own words, what it means for a function to be *differentiable at a point*.

   (c) Give an example, on the set of axes below, of a function that is not defined at one point, not continuous at two points, and not differentiable at three points.



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2. Use the power rule to calculate the first and second derivatives of the following functions.

   (a) $f(x) = x(x^{10} - 4x^2 + 8) - 1$

   (b) $g(\theta) = \dfrac{\sqrt[3]{\theta^2} - 2\pi\sqrt[4]{\theta^5}}{\sqrt{\theta}}$

3. Consider the piecewise function

$$h(x) = \begin{cases} x^2 + 1 & \text{if } x < 0, \\ \cos(x) & \text{if } 0 \leqslant x < 2\pi, \\ \frac{1}{x-3\pi} & \text{if } x \geqslant 2\pi. \end{cases}$$

(a) Where is the tangent line to h horizontal?

(b) Where is the tangent line to h vertical?

(c) At which points is the tangent line to h not defined?

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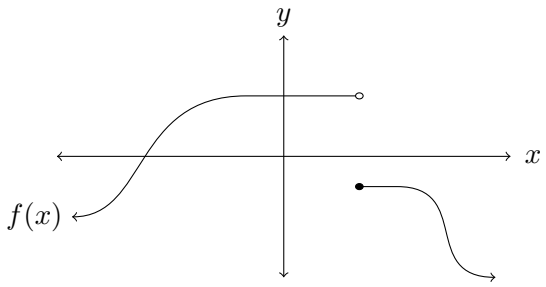
4. Consider the function f, whose graph is drawn below, and state whether each question is true or false, with justification.



(a) The function f is differentiable everywhere.

(b) The derivative of the function f is continuous everywhere.

(c) The limit $\lim_{x \to a} \left[f'(x) \right]$ exists for all $a \in \mathbb{R}$.