Derivatives

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1. Determine whether each of the following statements is *true* or *false*.

(a) If $f(x)$ is continuous at a then it is differentiable at a.

(b) If $f(x)$ is differentiable at a then $\lim_{x \to a^+} f(x)$ exists.

(c) If $\lim_{h \to 0} \frac{f(a+h) - f(a)}{h}$ exists then $\lim_{x \to a} f(x) = f(a)$.

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2. Let $f(x) = \frac{1}{2x^3 - 6x}$.

(a) Compute $f(2)$ and $f'(2)$.

(b) Write the equation of the line tangent to $f(x)$ at 2.

(c) Draw the graph of $f(x)$ and the tangent line you found in (b).

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3. Let $g(t) = \frac{|t^2 - 4|}{t - 5}$.

(a) What is the domain of g?

(b) Where is g differentiable? Where is g continuous?

(c) Find $g'(t)$ wherever it exists.

(d) Notice from your answers to (b) (if you got it right) that there is a point t_0 where g is continuous but *not* differentiable. Compute:

$$\lim_{t \to t_0^+} \frac{f(t_0 + h) - f(t_0)}{h} \qquad \lim_{t \to t_0^-} \frac{f(t_0 + h) - f(t_0)}{h}$$