Math 145 - Calculus I Name_____

More Basic Derivatives - Day 9

1. A pendulum is started and its horizontal displacement (in inches) is given by the function $d(t) = 8\cos(t)$, where t is time in seconds. Assume that positive displacement is to the right of center.

   (a) Sketch a graph of $d(t)$ for $0 \leq t \leq 10$.

   (b) At what times is $d(t) = 8$?

   (c) Let $v(t) = d'(t)$ be our name for the (horizontal) velocity of the pendulum. At what times is $v(t) = 0$?

   (d) At what times is the pendulum moving the fastest? Estimate the largest speed. Include units.

   (e) Sketch a graph of $v(t)$.

   (f) Guess a formula for $v(t) = d'(t)$.

2. It would be useful to know the derivative of the function $f(x) = \ln(x)$.

   (a) Sketch a graph of $\ln(x)$ for $x > 0$.

   (b) What can you say about the sign of the derivative?

   (c) If you want to find $f'(x)$ for an $x > 0$, what limit would you want to calculate?

   (d) This limit is too hard for us. Instead, let's numerically approximate $f'(2)$ by computing $f'(2) \approx \dfrac{f(2+h) - f(2)}{h}$ for several small values of h (e.g., 0.1, 0.01, 0.001, 0.0001).

3. Another important function is $g(x) = e^x$.

   (a) Write down (but do not evaluate) the limit definition of $g'(0)$.

   (b) Make a table to investigate your answer in (a) numerically as in 2(d) above.

   (c) Sketch a graph of $g(x) = e^x$, and then a graph of the derivative.