1. Consider the following twelve functions:

$$f_1(x) = \sqrt{5x} + \frac{83}{7+\sin x} \qquad g_1(x) = (2+\sin x)(e^x - 5\sqrt{x})$$

$$f_2(x) = 5\cos x + e^x - 13\tan x \qquad g_2(x) = 7\sec x + 14\tan x$$

$$f_3(x) = e^x \sec x \qquad g_3(x) = \frac{1+7\cos x}{\sin x}$$

$$f_4(x) = \tan x(1+\sin x) \qquad g_4(x) = \sin(2x)$$

$$f_5(x) = \cos\sqrt{x+1} \qquad g_5(x) = \frac{\tan x}{e^x}$$

$$f_6(x) = \sin(e^x) \qquad g_6(x) = \sqrt[3]{x}\cos x$$

It turns out that you can compute the derivatives of ten of these functions using our rules to date, plus possibly some algebra and some trig identities, and that you can't compute the other two without rules we haven't seen yet.

(a) Identify the two you can't compute yet, and explain why our current list of rules isn't enough to compute them.

(b) Compute the other ten derivatives. **DO NOT SIMPLIFY** your answers.

2. A particle moves along a horizontal line, and its position at time t is

$$s(t) = \frac{\cos t}{e^t}.$$

Note that positive values of $s(t)$ denote being to the right of 0, and negative values being to the left of 0.

(a) Find all values of $t \geq 0$ for which the velocity $v(t)$ of the particle is equal to 0. (There are infinitely many such t, but there is a pattern to them.)

(b) What is physically happening when the particle has zero velocity? See if you can get your group to agree to one interpretation. It may help to graph $y = s(t)$ and $y = v(t)$ on the same axes. Click here to try graphing on Wolfram Alpha. You should replace ".5" with your formula for $v(t)$; you may also want to adjust the x and y ranges appropriately.