Math 190 Homework 6: Due Monday October 26

Questions:

1. For the following problems find the derivative of the given function.

   (a) $2x^3 + \dfrac{3}{\sqrt{x}} + x^e - 4e^x$

   (b) $e^x \cos x$

   (c) $\dfrac{\cos x}{\sin x}$

2. Find the equation of the tangent line to

$$h(x) = \frac{x \cos x}{x + 1}$$

   at the point $x = \pi$.

3. (a) Use product rule to find the derivative of $\sin^2 x$.

   (b) Find all x-values where

$$f(x) = \sin^2 x - \cos x$$

   has horizontal tangent lines.

4. (a) Recall the derivative of $e^x \cos x$ from Question 1(c). Using your answer, find the derivative of

$$e^x \cos x \sin x$$

   using product rule once.

   (b) In the same way you solved Question 4(a) use the product rule twice to prove in the following *triple product rule*:

$$\frac{d}{dx}(fgh) = \frac{df}{dx}gh + f\frac{dg}{dx}h + fg\frac{dh}{dx}.$$

5. In this problem you will find all tangent lines of $f(x) = x^2$ which pass through the point $(1, -3)$. Consider following these steps:

   Step 1: Draw the graph of x^2 and label the point $(1, -3)$. Try to draw a line tangent to x^2 that passes through $(1, -3)$. Call this point p.

   Step 2: Find the equation of the tangent line to x^2 at point p.

   Step 3: Solve for the value(s) of p that will ensure your tangent line passes through $(1, -3)$.