Worksheet #7, September 15, 2015
Math 221 Lecture EL1

Instructions. Put your first and last name at the top of your paper. Everyone is to do their own worksheet but only one from each group is graded with the score shared. Be sure to show your work and explain your reasoning. All worksheets from each group will be collected.

1. Find \( \frac{d}{dx} f(x) \) if

\[
f(x) = \left( \frac{1}{x^4} - \frac{1}{x^8} \right) (x + x^3).
\]

2. Find \( g'(t) \) if

\[
g(t) = \frac{t - 2\sqrt{t} + 1}{t}
\]

3. Let \( f(x) = x^3e^x \). Find the equation for the tangent line to the curve \( y = f(x) \) at the point \( (1, f(1)) \)
4. Let \( g(x) = xe^x \cot x \). Find \( g'(x) \)

5. A mass on a spring system oscillates horizontally on a smooth surface, with no friction. Its position at time \( t \) in seconds measured in meters from the equilibrium position is described by the function \( p(t) = 2\cos(t) + 3\sin(t) \). The figure shows the graph of the equation from \( t = 0 \) to \( t = 10 \).

![Graph of the function](image)

Positive values of the function on the graph correspond to times when the spring is to the right of the equilibrium position, which is represented by the horizontal axis on the graph.

(a) Find the equations that describe \( v(t) \), the velocity of the spring at time \( t \), and \( a(t) \), the acceleration at time \( t \).

(b) Find the speed at which the spring is moving, and in what direction, at \( t = \pi/2 \).