Calculus 3.3 - Derivatives of Trigonometric Functions

Review Problems

1. **Finding derivatives.** Find derivatives of the following functions:
   
   (a) \( y = x e^x + 3x \)
   
   (b) \( y = \frac{ex}{3x^2 + e^x} \)

   **Basic Knowledge**

2. Find the derivatives of the following functions:
   
   (a) \( y = \sin(x) - 3 \cos(x) \)
   
   (b) \( y = 2 \sec(x) + 4 \tan(x) \)
   
   (c) \( y = x \sin(x) \)
   
   (d) \( y = \frac{\csc(x)}{\cos(x) + \sin(x)} \)

3. Find the equation of a line tangent to \( y = \cos(x) \) at point \( x = \pi \).

4. Find the equation of a line normal to \( y = \frac{\tan(x)}{x} \) at point \( x = \pi \).

   **Intermediate Knowledge**

5. Find the derivatives of the following functions. Do not use chain rule if you know it.
   
   (a) \( y = (\sin(x))^2 \)
   
   (b) \( y = \frac{e^x \cos(x)}{\sin(x) + 1} \)

6. Find the equation of a line tangent and a line normal to \( f(x) = \frac{\sec(x) - 1}{\cos(x) - 1} \) at \( x = \pi \).

   **Advanced Knowledge**

7. Find points at which the line tangent to the graph of \( f(x) = \sin(x) - \cos(x) \) is horizontal.

8. Find points at which the line tangent to the graph of \( y = \tan(x) - \sec(x) \) is horizontal.

9. A mass is hung on a spring. It is then pulled down and released. It’s equation of motion is \( x(t) = -4 \cos(t) \), where \( t \) is in seconds and \( x \) is the distance of the mass from the equilibrium point in centimeters.
   
   (a) Find the position, velocity, and acceleration of the mass at \( t = \pi \) sec.
   
   (b) After what time will the mass reach the height of 4 cm above the equilibrium point?
   
   (c) After what time will the mass reach the velocity of 2 cm/sec?