Here are some sample questions from sections 2.1–2.5. Some topics that we covered are not represented by these questions, but are still fair game.

1. Let \( f(x) = -x^2 + 3 \).
   (a) Using the definition of the derivative as a limit, compute \( f'(x) \).
   (b) Find the equation for the tangent line at \( x = 2 \).
   (c) Graph \( f(x) \) and the tangent line.

2. Find values for \( m \) and \( b \) so that \( f(x) = \begin{cases} x^2 & \text{if } x \leq -2 \\ mx + b & \text{if } x > -2 \end{cases} \) is differentiable at \( x = -2 \).

3. Sketch the graph of a function \( g \) for which \( g(0) = g'(0) = 0, g'(-1) = -1, g'(1) = 3, \) and \( g'(2) = 1 \).

4. The graph of a function \( f \) is given in each part below. On the same axes, sketch the graph of \( f' \).

5. Compute the following derivatives:
   (a) \( f(x) = 2 + x + \frac{3}{x} - \sqrt{x} - 5x^7 + x^{3/4} \Rightarrow f'(x) = \)
   (b) \( D_x [(x^9 + x^8 + x^5 + 3)(1 + 2x^2 + 9x^3 - 4x^4)] = \)
   (c) \( y = \frac{x^3 + x}{x} \Rightarrow \frac{dy}{dx} = \)
   (d) \( \frac{d}{dx} [(x^9 + 2x^{1/3} + x^5 + 3)^4] = \)
   (e) \( y = (3 + x^4)^8x^3 \Rightarrow \frac{dy}{dx} = \)
   (f) \( \frac{d}{dx} [5\tan(x^2\sin(x^3 + 7x))] = \)
   (g) \( D_x \left[ ((x^9 + x^8 + x^5 + 3)(1 + 2x^2 + x^3 - 4x^4) + 1)^9 \right] = \)
   (h) \( f(x) = \sin(3) \Rightarrow f'(x) = \)