A. Equation of the tangent line

Example 1: Write the equation of the tangent line to the graph of \( y = x^3 + 3x \) at the point \((-1, -4)\).

Example 2: Write the equation of the tangent line to the graph of \( y = \frac{x^2 - 5}{x + 1} \) at the point \((3, 1)\).

B. Finding second derivatives. The second derivative, or \( y'' \), is the derivative of the derivative. Determine the second derivatives of the following functions.

Example 3: \( f(x) = -2x^4 + 6x^3 - 5x^2 + 3x - 2 \)

Example 4: \( f(x) = \frac{2x^2 - 5}{x + 3} \)

C. L'Hopital's Rule. If direct substitution into \( \lim_{x \to c} \frac{f(x)}{g(x)} \) yields an indeterminate form such as \( \frac{0}{0} \) or \( \pm \infty \), you can find \( \lim_{x \to c} \frac{f(x)}{g(x)} \) by finding \( \lim_{x \to c} \frac{f'(x)}{g'(x)} \) or \( \lim_{x \to c} \frac{f''(x)}{g''(x)} \) Use L'Hopital’s Rule to find the following limits.

Example 5: \( \lim_{x \to 2} \frac{x^3 - 8}{x - 2} \)

Example 6: \( \lim_{x \to \infty} \frac{3x^2 - 7x + 1}{x^3 - 2x^2} \)

HW: Page 126, Problems 63, 64, 65, 93, 94, 96, Page 574 Problems 11, 12, 23 - 26 and the following review worksheet
Find the derivative of the following functions.

1. \( f(x) = -2x^3 + 6x^2 - 5x + \sqrt{2} \)

2. \( g(t) = (-3t^2 + 1)(t^2 - 5) \)

3. \( y = (x^4 + 3)(x^3 - 2x + 4) \)
   \[ y' = \frac{2x + 3}{4x - 1} \]

4. \( y = \frac{x}{2x + 1} \)

5. \( g(x) = \frac{3}{4x^2} \)

6. \( y = \frac{x^3 + 2x^4}{x^2} \)

7. \( y = \frac{x^3}{\sqrt{x - 1}} \)

8. \( y = (2x + 3)(\sqrt{x^2 - 4}) \)

9. Find the second derivative of \( y = 7x^2 + x - 5 \)

10. Use L’Hopital’s Rule to determine \( \lim_{x \to 4} \frac{x^2 - x - 12}{x - 4} \)

11. Write the equation of the line that is tangent to the graph of \( y = 7x^2 + x - 5 \) at the point (2,25).