3.2-Derivative Rules

Derivative Rules:

If $f$ and $g$ are differentiable functions, then...

\[
\frac{d}{dx}(x^n) =
\]

\[
\frac{d}{dx}(cf(x)) =
\]

\[
\frac{d}{dx}(f(x) \pm g(x)) =
\]

\[
\frac{d}{dx}(f(x) \cdot g(x)) =
\]

\[
\frac{d}{dx}\left(\frac{f(x)}{g(x)}\right) =
\]

Examples:

Compute the derivative of the following:

\[
f(x) = (4x^2 - 1)(7x^3 + x)
\]

**Method I:**

**Method II:**
Given \( f(4) = 3 \) and \( f'(4) = -5 \), find the derivative of:

\[
g(x) = \sqrt{x} f(x) \quad \text{ and } \quad h(x) = \frac{f(x)}{x}
\]

Find the equation of the line tangent to \( f(x) = x^2 + x \) at the point where \( x = 2 \).
Find the slope of the line(s) tangent to the curve $y = 1 - x^2$ which pass through the point $(0, 2)$.

Find the derivative of

$$g(x) = \begin{cases} 
  x^3 - x & \text{if } x \leq -1 \\
  2x - 4 & \text{if } x > -1
\end{cases}$$

Is this function differentiable at $x = -1$? Justify your answer.

**On Your Own:** 3.2 #3, 9, 10, 14, 16, 21, 23, 26, 32, 36, 46, 53, 59, 61, 68, 72