1. Explain the relationship between the function, \( f(x) \), and its derivative, \( f'(x) \).

\[ f'(x) = \text{slope} \]

2. Explain in your own words how you would find the derivative of \( f(x) = x^3 \)

\[ 3x^2 \]

3. Explain in your own words how the product rule works by showing how you would find the derivative of \( f(x) = x^2e^x \)

\[
\begin{align*}
    f' &= u'v + uv' \\
    &= 2xe^x + x^2e^x \\
    &= 2xe^x + x^2e^x
\end{align*}
\]

4. Explain in your own words how the quotient rule works by showing how you would find the derivative of \( f(x) = \frac{x^3}{2x^2+1} \)

\[
\begin{align*}
    u &= x^3 \\
    u' &= 3x^2 \\
    v &= 2x^2 + 1 \\
    v' &= 4x
\end{align*}
\]

\[
\begin{align*}
    y &= \frac{u'v - uv'}{v^2} \\
    &= \frac{3x^2(2x^2+1) - 6x^3}{(2x^2+1)^2} \\
    &= \frac{-2x^4 + 2x^2}{(2x^2+1)^2}
\end{align*}
\]

5. Explain in your own words how the chain rule works by showing how you would find the derivative of \( f(x) = (x^4 + 2)^3 \)

\[
\begin{align*}
    f' &= 12(x^4 + 2)^2 \\
    &= 12(64x^6 + 48x^4 + 12x^2 + 4)
\end{align*}
\]