1. (5 pts; p 163 #33) Use the quotient rule to find the derivative of \( f(x) = \frac{3x^2 + 2x}{x^4 + 1} \).

I prefer to write the quotient rule as \( \frac{d}{dx} \left[ \frac{u(x)}{v(x)} \right] = \frac{u'(x)v(x) - u(x)v'(x)}{v(x)^2} \).

\[
f'(x) = \frac{(6x+2)(x^2+1) - (3x^2+2x)(2x)}{(x^2+1)^2}
\]

2. (5 pts; p 172 #74) Find the derivative of \( s = \sqrt{t^4 + 3t^2 + 8} \).

We need to use the general power rule \( \frac{d}{dx} u(x)^n = n \cdot u(x)^{n-1} \cdot u'(x) \).

\[
s = \sqrt{t^4 + 3t^2 + 8} = (t^4 + 3t^2 + 8)^{1/4}.
\]

\[
\frac{ds}{dt} = \frac{1}{4}(t^4 + 3t^2 + 8)^{-3/4}(4t^3 + 6t)
\]

3. (5 pts; p 172 #47) Find an equation for the tangent line to the graph of \( y = \sqrt{x^2 + 3x} \) when \( x = 1 \).

\[
y = \sqrt{x^2 + 3x} = (x^2 + 3x)^{1/2}
\]

\[
\frac{dy}{dx} = \frac{1}{2}(x^2 + 3x)^{-1/2}(2x + 3) = \frac{2x + 3}{2\sqrt{x^2 + 3x}}
\]

When \( x = 1 \), we get \( \frac{dy}{dx} = \frac{2(1) + 3}{2\sqrt{1 + 3}} = \frac{5}{2\sqrt{4}} = \frac{5}{4} \). This gives the slope of the tangent line when \( x = 1 \).

When \( x = 1 \), we have \( y = 2 \), so the tangent line is \( y = \frac{5}{4}(x - 1) + 2 \).

4. (5 pts; p 177 #44) Find \( f''(x) \) for \( f(x) = \frac{1}{\sqrt{x-1}} \).

\[
f(x) = (x-1)^{-1/2}
\]

\[
f'(x) = -\frac{1}{2}(x-1)^{-3/2}(1) = -\frac{1}{2}(x-1)^{-3/2}
\]

\[
f''(x) = \left(-\frac{1}{2}\right)(-\frac{3}{2})(x-1)^{-5/2}(1) = \frac{3}{4}(x-1)^{-5/2}
\]