1. **(4 points)** *Find the equation of a tangent line to the curve $f(x) = x^4$ at $(2, 16)$.*

   The power rule informs us that $f'(x) = 4x^3$; we know this line must pass through $(2, 16)$, with slope $f'(2) = 4 \cdot 2^3 = 32$. The equation of the line is thus known to be $y = 32x + b$, and putting in the known values $(2, 16)$ will give us b: $16 = 32 \cdot 2 + b$, which leads to the fact that $b = -48$. Thus the equation of this line is $y = 32x - 48$.

2. **(4 points)** *For $f(t) = (4t^3 - 3t^2 + 2t - 1)$, evaluate $f'(t)$.*

   Using the power rule, together with the additive and scalar-constant multiplication properties of the derivative, we find that $f'(t) = 4(3t^2) - 3(2t^1) + 2(1x^0) - (0x^{-1}) = 12t^2 - 6t + 2$.

3. **(4 points)** *Evaluate $\frac{d}{dx}\left(4\sqrt{x} - \frac{5}{x^6}\right)$.*

   If we rephrase this expression as $\frac{d}{dx}\left(4x^{1/2} - 5x^{-6}\right)$, then we may use the power rule, together with the additive and scalar-constant multiplication properties of the derivative, to find that $\frac{d}{dx}\left(4x^{1/2} - 5x^{-6}\right) = 4\left(\frac{1}{2}x^{-1/2}\right) - 5\left(-6x^{-7}\right) = 2x^{-1/2} + 30x^{-7}$.

4. **(4 points)** *If $f(x) = \frac{3x-2}{x^2-4x}$, determine $f'(x)$.*

   Using the quotient rule,

$$
\begin{aligned}
f'(x) &= \frac{d}{dx}\frac{3x-2}{x^2-4x} \\
&= \frac{(x^2-4x)\frac{d}{dx}(3x-2) - (3x-2)\frac{d}{dx}(x^2-4x)}{(x^2-4x)^2} \\
&= \frac{(x^2-4x)(3) - (3x-2)(2x-4)}{(x^2-4x)^2}
\end{aligned}
$$

   which need not be further simplified.

5. **(4 points)** *Evaluate $\frac{d}{dt}\left[(t^3 - 3t + 2)(t + t^{-1})\right]$.*

   Using the product rule,

$$
\begin{aligned}
\frac{d}{dt}\left[(t^3 - 3t + 2)(t + t^{-1})\right] &= \left[\frac{d}{dt}(t^3 - 3t + 2)\right](t + t^{-1}) + (t^3 - 3t + 2)\frac{d}{dt}(t + t^{-1}) \\
&= (3t^2 - 3)(t + t^{-1}) + (t^3 - 3t + 2)(1 - t^{-2})
\end{aligned}
$$

   which need not be further simplified.

6. **(2 point bonus)** *Using only the product rule and the fact that $\frac{d}{dx}x = 1$, determine $\frac{d}{dx}\sqrt{x}$.*

   If we only knew the derivative of x, it would behoove us to relate $\sqrt{x}$ to x in some way. The obvious way to do so is to note that $\sqrt{x} \cdot \sqrt{x} = x$. Then, taking the derivative of each side of this equation, whe would get

$$
\frac{d}{dx}\left(\sqrt{x} \cdot \sqrt{x}\right) = \frac{d}{dx}x
$$

   The right side we have an evaluation for by the information we are given, but the left side could only be expanded by the product rule:

$$
\left(\frac{d}{dx}\sqrt{x}\right)\sqrt{x} + \sqrt{x}\left(\frac{d}{dx}\sqrt{x}\right) = 1
$$

and then we may algebraically simplify to isolate the derivative we seek:

$$2\sqrt{x}\frac{d}{dx}\sqrt{x} = 1 \Longrightarrow \frac{d}{dx}\sqrt{x} = \frac{1}{2\sqrt{x}}$$