1. Find $f'(x)$, do not simplify your answer.

$$f(x) = (4x^2 - \sin(x))(\cos(x) + x^3 - x + 1)$$

**Solution:**

$$f'(x) = (4x^2 - \sin(x))(-\sin(x) + 3x^2 - 1) + (8x - \cos(x))(\cos(x) + x^3 - x + 1)$$

2. Find $f'(x)$, do not simplify your answer.

$$f(x) = \frac{4x^2 - \sin(x)}{\cos(x) + x^3 - x + 1}$$

**Solution:**

$$f'(x) = \frac{(8x - \cos(x))(\cos(x) + x^3 - x + 1) - (4x^2 - \sin(x))(-\sin(x) + 3x^2 - 1)}{(\cos(x) + x^3 - x + 1)^2}$$

3. Find $f'(x)$, do not simplify your answer.

$$f(x) = \frac{\ln(x - 4)(4x^3 + 5x^2 - 6x + 7)}{\sec(x - 7)}$$

**Solution:**

$$f'(x) = \frac{(\ln(x-4)(4x^3+12x^2+10x-6)+\frac{1}{x^3+5x^2-6x+7})\sec(x-7)\ln(x-4)(4x^3+5x^2-6x+7)\sec(x-7)\tan(x-7)}{\sec^2(x-7)}$$

4. Find $f'(x)$, do not simplify your answer.

$$f(x) = \sqrt[3]{\frac{e^{2x-4}\cos(x)}{x^3\sin(4x+1)}}$$

**Solution:**

$$f'(x) = \frac{1}{3} \left( \frac{e^{2x-4}\cos(x)}{x^3\sin(4x+1)} \right)^{-\frac{2}{3}} \cdot 
\left( \frac{(-e^{2x-4}\sin(x)+2e^{2x-4}\cos(x))(x^3\sin(4x+1)) - (e^{2x-4}\cos(x))(4x^3\cos(4x+1)+3x^2\sin(4x+1))}{(x^3\sin(4x+1))^2} \right)$$

5. Find $f'(x)$, do not simplify your answer.

$$f(x) = (x^2 - x + 3)(x^3 + x + 1)$$

**Solution:**

$$f'(x) = (x^2 - x + 3)^{x^3 + x + 1} \left( 3x^2 + 1 \ln(x^2 - x + 3) + \frac{(x^3 + x + 1)(2x - 1)}{x^2 - x + 3} \right)$$

6. Find $\frac{dy}{dx}$ of

$$xe^y = ye^x$$

**Solution:**

$$\frac{dy}{dx} = \frac{-e^y + ye^x}{xe^y - e^x}$$
7. Find a general formula for \( f^{(n)}(x) \) of

\[
f(x) = \frac{1}{5x - 1}
\]

**Solution:**

\[
f^{(n)}(x) = (-1)^n \frac{5^n n!}{(5x - 1)^{n+1}}
\]

8. Derive the formula for \( \frac{d}{dx} (\cot^{-1}(x)) \).

**Solution:**

\[
y = \cot^{-1}(x)
\]

\[
\cot(y) = x
\]

\[
-\csc^2(y)y' = 1
\]

\[
y' = -\frac{1}{\csc^2(y)}
\]

\[
y' = -\frac{1}{x^2 + 1}
\]

9. Given that a particle’s distance from its starting point is given by \( d = -t^3 + 7t^2 + 4t - 5 \), where \( t \) is in seconds and \( d \) is in feet, when is the velocity of the particle zero and what is the acceleration of the particle at these points?

**Solution:** The velocity of the particle is zero at \( t = \frac{7 + \sqrt{61}}{3} \) and \( t = \frac{7 - \sqrt{61}}{3} \), the acceleration of the particle at these points is \(-2\sqrt{61}\) and \(2\sqrt{61}\) respectively.