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

\[
f(x) = (x^2 - 3x + 7)(\sin(x) - \cos(x))
\]

Solution:

\[
f'(x) = (2x - 3)(\sin(x) - \cos(x)) + (x^2 - 3x + 7)(\cos(x) + \sin(x))
\]

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

\[
f(x) = \frac{\sin(x) - \cos(x)}{x^2 - 3x + 7}
\]

Solution:

\[
f'(x) = \frac{(\cos(x) + \sin(x))(x^2 - 3x + 7) - (2x - 3)(\sin(x) - \cos(x))}{(x^2 - 3x + 7)^2}
\]

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

\[
f(x) = \frac{e^{3x^2 - 7}(x^3 + x + 1)}{\tan(2x + 3)}
\]

Solution:

\[
f'(x) = \frac{\tan(2x + 3) \left( e^{3x^2 - 7}(3x^2 + 1) + 6xe^{3x^2 - 7}(x^3 + x + 1) \right) - e^{3x^2 - 7}(x^3 + x + 1)(2 \sec^2(2x + 3))}{(\tan(2x + 3))^2}
\]

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

\[
f(x) = \sqrt[5]{\frac{e^x \ln(x)}{x^2 \sin(7x^2 + 1)}}
\]

Solution:

\[
f'(x) = \frac{1}{5} \left( \frac{e^x \ln(x)}{x^2 \sin(7x^2 + 1)} \right)^{-\frac{4}{5}}
\]

\[
\left( \frac{\left( e^x + e^x \ln(x) \right) (x^2 \sin(7x^2 + 1)) - (e^x \ln(x))(2x \sin(7x^2 + 1) + 14x^3 \cos(7x^2 + 1))}{(x^2 \sin(7x^2 + 1))^2} \right)
\]

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

\[
f(x) = \sin(x)^{\ln(x^2 + 1)}
\]

Solution:

\[
f'(x) = \sin(x)^{\ln(x^2 + 1)} \left( \frac{2 \ln(\sin(x))}{x^2 + 1} + \frac{\ln(x^2 + 1) \cos(x)}{\sin(x)} \right)
\]

6. Find \( \frac{dy}{dx} \) of

\[
y^3x - x^2y + y^4 = x^2y^2 + xy + 1
\]

Solution:

\[
\frac{dy}{dx} = \frac{-y^3 + 2xy + y + 2xy^2}{3xy^2 - x^2 + 4y^3 - 2x^2y - x}
\]
7. Find a general formula for $f^{(n)}(x)$ of

$$f(x) = \frac{1}{3x^3} = \frac{1}{3} x^{-3}$$

**Solution:**

$$f^{(n)}(x) = (-1)^n \frac{(n + 2)!}{3!} x^{-(n+3)}$$

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

**Solution:**

$$y = \sec^{-1}(x)$$

$$\sec(y) = x$$

$$\sec(y)\tan(y)y' = 1$$

$$y' = \frac{1}{\sec(y)\tan(y)}$$

$$y' = \frac{1}{x\sqrt{x^2 - 1}}$$

9. Given that a particle’s distance from its starting point is given by $d = t^3 + 3t^2 - t + 2$, 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 $t = \frac{-3 + 2\sqrt{3}}{3}$ and $t = \frac{-3 - 2\sqrt{3}}{3}$, the acceleration of the particle at these points is $4\sqrt{3}$ and $-4\sqrt{3}$ respectively.