1. (3 points each)

(a) \[
\frac{dy}{dx} = \frac{1}{2\sqrt{\tan^{-1}(e^{\sin x})}} \cdot \frac{1}{1 + (e^{\sin x})^2} \cdot e^{\sin x} \cdot \cos x
\]

(b) \[
\frac{dy}{dx} = \frac{1}{\ln(\sec(4x))} \cdot \frac{1}{\sec(4x)} \cdot \sec(4x) \tan(4x) \cdot 4
\]

(c) \[
\frac{dy}{dx} = (\ln 2)(2\cos x)(- \sin x)
\]

(d) \[
\frac{dy}{dx} = x^{\sqrt{2}} \left( \frac{\sqrt{x}}{x} + \frac{\ln x}{2\sqrt{x}} \right)
\]

2. HINT: Using implicit differentiation, we have:

\[
\pi + \cos(x - xy)[1 - (xy' + y)] = 9y^2 y' + 2x.
\]

Plug in \(x = \pi\) and \(y = 0\) and solve for \(y'\) to get the slope of the tangent line.

ANSWER: \(y = \frac{\pi + 1}{\pi} (x - \pi)\)

3. (a) (5 points) \(L(x) = \frac{1}{4}(x - 1) + 2\)

(b) (3 points) \(\sqrt{4.05} = f(1.05) \approx L(1.05) = 2.0125\)

4. HINT: \(f'(x) = e^{-x}(1 - x) = 0\) at \(x = 1\), which is the only critical number. Evaluate \(f(x)\) at \(x = 1\) (the critical number) and each endpoint of the interval \([-1, 2]\).

ANSWER: The absolute maximum value of \(f(x)\) is \(\frac{1}{e}\). The absolute minimum value of \(f(x)\) is \(-e\).

5. HINT: \[
\frac{dy}{dx} = \frac{dy/dt}{dx/dt} = \frac{10t + 1}{6t - 1} = 0\] at \(t = -\frac{1}{10}\). You need the \(y\)-coordinate of the point that corresponds to \(t = -\frac{1}{10}\).

ANSWER: \(y = -\frac{1}{20}\)

6. HINT: You KNOW that \(\frac{dh}{dt} = 0.5\) mm/sec and \(h = 2r\). You WANT \(\frac{dV}{dt}\) when \(r = 50\) mm.

ANSWER: \(3750\pi\) mm\(^3\)/sec