1. (a) A television camera is positioned 400 ft from the base of a rocket launching pad. A rocket rises vertically and its speed is 20 ft/s when it has risen 300 ft. How fast is the distance from the camera to the rocket changing at that moment?

(b) If the television camera is always kept focused on the rocket, how fast is angle of elevation changing at that moment?

2. A 50 ft ladder leans against a wall. As the base of the ladder is pulled away at a rate of 2 ft/sec., the ladder slides down the wall. At what rate is the angle of elevation of the ladder changing when the base of the ladder is 30 ft from the wall?

3. The cue ball rolls along the hyperbola $2x^2 - y^2 = 1$. As it goes through the point $(5, -7)$, the y coordinate is increasing at a rate of 20 in/sec. At what rate is the distance from the cue ball to the 8-ball changing if the 8-ball is at the point $(−1, 1)$? (The pool table is in dimensions of inches.)
4. Solve for $x$.

\[
12 + \frac{2}{3}e^{0.25x} = 46 \\
12 + 2e^{1+x} = 45 \\
4 - 0.2e^{1-2x} = 2 \\
\ln (2x + 3) = 3.25
\]

5. Differentiate the following using the derivative rules.

(a) \( f(x) = e^{-2x} \cos (5x) \)

(b) \( f(x) = x^2 \ln (1 + 3x^2) \)

(c) \( f(x) = \frac{5xe^{-0.2x}}{1 - 30e^{-0.2x}} \)

(d) \( f(x) = (\ln (x))^3 \)

(e) \( f(x) = \ln (\ln (1 + x^2)) \)

(f) \( f(x) = 3^x + 2^{4x} + 10^{1-x^2} + 3 \cdot 5^x \)

6. Often the spread of an infectious disease can be estimated by the equation

\[
y(t) = \frac{1000}{1 + 9e^{-0.3t}}
\]

(a) Initially \((t = 0)\), how many persons were infected?

(b) What is the maximum number of persons that can be infected?

(c) When will 75% of this maximum number be infected?

7. Determine the equation of the tangent line to the graph of

\( x^2e^{3y} - 2y + \cos y + \ln x + y = 2 \) at the point \((1, 0)\).