Problem Section
Solve each of the following problems. Show all of your work. (i.e. \( u = 1 - 5x \), etc.)

1. (5 points) Parameterize the following curve.

\[ x^2 - y^2 = 1 \]

\[ x^2 = y^2 + 1 \]

This looks like \( \sec^2 t = \tan^2 t + 1 \).

So, we let

\[ x = \sec t \]
\[ y = \tan t \]

2. (5 points) Find \( \frac{dy}{dx} \) using implicit differentiation.

\[ x^2y + y = 145242466546\pi \]

\[ 2xy + x^2y' + y' = 0 \]
\[ 2xy + (x^2 + 1)y' = 0 \]
\[ (x^2 + 1)y' = -2xy \]
\[ y' = \frac{-2xy}{x^2 + 1} \]
3. (10 points) A 13-ft ladder is leaning against a house when its base starts to slide away. By the
time the base is 12 ft from the house, the base is moving at the rate of 5 ft/sec. At what rate
is the angle $\theta$ between the ladder and the ground changing then?

\[
\cos \theta = \frac{x}{13}
\]

\[
\cos (\theta(t)) = \frac{x(t)}{13}
\]

\[
-\sin (\theta(t)) \theta'(t) = \frac{x'(t)}{13}
\]

\[
\theta'(t) = \frac{x'(t)}{-13 \sin (\theta(t))}
\]

\[
\theta' = \frac{5 \text{ ft/sec}}{-13 \left( \frac{5}{13} \right) (ft)}
\]

\[
\theta' = -1 \text{ rad/sec}
\]

- Start by drawing a picture and labeling everything that’s relevant.
- Try to come up with an equation relating your variables.
- Take derivatives. Remember that $x$, $\theta$, etc. are functions of $t$.
  i.e. $x(t)$, $\theta(t)$, etc.
- Solve for the thing you are trying to find.
- Plug in the known information.

\(x\) At the time in question,

\[
x = 12.
\]

\[
y \sqrt{13}
\]

So, $y^2 + 12^2 = 13^2$

\[
y^2 = 25
\]

\[
y = 5.
\]

Thus, $\sin \theta = \frac{5}{13}$. 

Page 2