Problem 1  Find the derivatives of the following functions.

\[
\begin{align*}
    u &= 3x^6 + 5x^4 - 5x + 2000 \\
    y &= \frac{3x^2 + 2x + 1}{2x^4 - 1} \\
    z &= \tan x + \sin x \\
    w &= \frac{x\sin x - 3}{x^2 + 1}
\end{align*}
\]

Use only Rules for Differentiation and derivatives of basic functions. No simplifying necessary.

Problem 2  A point \( P = (x, y) \) is traveling on the perimeter of a wheel with radius 14 inches. The origin \( O \) of the coordinate system is at the center of the wheel.

a) Express the angle \( \theta \) which the ray \( OP \) makes with the positive \( x \)-axis as a function of the \( x \)-coordinate of \( P \), given that the angle is in \([0, \pi]\). What is the angle when \( x = -7 \) inches?

b) Find the derivative of \( \theta \) with regard to \( x \) when \( x = -7 \) inches.

Problem 3  Suppose a function \( y = f(x) \) is such that

\[
y - \frac{\pi}{2} + 2\sin y = x.
\]

a) Find the derivative of \( f(x) \) at \( x = 2 \) given that \( f(2) = \pi/2 \).

b) Find an equation for the tangent line to the graph of \( f(x) \) at \( x = 2 \).

Problem 4  A bike wheel of diameter 28 inches is spinning counterclockwise in one place at 10 revolutions per minute. Place the origin of a coordinate system at the center of the wheel and let \( P \) be the point \((20, 0)\) (with unit 1 inch on both axes). How fast is the distance between \( P \) and a point on the perimeter of the wheel changing at the time when the point is at its highest position? Give exact answers.
Problem 5 Consider the function

\[ y = \sqrt[10]{\frac{3x + 4}{2x - 4}}. \]

a) Simplify \( \ln y \), using rules for logarithms, as much as possible.
b) Find \( y' \) using logarithmic differentiation.