Math 2141: Homework 8 Part 1, Due Friday November 1

Problem 1. Write the equation for the tangent line to \( y = x^2 + 3x - 2 \) when \( x = -1 \).

Problem 2. Find the points on the graph of \( f(x) = \frac{1}{3}x^3 - 2x^2 + 3x + 1 \) at which the tangent line is horizontal.

Problem 3. Calculate derivatives of the following functions. You do not need to simplify your answers, but do show your work (i.e. use of the various differentiation rules).

\[
\begin{align*}
  f(x) &= \frac{x}{\sqrt{4-x^2}} \\
  g(x) &= \cos(3x - 1) \cdot \sin(x^2) \\
  h(x) &= \sqrt[4]{\tan^2(x) + 3}
\end{align*}
\]

Problem 4. Use implicit differentiation to find the equation for the tangent line to the curve given by \( y^2 - y^3x + x^2 = 3 \) at the point \((2, 1)\).

Problem 5. Two cars start moving at the same point. One travels south at 60 miles per hour and the other travels west at 25 miles per hour. At what rate is the distance between the cars increasing two hours later?

Problem 6. A spotlight on the ground shines on a wall 12 m away. If a man 2 m tall walks from the spotlight towards the building at 1.6 m/s, how fast is the length of his shadow on the building decreasing when he is 4 m from the building?

Problem 7. A kite 100 ft above the ground moves horizontally at a speed of 8 ft/s. At what rate is the angle between the string and the horizontal decreasing when 200 ft of string has been let out?

Practice Problems

- Exercises 4.6: 1-12, 16-23.
- Exercises 4.9: 1-4, 9, 10.