

Answer the problems on **separate** paper. You do not need to rewrite the problem statements on your answer sheets. Do your own work. **Show all relevant steps** which lead to your solutions. Attach this question sheet to the front of your answer sheets.

1. (40 pts) Find the derivative of each of the following explicitly defined functions (simplify where possible):

a. $f(x) = x(3x - 4)^2$ b. $g(x) = \sqrt{\frac{1 - x^2}{4 + x^2}}$

c. $h(x) = \sin^{-1}(2 - 3x)$ d. $k(x) = \cos(\sin x)$

e. $j(x) = (1 - 2x)^x$

2. (16 pts) Find y' for each of the following implicitly defined functions:

a. $x^3 + 3xy^2 - y = 11$ b. $x^4 - 2y = x^2 + y^3$

3. (10 pts) Find the equation of the tangent line to the curve defined by $x^2 + y^3 = 2xy + 5$ at the point (3,2).

4. (10 pts) An sailor is standing at the end of pier which is 8 feet above the water and is using an electric winch to reel in a line which is attached to a boat out on the water. The winch is mounted 2 feet above the pier and steadily pulls the line in at a rate of 6 feet per minute. When the boat is 24 feet from the pier, how fast is it moving towards the pier?

5. (10 pts) Use differentials to approximate $\sqrt[4]{16.2}$.

6. (10 pts) Using calculus, find the absolute maximum and absolute minimum values of $f(x) = 4x^5 - 12x^3 + 2$ on $[-1, 2]$.

7. (10 pts) Using calculus, find the absolute maximum and absolute minimum values of $f(x) = \sqrt{x}(2x^2 - 3x)$ on $[0, 2]$.