

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

c. $h(x) = \cos^{-1}(4x + 3)$ d. $k(x) = \sin(\cos x)$

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

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

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

3. (10 pts) Find the equation of the tangent line to the curve defined by $x^3 + y^2 = 4xy - 7$ at the point (2,3).

4. (10 pts) An observer on the ground watches a hot air balloon begin its ascent. The observer is 400 yards from the initial starting point of the balloon. If when the balloon reaches an altitude of 300 yards, the balloon's rate of ascent is 3.5 yards per second, how fast is the distance between the balloon and the observer increasing at that moment?

5. (10 pts) Use differentials to approximate $\sqrt[3]{7.9}$.

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

7. (10 pts) Using calculus, find the absolute maximum and absolute minimum values of $f(x) = \sqrt{x}(4x^2 - 5x)$ on $[0, 2]$.