Higher Order, Implicit Derivatives and Curve Sketching

A. Higher order derivatives: Determine the 1st and 2nd order derivatives for each of the following:

1. $f(x) = 5x^3 - 3x^5$

2. $f(x) = \dfrac{x^3 + 7}{x}$

3. $f(x) = \sin(x^2)$

B. Application:

A dynamite blast blows a heavy rock straight up with a launch velocity of 160 ft/sec. It reaches a height of $s(t) = 160t - 16t^2$ feet after t sec.

a) How high does the rock go?

b) What are the velocity and the speed of the rock when it is 256 feet above the ground on the way up? On the way down?

c) What is the acceleration of the rock at any time t during its flight (after the blast)?

d) When does the rock hit the ground?

C. Implicit Differentiation

1. $x^2 y + xy^2 = 6$ with respect to x

2. $y^2 = x^2 + \sin xy$ with respect to x

3. $2xy + y^2 = x + y$ with respect to y

4. $2x^3 - 3y^2 = 8$ - find the 2nd derivatives

D. Application

Determine the equation of the line through the point (2, 3) tangent to the curve defined by the equation $x^2 + xy - y^2 = 1$

E. Curve Sketching

Sketch the curve $f(x) = 4x^2(1 - x^2)$