Homework 5.3 – Implicit Differentiation and Inverse Functions

1. **(1 pt) alfredLibrary/AUCI/chapter5/lesson3/inverseapplication1pet.pg**

Let $C = f(q) = 250 + 0.1q$ denote the cost in dollars to manufacture q kilograms of a chemical.

(a) Which of the following statements correctly explain the meaning of $f^{-1}(C)$? Check all that apply.

- A. The number of kilograms of the chemical someone can purchase with C dollars.
- B. The cost of manufacturing C kilograms of the chemical.
- C. The number of kilograms of the chemical that can be manufactured with C dollars.
- D. The cost of manufacturing one kilogram of the chemical.
- E. The number of kilograms of chemical that can be manufactured for each 1 dollar spent.
- F. None of the above.

(b) Find a formula for $f^{-1}(C) =$ ______________
(Note that C should be the independent variable in your inverse formula, not q.)

2. **(1 pt) alfredLibrary/AUCI/chapter5/lesson3/inversesolve2pet.pg**
If $f(x) = \sqrt{x^3 - 9}$, then $f^{-1}(x) =$ ________.

3. **(1 pt) alfredLibrary/AUCI/chapter5/lesson3/implicitdrill1pet.pg**
Practice implicit differentiation.

(a) If $6x^3 + x^2y - xy^3 = -2$, then the slope of the curve at the point $(1,0)$ is ______________.

(b) If $5e^{xy} - 5x = y + 261$, then the rate of change of the curve at the point $(2,2)$ is ______________.

(c) If $\sqrt{x} + \sqrt{y} = 7x$, then the slope of the tangent line at the point $(4,676)$ is ______________.

4. **(1 pt) Library/AlfredUniv/AUCI/chapter5/lesson3-/implicitapplication1pet.pg**

Recall, the volume of a sphere is $V = \frac{4}{3}\pi r^3$. If the sphere is increasing in size over time, then we may treat volume and radius as functions of time. That is, $V(t) = \frac{4}{3}\pi[r(t)]^3$.

Suppose the radius of the sphere is increasing at a constant rate of 1.5 centimeters per second. At the moment when the radius is 20 centimeters, the volume is increasing at a rate of ________ cubic centimeters per second.