name : _____

section : 105

GSI : Charles Wang

(2 pts) Circle True or False. (+1 for correct, 0 for blank, -1 for incorrect)

1. (True False) The second derivative test always classifies critical points as local minima or maxima.

2. (True False) The graph of a function can always be recovered from the graph of its first derivative.

(10 pts) For the following, you must **justify** your answer to receive credit. (Showing your work counts as justification.)

3. Air is escaping from a spherical balloon, initially at a radius of 100cm, at a rate of 5cm^3 per minute. The volume, V, of a sphere with radius r is $V = \frac{4}{3}\pi r^3$.

   (a) (2 pt) Draw a diagram of the problem, indicating the given quantities, and compute the volume of the balloon when $r = 10$cm.

   (b) (1 pt) Write a formula for the radius $r(t)$ of the balloon at time t in terms of the volume $V(t)$ at time t.

   (c) (4 pts) Use implicit differentiation with your formula from above to obtain a formula for the rate of change of volume at time t in terms of the rate of change of the radius at time t.

   (d) (3 pts) Determine the rate at which the radius of the balloon is decreasing when the radius of the balloon is 10cm.