MIDTERM EXAM III
Math 16A
Temple-Fall 2012

−Print your name and put your signature on the upper right-hand corner of this exam. Write only on the exam.

−Show all of your work, and justify your answers for full credit.

SCORES

#1

#2

#3

#4

#5

TOTAL:

1. Consider the following function: $f(x) = -x^3 - x^2 + x - 1$.

   (a) (5 pts) Find all critical numbers.

   (b) (5 pts) Apply the second derivative test to determine which critical numbers are relative max and relative min.

   (c) (5 pts) Using the open bracket notation, determine the intervals on which f is increasing and decreasing.

(d) (5 pts) Determine the intervals in which f is concave up and concave down, and find all inflection points.

(e) (5 pts) Graph f, indicating the above features.

(f) (5 pts) Determine the absolute minimum of f on the interval $[-2, 0]$.

2. (10 pts) Determine the vertical and horizontal asymptotes of the function

$$f(x) = \frac{x^2 - 9}{x^2 - 3x + 2}$$

3. (20 pts) Consider the curve described by the relation

$$x^2y^3 + \sin(y+1) + 1 = 0.$$

Verify $(1, -1)$ lies on the curve, and use implicit differentiation to find the slope of the graph of $f(x)$ at $(1, -1)$. Use this to find the point-slope form of the equation of the line tangent to the graph of f at the point $(-1, 1)$.

4. (20 pts) A ball thrown upward from initial height y_0 rises under the downward force of gravity according to the trajectory $y(t) = -16t^2+v_0t+y_0$, where v_0 is the initial upward velocity. Derive a formula for how high the ball rises.

5. (20 pts) An airplane is crashing to the ground along a vertical straight line that is 3000 meters from a radar station (measured horizontally). The radar station measures the rate of change of distance between the airplane and the station is decreasing at 50 meters per second when the plane is at an altitude of 4000 meters. How fast is the plane losing altitude at that moment? (Hint: Draw a picture.)