Math 108
Spring 2015
Dr. Lily Yen

# Test 3

Show all your work

Name: _____

Score: ___/32

**Calculators allowed for this test.**

**Problem 1**: Consider the following equation:

$$y^3 + 2x^2y - 8y = x^3 + 19$$

a. Determine $dy/dx$.

Score: /3

b. Find the equation of the tangent line at the point whose $x$-coordinate is 2.

Score: /2

**Problem 2**: The following parts are related.

a. State the Extreme Value Theorem.

Score: /2

b. There are two conditions in the Extreme Value Theorem which together guarantee the conclusion. Provide graphically a counter example for each of the two conditions separately.

Score: /3

**Problem 3**: The number of salmon swimming upstream to spawn is approximated by

$$S(x) = -x^3 + 3x^2 + 260x + 5000, \quad \text{for } x \in [6, 20],$$

where $x$ represents the temperature of the water in degrees Celsius. Find the water temperature accurate to 2 decimal places that produces the maximum number of salmon swimming upstream. No marks for only numerical answers without appropriate calculus steps.

Score: /6

**Problem 4**: Use the Linear Approximation Method to approximate $2\sqrt[3]{8.001}$ to 5 decimal places. Compare your answer with your calculator's evaluation. Show all your steps.

Score: /5

**Problem 5**: A closed box with a square base is to have a volume of $16\,000\,\text{cm}^3$. The material for the top and bottom of the box costs $\$3.00\,/\text{cm}^2$, while the material for the sides costs $\$1.50\,/\text{cm}^2$.

- Find the cost function.
- Find exact dimensions of the box that will lead to the minimum total cost.
- State the minimum total cost.

Score: /6

**Problem 6**: A cone-shaped icicle is dripping from the roof. The radius of the icicle is decreasing at a rate of 0.2 cm/hr, while the length is increasing at a rate of 0.8 cm/hr. If the icicle is currently 4 cm in radius and 20 cm long, is the volume of the icicle increasing or decreasing, and at what rate? Provide 2-decimal place accuracy.

Score: /5