Math 115 — Practice for Exam 3

Generated November 19, 2015

Name: _____

Instructor: _____ Section Number: _____

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1. This exam has 4 questions. Note that the problems are not of equal difficulty, so you may want to skip over and return to a problem on which you are stuck.
2. Do not separate the pages of the exam. If any pages do become separated, write your name on them and point them out to your instructor when you hand in the exam.
3. Please read the instructions for each individual exercise carefully. One of the skills being tested on this exam is your ability to interpret questions, so instructors will not answer questions about exam problems during the exam.
4. Show an appropriate amount of work (including appropriate explanation) for each exercise so that the graders can see not only the answer but also how you obtained it. Include units in your answers where appropriate.
5. You may use any calculator except a TI-92 (or other calculator with a full alphanumeric keypad). However, you must show work for any calculation which we have learned how to do in this course. You are also allowed two sides of a $3'' \times 5''$ note card.
6. If you use graphs or tables to obtain an answer, be certain to include an explanation and sketch of the graph, and to write out the entries of the table that you use.
7. You must use the methods learned in this course to solve all problems.

Semester	Exam	Problem	Name	Points	Score
Fall 2009	2	8	WiFi Up High	16	
Fall 2009	3	5	icicle	13	
Winter 2009	3	5	potter	8	
Winter 2006	3	3		9	
Total				46	

Recommended time (based on points): 50 minutes

8. [16 points] Some airlines have started offering wireless internet access during flight. The company *WiFi Up High* (WFUH) would like to enter the market and begin working with airlines to offer such service. WFUH will charge passengers based on the amount of time the passenger uses the service during flight.
Preliminary research indicates that during NW flight 2337 (which flies from Detroit to Los Angeles), the number of hours of wifi that will be used by passengers at a price of p dollars per hour is given by the function

$$h(p) = \frac{45000}{149 + e^{0.4p}}.$$

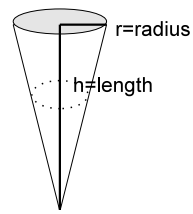
Since offering wifi to its customers is likely to increase business for the airline, WFUH also plans to charge the airline a flat fee of a dollars per flight on which the service is offered.

a. [3 points] If WFUH offers its service to passengers at a price of \$2 per hour, what will be its expected revenue from one NW 2337 flight?

b. [8 points] Use calculus to determine how much WFUH should charge passengers per hour of usage in order to maximize its revenue from NW flight 2337. (Round your answer to the nearest \$0.01.)

c. [5 points] Suppose that WFUH initially decides to charge \$12.50 per hour of use. Note that $h(12.50)$ is approximately 151. Suppose the marginal cost to WFUH when 151 hours of wifi are being used is \$5 per hour of use. In order to increase its profit, should WFUH raise or lower the price it is charging per hour of use on NW flight 2337? Explain.

5. [13 points] A cone-shaped icicle is dripping from above the entrance to Dennison Hall. The icicle is melting at a rate of 1.2 cm^3 per hour. At 10:00 a.m., the icicle was 25 cm long and had a 2 cm radius at its widest point. Assume that the icicle keeps the same proportions as it melts. [Note: the volume of a cone is $V = \frac{1}{3}\pi r^2 h$.]



a. [5 points] Determine the rate at which the length of the icicle is changing at 10:00 a.m.

b. [4 points] At what rate is the radius of the icicle changing at 10:00 a.m.?

c. [4 points] Let $V(t)$ and $r(t)$ denote the volume and radius, respectively, of the icicle t hours after 10:00 a.m. Assume that the icicle continued to melt from $t = 0$ (10:00 a.m.) to $t = M$. Circle all of the statements below that must be true if "After the icicle began dripping at 10:00 a.m., it took exactly M hours for the icicle to melt completely." [Circle the entire expression, and be certain that your circled answers are VERY clear!!]

i. $\displaystyle\int_0^M V'(t)\,dt > \int_0^{M/2} V'(t)\,dt$

ii. $\displaystyle\int_0^M V'(t)\,dt = 0$

iii. $\displaystyle\int_0^M V'(t)\,dt = -V(0)$

iv. $\displaystyle\int_0^2 r(t)\,dt = 0$

v. $\displaystyle\int_0^M r(t)\,dt = -2$

vi. $\displaystyle\int_0^M r'(t)\,dt = -2$

vii. $\displaystyle\int_2^0 V'(r)\,dr = M$

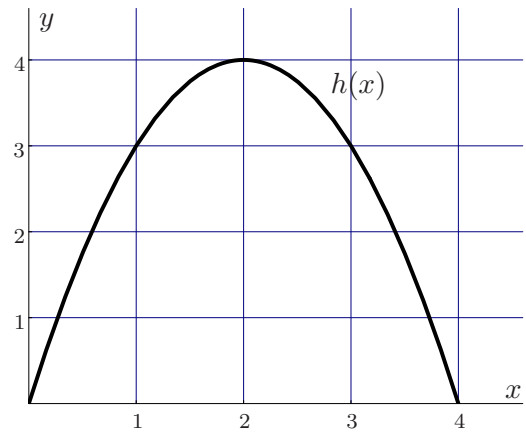
viii. $\displaystyle\int_0^M h(t)\,dt = 0$

5. (8 points) A potter has a fixed volume of clay in the form of a cylinder. As he rolls the clay, the length of the cylinder, L, of increases, while the radius, r, decreases. If the length of the cylinder is increasing at a constant rate of 0.2 cm per second, find the rate at which the radius is changing when the radius is 1.5 cm and the length is 4 cm.

[*Recall that the volume of a cylinder of radius r and length L is $\pi r^2 L$.*]

3. (9 points) Problems (a) and (b) below are independent of each other.

(a) (6 pts.) The graph of a function $h(x)$ is given below.



• Numbers:

$A = h'(1)$, $B = h'(2)$, $C = h'(3)$, $D = h'(3.001)$, $E = \dfrac{h(3)}{3}$, $F = \dfrac{h(3) - h(2)}{3 - 2}$.

• Write the numbers A–F from smallest to largest:

_____

(smallest) (largest)

(b) (3 pts.) Consider the function $w(x)$ given by:

$$w(x) = \begin{cases} -x + 3, & 0 \le x < 1 \\ 2x, & 1 \le x \le 2 \end{cases}$$

Write the the numbers L, I, R (defined below) from smallest to largest.

• Numbers:

$L =$ Left-hand sum of w over [0,2] using 2 subdivisions

$I = \displaystyle\int_0^2 w(x)\, dx$

$R =$ Right-hand sum of w over [0,2] using 2 subdivisions.

• Ordered numbers:

_____

(smallest) (largest)