Math 120 - Autumn 2006
Final Exam
December 9, 2006

Name (please print): _____

Section: _____   Student ID Number: _____

Signature: _____

1	10	
2	10	
3	10	
4	10	
5	10	
6	10	
7	10	
8	10	
Total	80	

- Complete all questions.

- You may use a calculator during this examination. Other electronic devices are not allowed, and should be turned off for the duration of the exam.

- If you use a trial-and-error or guess-and-check method, or read a numerical solution from a graph on your calculator when an algebraic method is available, you will not receive full credit.

- You may use one hand-written 8.5 by 11 inch page of notes.

- Show all work for full credit.

- You have 180 minutes to complete the exam.

- Good luck!

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1. Jo is selling tickets to a concert. She knows that the number of tickets sold will be a linear function of the price of the ticket. If the price is $10.00, then she will sell 800 tickets. For each $1.12 increase in price, 45 fewer tickets will be sold.

   What should Jo set the price at in order to make the most money?

2. You are riding a bicycle. Assume the front sprocket has radius 9 inches and the rear sprocket has radius 4 inches. The front sprocket rotates at 30 revolutions per minute and the bicycle is traveling 5500 inches per minute.

   Find the radius of the rear wheel.

3. Gertrude is running clockwise around a circular track, starting at the point shown in the figure. She runs at a constant 5 meters per second. She takes 91 seconds to reach the northernmost point of the track, and 95 seconds to complete one lap. How far from her starting point is she after running for 8.5 minutes?
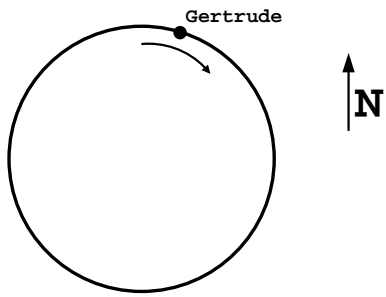
4. Let $h(x) = x^2 + 4$ and $g(x) = \begin{cases} -3 & \text{, if } x \leq 10 \\ \sqrt{x} & \text{, if } x > 10 \end{cases}$

(a) Find the multipart rule for $h(g(2x))$.

(b) Evaluate and simplify $\dfrac{h(3a) - h(2a)}{a}$. (Simplify as much as possible)

5. Fred was measuring the height of a building. He stood standing at some distance from the building and measured an angle of 38 degrees to the top of the building. He then walked 100 feet further away from the building and measured an angle of 34 degrees to the top.

How tall is the building?

6. A space probe lands on a distant planet. The temperature sensor in the probe determines that the temperature on the planet is a sinusoidal function of the time. Two hours after landing, the temperature was at its maximum, 52 °C. The temperature then decreased, and 7.6 hours after landing reached its minimum, -108 °C.

   In the first 24 hours after landing, how much time is the temperature below 10 ° C?

7. At midnight on January 1, 2000, the population in Newberg was 1325 and the population in Kowplunc was 550. The population of Newberg quadruples every 15 years. At midnight on January 1, 2005, the population in Kowplunc was twice the size of the population of Newberg.

   When will the population of Kowplunc be exactly 20,000? (Give your answer in years after January 1, 2000.)

8. Tristan and Iseult are moving at constant speeds in the coordinate plane, measured in meters. Tristan starts at the point $(10, 15)$ and moves at 2 meters per second directly toward the point $(6, -2)$. At the same time, Iseult starts from the point $(18, 3)$ and heads directly toward the point $(1, 1)$. It will take her 8 seconds to reach $(1, 1)$.

(a) Express Tristan's x and y coordinates as linear functions of the time since he started moving.

(b) Express Iseult's x and y coordinates as linear functions of the time since she started moving.

(c) When does Iseult reach the y-axis?