Math 120 - Winter 2012
Final Exam
March 10, 2012

Name: _____   Student ID no. : _____

Signature: _____   Section: _____

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

- Complete all questions.

- Show all work for full credit.

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

- If you use a trial-and-error or guess-and-check method 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.

- You have 170 minutes to complete the exam.

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1. Rudy and Murray are moving in the xy-plane along straight lines at constant speeds. Rudy starts from the point $(10, 0)$ and heads directly toward the point $(-6, 6)$, reaching it in 10 seconds. Murray starts from the point $(3, 7)$ and travels along the line $y = x + 4$. Murray moves toward the y-axis, and takes twice as long to reach the y-axis as Rudy does to reach the y-axis.

   (a) Find the parametric equations of motion for Rudy.

   (b) Find the parametric equations of motion for Murray.

   (c) How long has Rudy been moving when the distance between Rudy and Murray is as small as it ever gets?

2. Inga is walking near the Circular Forest, a forest in the shape of a circle with a radius of 10 km.

Inga starts her walk from a point 13 km WEST and 3 km NORTH of the center of the forest. She starts walking due east. After reaching the forest, she continues traveling east for 5 km, and then turns and walks due SOUTH until leaving the forest.

Inga walks at a constant speed of 3 km per hour. How much time did she spend in the forest during her walk?

3. Consider the figure below illustrating a region bounded by two circular arcs. The area of the striped region is 18.7 square meters, $z = 2$ meters, and $s = 10.2$ meters. Find the value of θ.

The figure is not to scale.
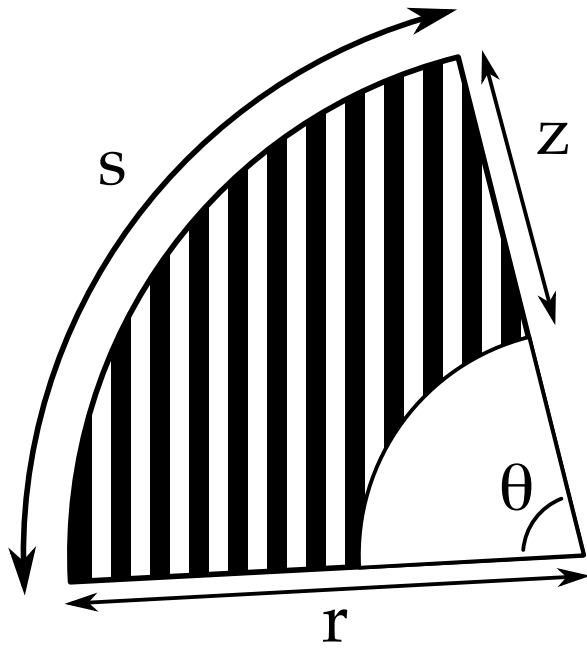
4. Maria is running around a circular track. She runs clockwise and, from when she starts, it takes her 28 seconds to reach the southernmost point of the track. She takes 105 seconds to run each lap of the track.

(a) From when she starts, how long does it take her to reach the easternmost point of the track?

(b) Bob starts running on the track at the same time as Maria. He starts from the northernmost point and runs counter-clockwise. He takes 130 seconds to run each lap of the track.

Let R be the radius of the track. Using a coordinate system with the origin at the center of the track, find Bob's x- and y-coordinates when he passes Maria for the first time (your answer will involve R).

5. The pressure inside Simone's eyeball is a sinusoidal function of time. The pressure reaches a minimum of 1.8 kPa 4 hours after you begin measuring it. The pressure then increases, reaching a maximum of 2.3 kPa 9 hours after you begin measuring it.

   How long do you have to measure the pressure until you have observed it below 1.9 kPa for 5 hours?

6. Margarita knows that her score on the final exam will be a quadratic function of the amount of time she studies. If she studies for 10 hours, she will score 50 %. If she studies for 20 hours, she will score 85 %. If she studies for 35 hours, she will score 80 % (her score decreases due to overwork and stress from lack of sleep).

(a) How much should she study to maximize her score on the exam?

(b) What is her maximum possible score on the exam?

7. Margot has a pizza in the shape shown below. The dimensions are in centimeters.

Margot wants to make a vertical cut in the pizza. If her cut is x centimeters from the left edge, express the area to the left of the cut as a multipart function of x.

7

8

17

36

5
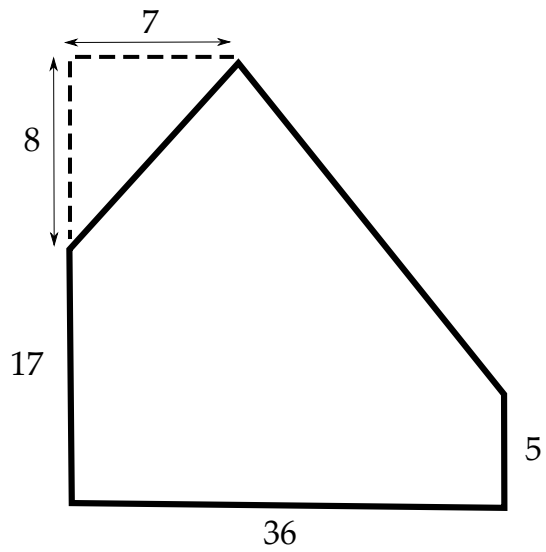
8. (a) Let $h(x) = 8x + 3\sqrt{x}$. Find $h^{-1}(x)$.

(b) Let $k(x) = \frac{2}{5}x + \sqrt{x}$. Find the fixed points of $k(x)$.