

Math 120 A, B - Winter 2010  
Final Exam  
March 13, 2010

Name: \_\_\_\_\_

Student ID no. : \_\_\_\_\_

Signature: \_\_\_\_\_

Section: \_\_\_\_\_

1	10	
2	10	
3	10	
4	10	
5	10	
6	10	
7	10	
Total	70	

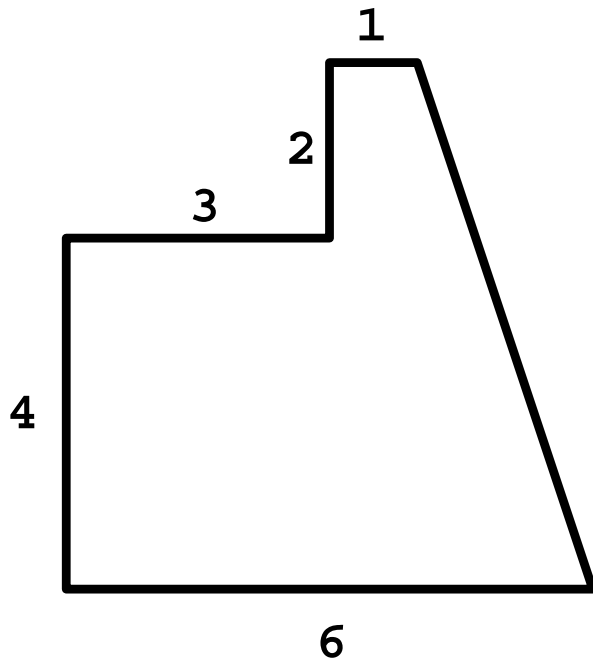
- Complete all questions.
- Show all work for full credit.
- You may use a scientific calculator during this examination. Graphic calculators are not allowed. Also, other electronic devices are not allowed, and should be turned off and put away for the duration of the exam.
- If you use a trial-and-error 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. Write your name on your notesheet and turn it in with your exam.
- You have 170 minutes to complete the exam.

1. Maria is walking near a radio transmitter antenna. She begins 3 km west and 4 km south of the transmitter, and walks directly toward a point 5 km due north of the transmitter. However, when she reaches a point due west of the transmitter, she turns and walks due south for 6 km and ends her walk.

Maria walks at a constant speed of 4 km/hr. During her walk, for how much time was she within 3 km of the transmitter?

2. A polygonal pizza is shown below, with the horizontal and vertical side lengths labeled in inches.

If a vertical cut is made  $x$  inches from the left edge of the pizza, what is the area to the left of the cut? Express the area as a multipart function of  $x$ .



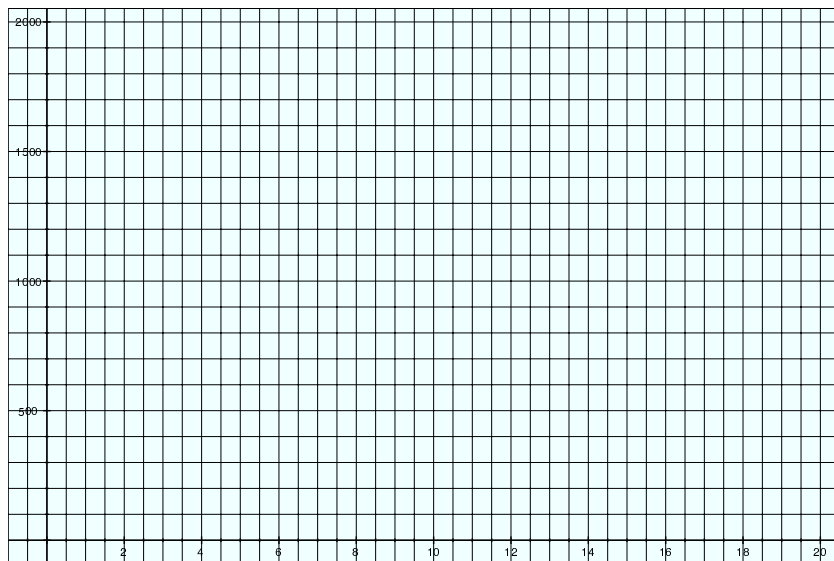
3. Julia is selling tickets to a concert. She knows from previous experience that the number of tickets she will sell depends on the price she charges per ticket. The relationship is given by

$$f(p) = \begin{cases} 500 - \frac{100}{3}p & \text{if } 0 \leq p \leq 12, \\ 250 - 12.5p & \text{if } 12 \leq p \leq 20 \end{cases}$$

where  $p$  is the price per ticket (in dollars) and  $f(p)$  is the number of tickets sold.

- (a) Let  $M(p)$  be the amount of money Julia will make from the sale of tickets at price  $p$ . Write the multi-part rule for the function  $M(p)$ .

- (b) Sketch a graph of  $M(p)$  below.



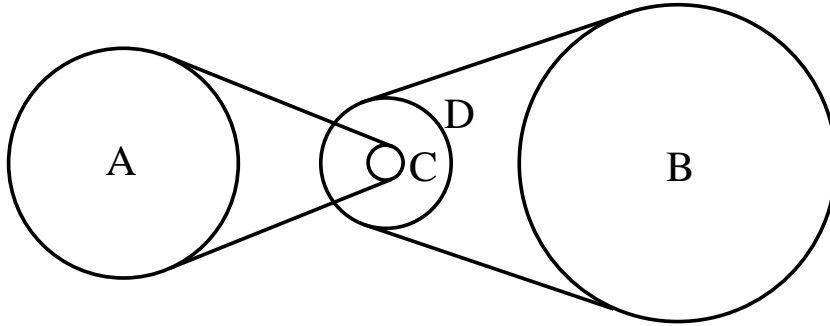
- (c) What price  $p$  should she charge to make the most money?

4. Georgia is roller skating on a circular track. From her starting point, it takes her 3 seconds to reach the westernmost point of the track, and 25 seconds to reach the northernmost point. Georgia skates at a constant 2.7 meters per second.

(a) Express Georgia's coordinates as functions of time, using the center of the track as the origin.

(b) After skating for 11 minutes, how far (in a straight line) will she be from the northernmost point?

5. You are designing a system of wheels and belts as pictured below. You want wheel A to rotate 40 RPM while wheel B rotates 85 RPM. Wheel A has a radius of 10 inches, wheel B has a radius of 12 inches and wheel D has a radius of 7 inches. Assume wheels *C* and *D* are rigidly fastened to the same axle. What is the radius  $r$  of wheel *C*?



6. Fidel is measuring the light intensity of a distant star. He has found that the intensity varies between a minimum of 200 units and a maximum of 760 units. At 7:00 AM today, he found the intensity was 200. The intensity then increased, reaching an intensity of 480 at 11:00 AM today.

Assume that the light intensity is a sinusoidal function of time. For what length of time today will the intensity be below 300 units?

7. You are measuring trees in a forest. Standing on the ground exactly half-way between two trees, you measure the angle the top of each tree makes with the horizon: one angle is  $48^\circ$ , and the other is  $72^\circ$ . If one tree is 30 feet taller than the other, how far apart (horizontal distance along the ground) are the two trees?