Math 120 A, B Winter 2012
Mid-Term Exam Number Two
February 23, 2012

Name: _____ Student ID no. : _____

Signature: _____ Section: _____

1	10	
2	10	
3	10	
4	10	
Total	40	

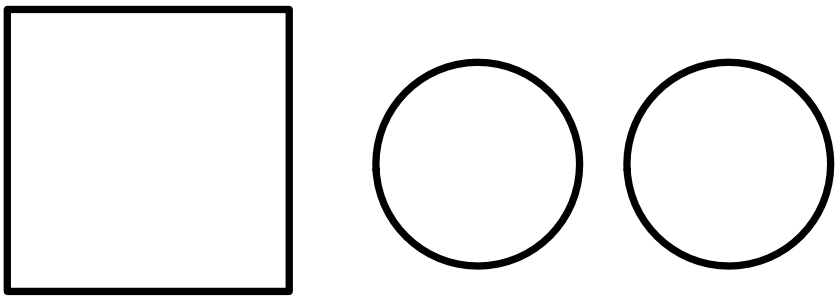
- Complete all four questions.
- Show all work for full credit.
- You may use a scientific calculator during this examination. Graphing calculators are not allowed. Also, other electronic devices are not allowed, and should be turned off and put away for the duration of the exam.
- If you use a trial-and-error 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 50 minutes to complete the exam.

1. On a certain island, there are two species of birds, A and B. The A population increases at the constant rate of 13% every 8 years. The B population triples every 12 years.

   In the year 1990, the B population was 300, and the A population was 5000.

   When will the populations be equal? Give you answer in years after 1990.

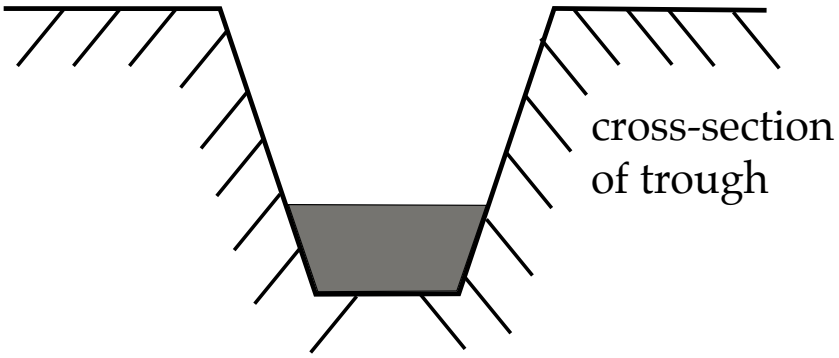
2. You have 300 cm of wire with which to make two identical circles and a square. For example, you squares and circle might look like this:



(a) What should the side length of each square be to *minimize* the combined area of the circles and the square?

(b) What should the side length of each square be to *maximize* the combined area of the circles and the square?

3. A trough has a trapezoidal cross-section. The trough is 12 feet deep. The bottom of the trapezoid is 5 feet wide, and the top of the trough is 13 feet wide.



Water starts flowing into the trough. The depth of the water in the trough increases at a constant rate of 0.5 feet per hour.

(a) Give a function $w = f(t)$ relating the width w of the surface of the water to the time t since water started flowing.

(b) Specify the domain of the function you gave in part (a).

(c) Give a function $t = f^{-1}(w)$ relating the time to the width of the surface of the water.

4. Consider the figure below illustrating a region bounded by two circular arcs. The area of the striped region is 2835 square meters, $z = 30$ meters, and $s = 108$ meters. Find the value of r.

   The figure is not to scale.