

Math 120 A - Autumn 2013
Mid-Term Exam Number Two
November 14, 2013

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. The population of the city of A triples every 22 years. In the year 2000, the population of A was 10,000.

The city of A has a rat infestation problem. In the year 2003, there were 4 rats per person. In the year 2012, there were 7 rats per person. Assume the number of rats in the city is an exponential function of time.

- (a) When will there be 3 million rats in the city of A? Give your answer in years after 2000.

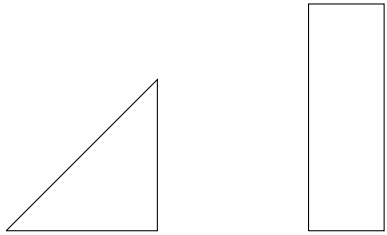
- (b) How long does it take the number of rats in the city of A to double?

2. The concentration of caffeine in a cup of tea is a linear-to-linear function of time. Initially (i.e., when the tea is placed into hot water), it is zero. After steeping for one minute, it is 30 mg/ml. After steeping for four minutes, it is 80 mg/ml.

(a) What will the concentration be after 11 minutes?

(b) How long does the tea need to steep until the concentration is 140 mg/ml?

3. You have 200 meters of fencing with which to build two enclosures. One enclosure will be an isosceles right triangle, and the other will be a rectangle that is three times as long as it is wide. The figure below shows the two shapes.



What should the dimensions of the rectangular enclosure be to **minimize** the combined total area of the two enclosures?

4. Let $f(x) = \frac{x+5}{x+3}$. Let $g(x) = f(f(x))$.

(a) Find the asymptotes of $g(x)$.

(b) Find $g^{-1}(x)$.

(c) Find the fixed points of $g(x)$.