

Math 120 C - Autumn 2010  
Mid-Term Exam Number Two  
November 18, 2010

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. 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 50 minutes to complete the exam.

1. Alex and Boris are moving in the  $xy$ -plane, along straight lines at constant speeds. Alex starts at the origin and will reach the point  $(9, 6)$  after 3 seconds. Boris starts at the same time as Alex does. He starts from the point  $(4, 0)$  and will reach the point  $(0, 10)$  after 4 seconds.

When will Alex and Boris be closest together?

2. The population of city P triples every 35 years. In the year 1995, city P's population was 60,000.

City Q's population has a constant doubling time. In 2005, the population of city Q was 10% less than city P's population. In 2010, the population of city Q was 10% more than city P's population.

When will city Q's population reach 250,000? Give your answer in years after 1995.

3. The population of tigers in a certain region is always growing, but will never surpass 1200. In 1980, there were 300 tigers. In 1985, there were 320 tigers.

Assume that the population of tigers is a linear-to-linear rational function of time.

When will there be 350 tigers? Give your answer in years after 1980.

4. Let  $f(x) = 2x - 3$  and  $g(x) = x^2 - 6x$ .

(a) Let  $m(x) = g(f(x)) - f(g(x))$ . Find the vertex of the graph of  $m(x)$ .

(b) Let  $(h, k)$  be the vertex you found in part (a). Let  $p(x)$  be  $m(x)$  restricted to  $x \leq h$ . Find  $p^{-1}(x)$ .