

Math 120 B - 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. Jessa is deciding how much to charge for her self-published memoir. The number of copies she sells is a linear function of the amount that she charges.

If she charges \$10 per copy, she'll sell 200 copies.

If she charges \$30 per copy, she'll sell 140 copies.

(a) Find a function $f(x)$ for the **total amount of money** Jessa earns by charging $\$x$ per copy.

(b) How much should she charge in order to **maximize** her revenue?

2. (a) Suppose $f(x) = \sqrt{x} + 2x$, and $g(x) = e^x + 3$. Compute $f(g(x))$.

(b) Suppose $f(x) = \sqrt{x} + 2x$. Compute its inverse function, $f^{-1}(x)$.

(c) Suppose $f(x) = \sqrt{x} + 2x$. Give the rule for $h(x)$, whose graph is that of $f(x)$ after being dilated vertically by a scaling factor of 2, and *then* translated down 3 units.

3. The cities of Catoma and Vellebue are both growing according to an *exponential* model.

The population of Catoma was 10,000 in the year 1990 and 14,000 in the year 1998.

The population of Vellebue doubles every 15 years. In 2006, it was one quarter of the population of Catoma.

(a) Give a formula $c(t)$ for the number of people in Catoma, t years after 1990.

(b) Give a formula $v(t)$ for the number of people in Vellebue, t years after 1990.

(c) In what year will the population of Vellebue be 150,000?

4. The population of the Democratic Republic of Rationalia can be modeled by a *linear-to-linear rational function*.

In the year 1900, there were 40 million people in Rationalia.

In the year 2000, there were 85 million people in Rationalia.

In the long term, Rationalia's population will approach (but not exceed) 130 million.

- (a) Write a linear-to-linear rational function $f(x)$ for the population of Rationalia, in **millions**, as a function of time. Let $x = 0$ represent the year 1900.

- (b) What will the population be in the year 2050?