Math 120 A - Spring 2014
Final Exam
June 7, 2014

Name: _____   Student ID no. : _____

Signature: _____   Section: _____

1	12	
2	12	
3	12	
4	13	
5	12	
6	12	
7	13	
8	14	
Total	100	

- This exam consists of EIGHT problems on NINE pages, including this cover sheet.

- Show all work for full credit.

- You may use a scientific calculator during this exam. Graphing calculators are not permitted. Also, other electronic devices are not allowed, and should be turned off and put away for the duration of the exam.

- You do not need to simplify your answers.

- If you use a trial-and-error or guess-and-check method when a more rigorous method is available, you will not receive full credit.

- If you write on the back of the page, please indicate that you have done so!

- You may use one hand-written double-sided 8.5" by 11" page of notes.

- You have 170 minutes to complete the exam.

1. **[12 points]** Gretel stands 2 miles west and 6 miles north of the **westernmost** point of a circular forest with radius 20 miles. At the **easternmost** point of the forest is a house made out of candy.

   Gretel walks in a straight line to the house at a speed of 3 miles per hour.

   For how much time does she walk **inside the forest**?

2. **[12 points]** Asha and Burt are standing on a coordinate grid and begin walking at the same time.

   (a) Asha begins at $(6, -5)$ and walks in a straight line at a constant speed towards $(2, 3)$, reaching it in 8 seconds.

   Give parametric equations for Asha's coordinates t seconds after she begins walking.

   (b) Burt begins at $(-10, 7)$ and walks in a straight line towards $(5, -1)$ at a constant speed of 3.4 units per second.

   Give parametric equations for Burt's coordinates t seconds after he begins walking.

   (c) When are Asha and Burt closest together?

3. **[12 points]**

   (a) Let $f(x) = |x| - x^2 + 2$, and let $g(x) = x - 2$. Write down the multipart rule for $f(g(x))$.

   (b) Let $f(x) = |x| - x^2 + 2$. Is $f(x)$ one-to-one? Explain in one or two sentences.

   (c) Let $f(x) = |x| - x^2 + 2$. Let $h(x)$ be the function whose graph is formed by vertically dilating the graph of $f(x)$ by a factor of 3, and then shifting it 2 units down.

      Write a formula for $h(x)$.

4. **[13 points]** The cities of Largo and Andante have populations that grow at exponential rates.

The population of Largo increases by 2.3% every year, and the population of Andante doubles every 15 years.

In the year 2000, Largo had a population of 4,000,000. In the year 2010, Andante's population was half of Largo's.

(a) Write a function $\ell(t)$ for the population of Largo, in millions, t years after 2000.

(b) Write a function $a(t)$ for the population of Andante, in millions, t years after 2000.

(c) When will the population of Andante be three times the population of Largo?

5. **[12 points]**

   (a) Find a linear-to-linear rational function $f(x)$ whose graph has x-intercept 21 and y-intercept 36, and passes through the point $(1, 40)$.

   (b) Compute the horizontal and vertical asymptotes of $f(x)$ from part (a).
      (Specify which is which.)

6. **[12 points]** You are standing on flat ground some distance away from a skyscraper. Climbing up the skyscraper, 150 feet from the top, is a gorilla.

From where you stand, you measure the angle of elevation from the ground to the gorilla, and you find it to be $70°$.

Then you measure the angle of elevation from the ground to the top of the skyscraper. It's $75°$.

How tall is the skyscraper?

7. **[13 points]** Andy and Chloe begin running around a circular track at the same time.

Chloe begins at the northernmost point of the track and runs clockwise at a speed of 4 meters per second.

Andy begins at the southernmost point of the track and runs counterclockwise at a speed of 3 meters per second, passing Chloe for the first time after 11 seconds.

(a) What is the radius of the track?

(b) After ten minutes, who is farther east: Chloe or Andy?

8. **[14 points]** The temperature in my refrigerator is a sinusoidal function of time. It will next reach its maximum temperature of $40°$ F two hours from now, and then reach the minimum of $35°$ F three hours later.

   (a) Find a function $f(t)$ for the temperature of my refrigerator, in Fahrenheit, t hours from now.

   (b) In the next 20 hours, for how much time will the temperature be above $38°$ F?