Math 120 A - Spring 2009
Mid-Term Exam Number Two
May 21, 2009

Name: _____   Student ID no. : _____

Signature: _____   Section: _____

1	10	
2	10	
3	10	
4	10	
Total	40	

- Complete all four questions.

- 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.

- Show all work for full credit.

- You have 50 minutes to complete the exam.

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1. The people of a certain country are working to improve the literacy rate (i.e., the percentage of the population who can read) among them. Today, the literacy rate is 50%. Their goal is to increase the literacy rate to 75% in ten years, and after that continuing to increase the literacy rate indefinitely, ultimately getting closer and closer to 100%.

   Suppose that the literacy rate is a linear-to-linear rational function of time.

   (a) Find the function that gives the literacy rate in terms of t, years after today.

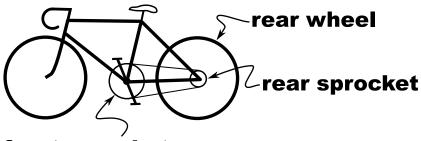   (b) Find the inverse of the function you found in part (a).

2. Jürgen is running clockwise around a circular track. From his starting point, it takes him 14 seconds to reach the westernmost point of the track. It takes him 80 seconds from his starting point to reach the northernmost point of the track. He runs at 3 meters per second.

   (a) After running for 8 minutes, how far (in a straight line) is Jürgen from the easternmost point of the track?

   (b) At the same time that Jürgen starts, Beatrice starts running counterclockwise from the easternmost point at 4 meters per second. How long has Beatrice been running when she passes Jürgen for the first time?

3. The water pressure in a city water system varies sinusoidally. At 4 AM today, the pressure was at a maximum: 100 psi (pounds per square inch). After 4 AM, the pressure dropped, reaching the minimum pressure of 60 psi at 10:30 AM today.

   For how much time today (from midnight to midnight) is the water pressure below 70 psi?

4. Each of the wheels of a bicycle has a radius of 33 cm. The front sprocket has a radius of 7 cm. What radius should the rear sprocket have to achieve a speed of 25 km per hour while pedaling at 95 rpm (revolutions per minute)?

rear wheel

rear sprocket

front sprocket