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

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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.

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1. You have 100 cm of wire with which to construct a square and a semicircle.
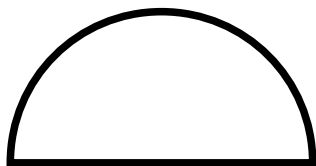
   (a) What should the radius of the semicircle be to result in the smallest possible combined area of the square and the semicircle?

   (b) What should the radius of the semicircle be to result in the largest possible combined area of the square and the semicircle?

2. Four pulleys are connected as shown in the figure below (the figure is not to scale). Assume pulleys A and B are rigidly attached to the same axle. Pulley A has a radius of 3 cm. Pulley C has a radius of 4 cm and is turning at 325 rpm (revolutions per minute). Pulley D has a radius of 6 cm. If Pulley D has an angular speed of 150 *radians* per minute, what is the radius of pulley B?
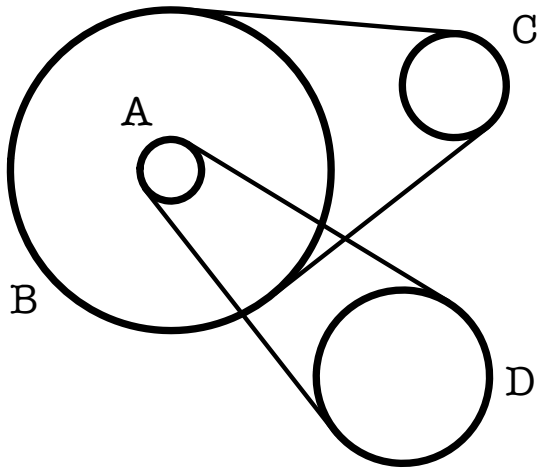
3. City P had a population of 20,000 in the year 2005. The population of city P always increases by 11% every 24 years.

City Q's population doubles in two-thirds of the time that city P's population doubles. In the year 2010, city Q has 90% as many people as city P.

In the year 2027, what will be the population of city Q?

4. A *fixed point* for a function $f(x)$ is any number k such that

$$f(k) = k.$$

Give an example of a *linear-to-linear rational function* with fixed points -2 and 5.