

Math 120 A, B - Winter 2007  
Final Exam  
March 10, 2007

Name: \_\_\_\_\_

Section: \_\_\_\_\_

1	10	
2	10	
3	10	
4	10	
5	10	
6	10	
7	10	
Total	70	

- Complete all questions.
- You may use a calculator during this examination. Other electronic devices are not allowed, and must be turned off for the duration of the exam.
- If you use a trial-and-error or guess-and-check method, or read a numerical solution from a graph on your calculator 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.
- Show all work for full credit.
- You have 170 minutes to complete the exam.

1. A blob from outer space has been discovered. It is spherical, and its diameter is a sinusoidal function of time. At 2:00 AM, you observe the blob's diameter to be at its maximum, 3.2 meters. The diameter then shrinks, reaching its minimum, 1.4 meters, at 7:00 AM.

What is the **second** time after 7:00 AM that the blob's diameter is 1.8 meters?

2. The population of the city of Gub has a doubling time of 63 years. In 1980, Gub's population was 20,000, while the city of Lok's population was 10,000. In 2005, Gub's population was 50 percent more than the population of Lok in 2005. Assuming Lok's population is growing exponentially, when will the cities have equal populations?

3. Recall that a function  $k$  is a fixed point of a function  $f(x)$  if

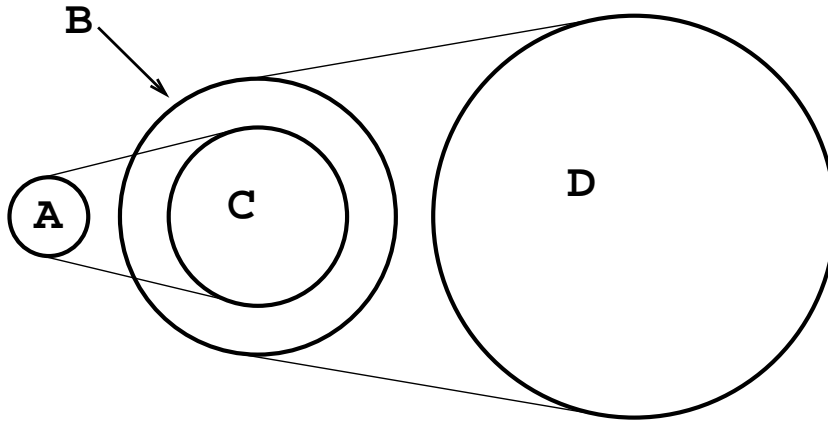
$$f(k) = k.$$

(a) Find the fixed point(s) of the function

$$f(x) = \begin{cases} 5x - 18 & \text{if } x < 2 \\ -x + 14 & \text{if } x \geq 2 \end{cases}$$

(b) Find a quadratic function  $g(x)$  whose fixed points are 3 and 4.

4. Four pulleys are attached as shown in the figure. Pulley A is attached to pulley C by a belt, and B is attached to D by a belt. Pulleys B and C are attached to the same axle, and hence they rotate together. The figure is not to scale.



You know the radii of three of the pulleys:

- A 2.5 cm
- B 7.1 cm
- D 9.6 cm

If pulley A has an angular speed 12.3 rad/sec, and pulley D has an angular speed of 6.3 rad/sec, what is the radius of pulley C?

5. Let  $f(x) = 3x + 5$  and

$$g(x) = \begin{cases} x^2 & \text{if } x < -2 \\ 1 - x & \text{if } x \geq -2 \end{cases}$$

(a) Write the multipart rule for  $g(f(x))$ .

(b) Write the multipart rule for  $f(g(x))$ .

6. The weight of a certain fish is a linear-to-linear rational function of time. Today, the fish's weight is 10 kg. One week from today, the fish will weigh 12 kg. Two weeks from today, the fish will weigh 13 kg.

When will the fish weigh 15.62 kg?

7. You are going to ride a ferris wheel that has a radius of 160 feet and rotates at a constant 1.57 revolutions per minute. The lowest point on the wheel is 24 feet off the ground. From the point where you start your ride, it will take you 21 seconds to reach the highest point of the wheel.

(a) How far off the ground will you be when the ride starts?

(b) How far off the ground will you be after 5.6 minutes on the ride?