Math 120 A - Spring 2005
Final Exam
June 4, 2005

Name: _____ Section: _____

Student ID Number: _____ TA's name: _____

1	10	
2	10	
3	10	
4	10	
5	10	
6	10	
7	10	
8	10	
Total	80	

- Complete all questions.
- You may use a calculator during this examination. Other electronic devices are not allowed, and should 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) Let $f(x) = \dfrac{x+3}{x+1}$. Find the asymptotes of the function $g(x) = f(f(x))$.

(b) A linear-to-linear rational function's vertical asymptote is $x = 4$, its horizontal asymptote is $y = 5$ and its graph passes through the point $(10, 6)$.
Find the y-intercept of its graph.

2. Susan walks down a straight railroad track from the town of Gurb to the town of Splunge. Gurb is located 4 miles due east of the town of Huth. Splunge is located 16 miles north and 7 miles west of Huth.

   On Susan's walk, what is the closest she gets to Huth?

3. A chicken is walking in a straight line on the (x, y)-plane, which is measured in feet (so, for instance, the point $(0, 1)$ is 1 foot from the origin). The chicken starts at the point $(1, 2)$ and walks along the line $y = -2x + 4$ at a constant speed. Five seconds later, the chicken's y-coordinate is 40.

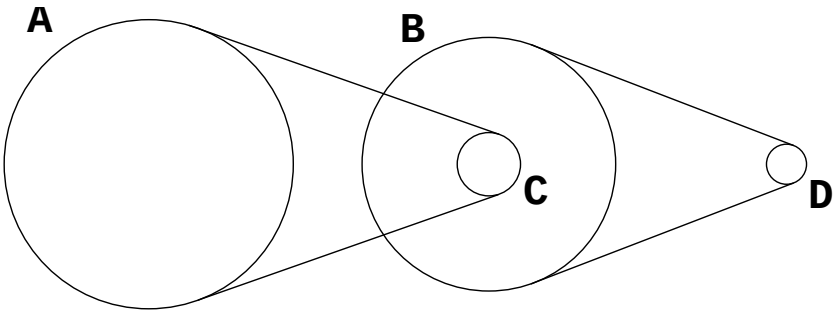
   (a) Find the speed of the chicken.

   (b) Express the distance from the chicken to the origin as a function of t, the number of seconds the chicken has been walking.

4. The populations of Rimpo and of Sumpo are growing exponentially. In 1980, the population of Rimpo was 8000. The population of Rimpo doubles every 17 years. In 1970, there were three times as many people in Sumpo as in Rimpo. In 2000, there were four times as many people in Sumpo as in Rimpo.

   How long does it take the population of Sumpo to double?

5. Rick is working on a complicated bicycle transmission system involving four sprockets, connected by two chains as shown in the figure. Note: the figure is not to scale.

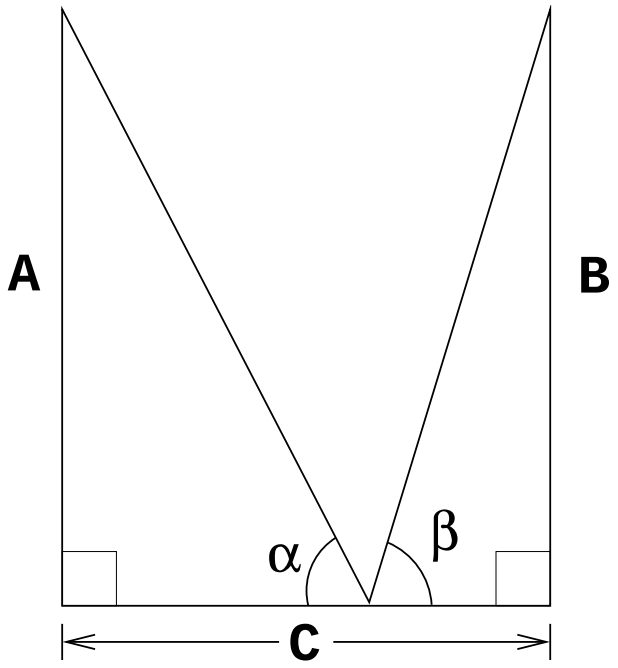


The sprockets labeled B and C are attached to the same axle and rotate together.

Sprocket A has a radius of 8 cm, and sprocket B has a radius of 7 cm. Sprocket D has a radius of 1 cm.

Rick wants the angular speed of sprocket D to be 200 radians per second when the angular speed of sprocket A is 80 rpm. What should the radius of sprocket C be?

6. Side A and side B have the same length. If C is 10 cm, $\alpha = 62°$, and $\beta = 70°$, what is the length of A?



7. Let $u(t)$ be the unit step function

$$u(t) = \begin{cases} 0 & \text{if } t < 0 \\ 1 & \text{if } 0 \leq t \leq 1 \\ 0 & \text{if } t > 1 \end{cases}$$

(a) Write the multipart rule for the function $g(t) = tu(t) + u(t - \frac{1}{2})$

(b) Find all solutions to the equation

$$1.7 = g(t)$$

8. Suppose $f(x)$ is a quadratic function. The graph of $f(x)$ has its vertex at $(-3, 8)$.

   (a) What is the vertex of the graph of $g(x) = 3f(3x + 10) + 7$?

   (b) Suppose $f(4) = 9$. Find $f(5)$.