Math 120 **Final Examination** **Spring 2003**

Your Name

Your Signature

Student ID #

Quiz Section

Professor's Name

TA's Name

- Before you begin, check that your exam contains 10 pages (not counting this cover sheet).
- Please turn off all cell phones and pagers and other noise-making devices.
- This exam is closed book.
- You may use one $8\frac{1}{2} \times 11$ sheet of hand-written notes. Students may not share notes.
- Calculators are allowed. Students may not share calculators.
- We can only give credit for computations we see on your exam paper. Show **all** your work.
- If you use a trial and error (or guess and check) method when an algebraic method is available, you will not receive full credit.
- If you need more room, use the backs of the pages and indicate to the reader that you have done so.
- Raise your hand if you have a question.

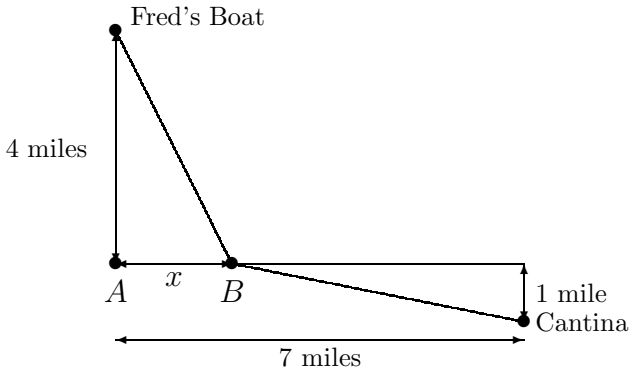
Problem	Total Points	Score
1	8	
2	8	
3	10	
4	16	
5	12	

Problem	Total Points	Score
6	12	
7	12	
8	10	
9	12	
Total	**100**	

1. (8 points) Let $f(x) = 4x^2 - 9$. Compute and simplify

$$\frac{f(x+h) - f(x)}{h}.$$

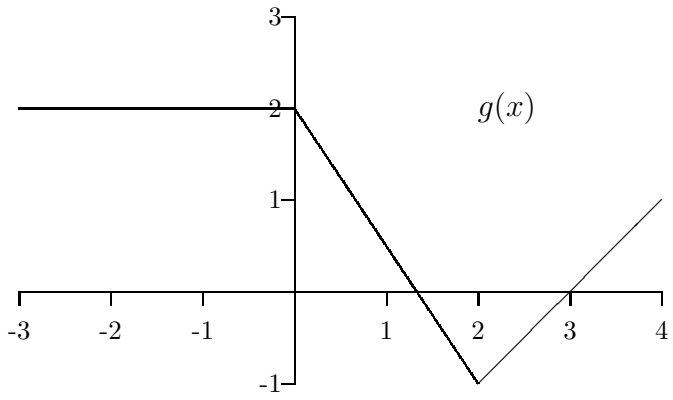
2. (8 points) Fred is in a rowboat 4 miles north of a point A on the shore of Cowshead Lake. He wants to meet his buddy Craig who is waiting at the Cowshead Cantina 7 miles east and 1 mile south of the point A. Fred can paddle 3 miles per hour and can walk 4.5 miles per hour. He paddles in a straight line to a point B, x miles east of point A, and walks in a straight line the rest of the way. His path is pictured below. Find a function $T(x)$ that gives the total time it takes Fred to get to the Cantina.



3. (10 points) Let $g(x)$ be the multi-part function

$$g(x) = \begin{cases} 2, & \text{if } -3 \le x \le 0 \\ -\frac{3}{2}x + 2, & \text{if } 0 \le x \le 2 \\ x - 3, & \text{if } 2 \le x \le 4. \end{cases}$$

The graph of $g(x)$ is given below.



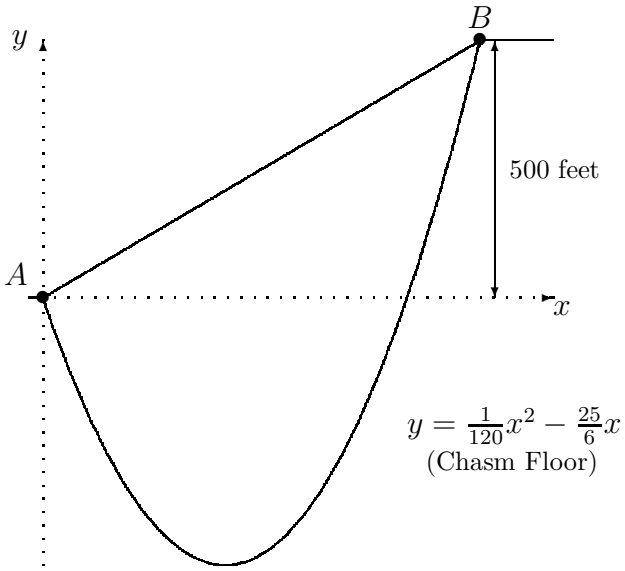
Find each of the following.

(a) the range of $g(x)$

(b) the domain of $h(x) = g(\frac{1}{3}x - 1)$

(c) the domain of $k(x) = \sqrt{-g(x)}$

4. (16 points) Myra is on a lift crossing the Grand Chasm. The lift travels along a straight track from point A to point B in the picture below. If we impose a coordinate system with the origin at point A, then the floor of the chasm is the graph of $y = \frac{1}{120}x^2 - \frac{25}{6}x$. Passengers on the lift gain 500 feet in altitude during the crossing. (Drawing may not be to scale.)



(a) Find the coordinates of point B.

If you are unable to complete part (a), make a reasonable guess for the coordinates of point B and use your guess to complete the rest of the problem.

GUESS: _____

(b) Find the equation of the line that gives the path of the lift.

(c) Find a function $h(x)$ that gives Myra's vertical height above the chasm floor while she is on the lift.

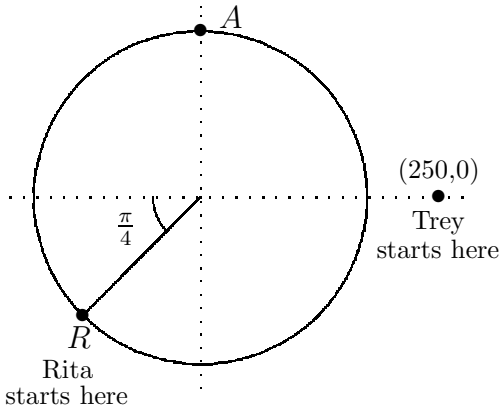
(d) Give Myra's coordinates when she has maximum vertical height above the chasm floor.

5. (12 points)

   (a) Find two solutions of $3\sin(10x + 4) = 2$.

   (b) How many angles θ between 300° and 750° have $\cos\theta = 0.9694$? (You must justify your answer with some words and/or a picture.)

6. (12 points) Rita runs counter-clockwise around a circular track with radius 175 feet. At time $t = 0$, Rita is a the point R in the picture below. Rita runs at a constant speed of 6 miles per hour until she reaches point A. Also at time $t = 0$, Trey starts walking in a straight line at a constant speed, from a point 250 feet east of the center of the track toward the point A. Trey and Rita reach point A at the same time.



(a) Compute Trey's speed in feet per second.

(b) Impose a coordinate system with the origin at the center of the track and find Trey's x- and y-coordinates after t seconds.

7. (12 points)

(a) Let $f(x) = \ln(3x) - \ln(x-4)$. Find $f^{-1}(x)$.

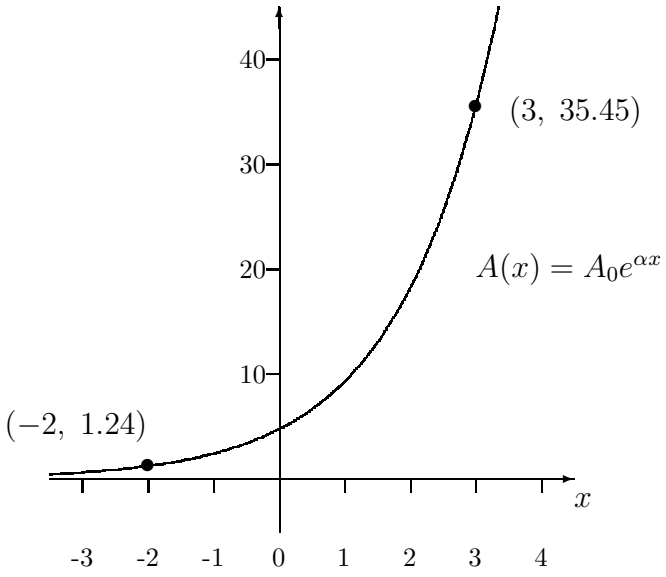
(b) Solve for t:

$$4^{7t-3} = 9.$$

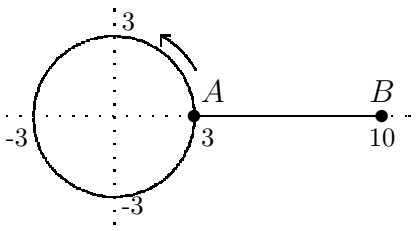
8. (10 points) Below is the graph of a function

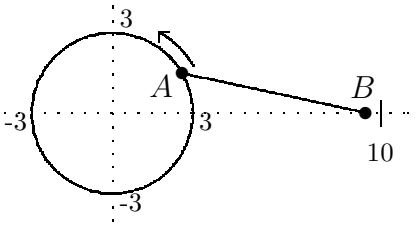
$$A(x) = A_0 e^{\alpha x}.$$

The coordinates of two points are given. Find the values of A_0 and α.



9. (12 points) A seven-foot long rod is attached at one end A to a point on a wheel of radius 3 feet, centered at the origin. The other end B is free to move back and forth along the x-axis. The point A is at $(3, 0)$ at time $t = 0$, and the wheel rotates counter-clockwise at a constant speed of 4 revolutions per minute.





(a) Compute the angular speed of the wheel in radians per second.

(b) Give the x- and y-coordinates of end A after t seconds.

(c) Give the x- and y-coordinates of end B after t seconds.