**MATH 495.595 / PRACTICE MIDTERM EXAM QUESTIONS**

| Table One | | Table Two | |
|---|---|---|---|
| **A** | **B** | **C** | **D** |
| 0 | 2 | 1 | 3 |
| 1 | 3 | 2 | 6 |
| 2 | 3 | 3 | 9 |
| 3 | 4 | 4 | 12 |

1. For each of the given (input, output) relationships in Tables One and Two; answer the following: Is the relationship a function? Why or why not?
   a. A a function of B  b. B a function of A
   c. C a function of D  d. D a function of C

   For the relationships that are functions; also answer:
   i. What is the domain of the function?  ii. What is the range of the function?

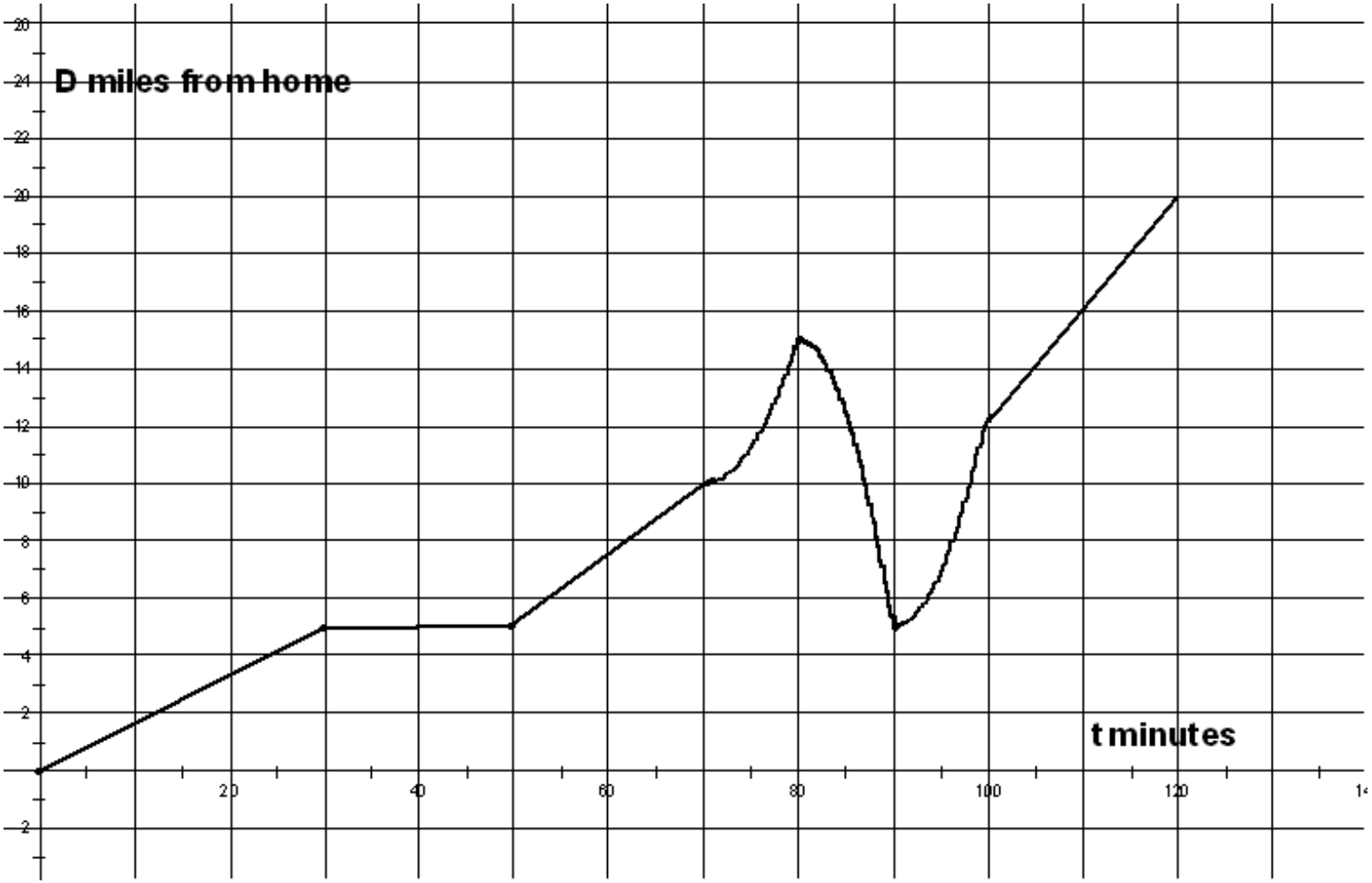
2. What is the domain and range for each of the following functions? Show your work for determining the domain when applicable. You may find graphing the function or using the calculator table feature for the function to be helpful; especially for determining the range. If you do so, include a sketch of the graph (label key points).

   a. $f(x) = \dfrac{1}{3x-3}$  b. $f(x) = \dfrac{1}{1+x^2}$  c. $f(x) = \sqrt{5x-10}$

   d. $f(x) = \dfrac{1}{\sqrt{4-x^2}}$  e. $f(x) = \dfrac{1}{\sqrt{4x-2}}$  f. $y = \sqrt{(x-2)}^3$

3. Use the provided graph of Eugene's bike trip to answer the following questions: Be sure you can find equations of any of the requested lines.
   a. When is Eugene taking a break? How do you know?
   b. When is Eugene going away from or towards his house? How do you know?
   c. When is Eugene going faster and faster? Explain how you know using calculus concepts.
   d. When is Eugene going slower and slower? Explain how you know using calculus concepts.
   e. When is Eugene going at a constant rate and what are his speeds in mph during those times? Explain how you know using calculus concepts.
   f. When is Eugene going the fastest and how fast, in mph is he going? Which calculus concept does this relate to?
   g. What is Eugene's average speed, in mph, during the first 45 minutes of his trip? The second 45 minutes? Which calculus concept does this relate to?
   h. When is Eugene's average speed 9 mph, 12 mph, 15 mph? Which calculus concept does this relate to?
   i. When is Eugene's speed 9 mph, 12 mph, 15 mph? Which calculus concept does this relate to?

**MATH 495.595 / PRACTICE MIDTERM EUGENE'S BIKE TRIP**



4. Suppose you wish to fence in a rectangular pen with 500 square feet of area with the front and one side cedar fencing at $10 / foot and the back and the other side wire fencing at $4 / foot.
   a. What is the least cost for such a rectangular pen? Support your conclusion with a carefully constructed cost function, a graph of the function with everything clearly labeled, with the least cost of the pen clearly marked on the graph and with a final sketch of the pen with the cost and the fence dimensions of the pen clearly labeled.

   b. Suppose I wish to use the same construction ideas and spend exactly $1420 on the fencing material. What are the dimensions now? Use the quadratic formula for full credit; show your work for determining the solution; mark the point(s) on the graph in part a).

5. What is the open top box of maximum volume that can be made out of a 30 inch by 50 inch sheet of cardboard by cutting out corner squares and folding up the edges to make a box as we did in class? Construct a volume function and give all details of your solution.

6. Suppose you wish to fence in a rectangular pen with 500 square feet of area with the front and one side cedar fencing at $10 / foot and the back and the other side wire fencing at $4 / foot.
   a. What is the least cost for such a rectangular pen? Support your conclusion with a carefully constructed cost function, a graph of the function with everything clearly labeled, with the least cost of the pen clearly marked on the graph and with a final sketch of the pen with the cost and the fence dimensions of the pen clearly labeled.

   b. Suppose I wish to use the same construction ideas and spend exactly $1420 on the fencing material. What are the dimensions now? Use the quadratic formula for full credit; show your work for determining the solution; mark the point(s) on the graph in part a).

7. Use Fermat's Method to compute the derivative of a linear function. Explain your result in practical terms by describing the relationship of the result to the graph of the function.

8. Use Fermat's Method to compute the derivatives of $f(x) = 5x^2 + 1$ and $f(x) = 2 - x^3$. Carefully show all of your steps.