Math 160, Test #1A
September 25, 2015

Read all instructions for each individual problem carefully. For each problem, *show your work*, and/or otherwise explain how you got your answer. Correct answers with insufficient justification may not receive full credit, and partial credit for incorrect answers can only be given based on work shown and/or written explanation.

Please write all work and answers on this test, rather than using any separate sheets of paper. If you find that you need more space than what is provided, write any additional work on the back of the page.

1. Let L denote the line that passes through the points (4, 2) and (8, -4).

    (a) Find an equation for L. Write the equation in slope-intercept form.

    (b) Sketch a graph of line L in the space below. On your graph, label the y-intercept and the x-intercept with their exact coordinates.

2. For all three parts of this problem, $r(x) = \sqrt{x+4}$ and $s(x) = x^2$.

Find algebraic expressions for each of the following functions, and find each function's domain. Write the domain using interval notation.

(a) $s + r$

(b) r/s

(c) $s \circ r$

3. Joe is shopping for a new TV antenna to pick up "over-the-air" channels. The local CBS channel broadcasts from a location that is 28 miles north and 16 miles west of Joe's house. The local ABC channel broadcasts from a location that is 14 miles north and 32 miles east from Joe's house.

   (a) Sketch a graph, with Joe's house at the origin, showing the location of each channel's broadcast location relative to Joe's house. Clearly identify the coordinates (x, y) of each location.

   (b) At the local Radio Shack, there's an inexpensive TV antenna that can pick up signals from up to 35 miles away. Would this antenna be able to pick up the local CBS and ABC broadcasts? Justify your answer.

4. The diagram below shows a graph of the function $f(t) = \dfrac{t}{t^2 + 2t + 3}$.
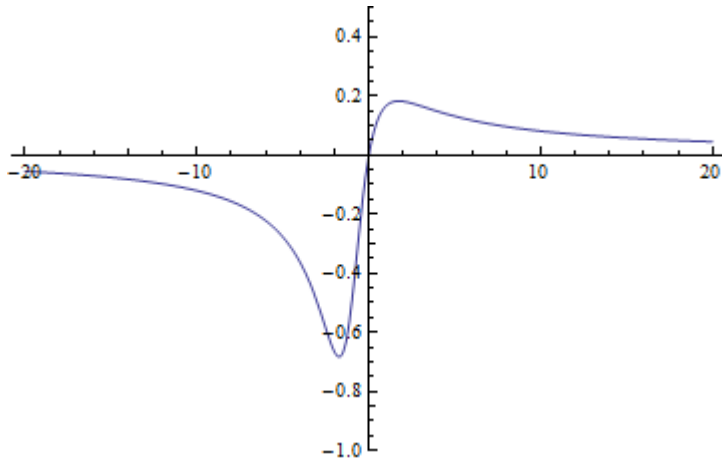
You will need to use the diagram to answer part (b) below.

(a) What is the *domain* of f? (Hint: the denominator, $t^2 + 2t + 3$, is never equal to zero.)

(b) Based on the graph, what is the apparent *range* of f? (Your answer might not be exact; just give a reasonable estimate based on what you can see from the graph.) Write your answer using interval notation.

5. Each of the following is a multiple-choice question. Circle the correct choice for each, and briefly (one or two sentences) explain your choice.

(a) The number of Facebook stock shares that Mark owns at time t is given by $f(t)$. The value per share of Facebook stock at time t is $g(t)$ dollars. Find a function that would tell us the total value of Mark's Facebook shares at time t. Circle the correct choice, and explain your answer.

(i) $f(t)g(t)$ (ii) $\dfrac{f(t)}{g(t)}$ (iii) $f(g(t))$ (iv) $f(t) + g(t)$

(b) Walter owns and operates a car wash. Let $f(t)$ denote the number of cars washed on day t of the week (where $t = 1$ on Sunday, $t = 2$ on Monday, etc.), and let $g(x)$ denote the profit earned from washing x cars in a day. What does the function $(g \circ f)(t)$ represent? Circle the correct choice, and explain your answer.

   i. The number of cars that need to be washed to earn a profit of t dollars.
   ii. The number of cars washed on day t.
  iii. The total profit earned for washing t cars.
  iv. The total profit earned on day t.

6. A box with an open top and a square base (see diagram below) must have a volume of 81 cubic inches. Let x denote the length of one side of the base.

(a) Find a function in the variable x giving the surface area (that is, the sum of the areas of all five sides) of the box.
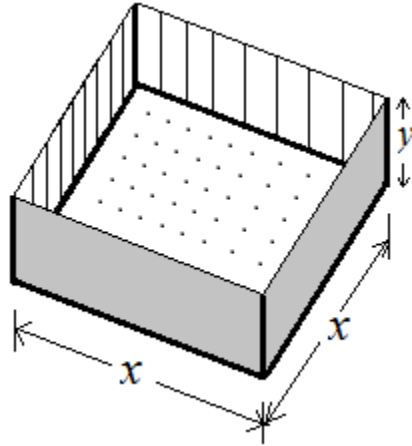
(b) What is the domain of the function you found in part (a)? Write your answer using interval notation, and briefly explain your answer.

7. In Marvadel City, the percentage of adults who smoke cigarettes stood at 25% at the beginning of 1995; this percentage decreased linearly to 19% at the beginning of 2010.

(a) Find a linear function, $f(t)$, giving the percentage of adults in Marvadel City who smoked at the beginning of year t, where $t = 0$ corresponds to the beginning of 1995.

(b) What percentage of adults in Marvadel City smoked at the beginning of 2001?

(c) If the percentage of adults who smoke continues to decrease linearly, by what year will all adults in Marvadel City quit smoking cigarettes? (Round your answer, if rounding is necessary, to the nearest year.).