**UNVR 397A – Math Sense**  
**What’s Wrong with this Picture?**

**Part I Directions.** For each of the following problems, an error has been made by a student. Your job is to do the following:

(i) Before doing any calculations, try to find a reason why the student’s answer cannot be right.
(ii) Find a correct way to approach the problem.
(iii) If possible (sometimes it won’t be since humans are not good mind readers!), try to figure out what the student did to get the wrong answer.
(iv) Think of a way to convince the student that her or his answer cannot be right and to help the student get on the right track.

1. A bug starts from the point (1, 0) and walks 180° counterclockwise around the unit circle (a circle of radius one). Find the x and the y coordinate of the point where the bug ends up.

   **Student Answer.** x = −0.6 and y = −0.8

2. The following data is recorded from a bike rider who is riding at a constant speed.

<table>
<thead>
<tr>
<th>t (time since start of ride in seconds)</th>
<th>15</th>
<th>20</th>
</tr>
</thead>
<tbody>
<tr>
<td>d (distance traveled from starting position in feet)</td>
<td>200</td>
<td>267</td>
</tr>
</tbody>
</table>

   At what speed is the biker traveling?

   **Student Solution.** The speed of the bike is given by

   \[
   \frac{267 - 200}{5} \text{ feet per second} = 227 \text{ feet per second.}
   \]

3. Find the area of the shaded region below.

   **Student Solution.** The area is

   \[
   \int_0^1 (x - 2)dx + \int_1^4 -1dx = -4.5
   \]

4. Solve the following equations for x.

   (a) \(x^2 = 9\)

   **Student Solution.** \(x = 3\).

   (b) \(x(x - 2) = x^2\)

   **Student Solution.**

   \[
   x(x + 2) = x^3 \Rightarrow x + 2 = x^2 \Rightarrow x^2 - x - 2 = 0 \Rightarrow (x - 2)(x + 1) = 0.
   \]

   Therefore, the solutions are \(x = 2\) and \(x = -1\).

   (c) \(\sqrt{x} = -2x\)

   **Student Solution.**

   \[
   \sqrt{x} = -2x \Rightarrow x = 4x^2 \Rightarrow 0 = x(1 - 4x) \Rightarrow x = 0 \text{ or } x = \frac{1}{4}
   \]
(d) $x^2 - x - 6 = -4$
    Student Solution.

\[ x^2 - x - 6 = -4 \implies (x - 3)(x + 2) = -4 \implies x = -1 \text{ or } x = -6 \]

5. A clothing store advertises a 50% off all clothing prices. Inside the store, you notice that clothing from their fluorescent plaid collection is 60% off the sale price. If a fluorescent plaid shirt ordinarily costs $15.00, how much would you save if you bought the shirt?
    Student Solution. You save $(.5 + .6)15 = $16.50.

6. Find the maximum output value of the function $f(x) = -0.00025x^4 + 0.0233x^3 - 0.5x^2 + 5$ on the interval $0 \leq x \leq 100$.
    Student Solution. I graphed the function on my calculator and the highest point on the parabola was $y = 5$.

7. A rancher wants to fence closed a square region of grazing land with an area of 4 million square feet. How many feet of fencing will be needed to do this?
    Student Solution. To get an area of 4 million square feet, 2 million feet of fencing are needed on each side of the square. This means that 8 million total feet of fencing are needed.

Part 2. Please follow the directions for each problem.

1. Somebody uses the graph below to make the following statement:
   House prices increased by 2000 pounds between 1998 and 1999. We can see from the graph that the prices tripled.

   ![Graph showing house prices]

   What is wrong with this argument?

2. The graph below shows the number of CDs sold in a country, in millions, over the last four years. Somebody uses the graph to conclude that sales increased the most between year 1 and year 2 because the graph is the steepest there. What is wrong with this argument?

   ![Graph showing CD sales]

3. In 1936, Literary Digest and George Gallup predicted the winner of the presidential election. Literary Digest received 2 million survey responses suggesting that Republican Alfred E. Landon would defeat Franklin Delano Roosevelt. The survey was sent to names chosen from the phone book and from automobile registrations. Gallup correctly predicted that Franklin Roosevelt would win the election based on a random sample of 300,000 people. Explain how this could have happened.