

Math 110 Mathematical Investigations

Sample Problems from Class Activity

(Based on problems from "Mathematics for the Liberal Arts" by Lumen Learning)

Instructions:

Choose ONE of these scenarios and do the following:

- Read the scenario carefully. Identify the question/problem you are trying to address.
 - Create a list of information that you would need in order to solve the problem.
 - Request that information from me.
 - Create a problem-solving pathway as described in the reading. [See reverse side if you were not able to complete the reading before this talk 😊]
 - Solve the problem given in the scenario. Explain your solution in complete sentences.
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Scenario 1: You are considering buying a water filter pitcher and a reusable water bottle rather than buying bottled water. Will doing so save you money?

Scenario 2: You just moved to downtown Denver to start a new job, but you're concerned that having a car in the city will be too difficult, so you decide to buy a motorcycle! Since you can't afford to pay for the motorcycle outright, your mom offers to loan you part of the money interest free, and for the rest you will take out a loan from a local bank. Considering your current budget, you have enough to make the bank loan payment, but you are going to have to cut back on your latte habit to have money to pay back your mom. If you reduce your latte expenses by 70% and use that money to pay back your mom, how many years will it take to pay her back?

Scenario 3: You have your own unique artistic flair, and you decide that you want to cover your car in bottle caps, like in this picture. How many bottle caps will you need?



Scenario 4: Your good friend has just received two job offers, and now they need to decide which job offer they should take. There are three major factors that they will consider: salary, gas expenses, and vacation days. You want to help your friend decide which job to take. Taking into account these three factors, which job is the better financial decision?

Building A Problem-Solving Pathway

Problem solving is best approached by first starting at the end: identifying exactly what you are looking for. From there, you then work backwards, asking “what information and procedures will I need to find this?” Very few interesting questions can be answered in one mathematical step; often times you will need to chain together a **solution pathway**, a series of steps that will allow you to answer the question.

Problem-Solving Process

1. Identify the question you’re trying to answer.
2. Work backwards, identifying the information you will need and the relationships you will use to answer that question.
3. Continue working backwards, creating a solution pathway.
4. If you are missing necessary information, look it up or estimate it. If you have unnecessary information, ignore it.
5. Solve the problem, following your solution pathway.

Example Scenario: A recipe for zucchini muffins states that it yields 12 muffins, with 250 calories per muffin. You instead decide to make mini muffins, and the recipe yields 20 muffins. If you eat 4, how many calories will you consume?

To answer the question of how many calories four mini muffins will contain, there are several solution pathways. We will explore one possible pathway:

1. To find how many calories in 4 mini-muffins, it may help to know the number of calories in just 1 mini-muffin. Then, we would multiply the number of calories in 1 mini-muffin by 4.
2. To find the calories in each mini-muffin, we could first find the total calories for the entire recipe, then divide it by the number of mini-muffins produced.
3. To find the total calories for the recipe, we could multiply the calories per standard muffin by the number of muffins.

Notice that this produces a multi-step solution pathway. It is often easier to solve a problem in small steps, rather than trying to find a way to jump directly from the given information to the solution. To solve our problem, we follow the pathway backwards:

$$\text{Step 3: } 12 \text{ muffins} \times \frac{250 \text{ calories}}{1 \text{ muffin}} = 3000 \text{ calories for the whole recipe}$$

$$\text{Step 2: } \frac{3000 \text{ calories}}{20 \text{ mini muffins}} = 150 \text{ calories/mini muffin}$$

$$\text{Step 1: } 150 \text{ calories/mini muffin} \times 4 \text{ mini muffins} = 600 \text{ calories in 4 mini muffins}$$

For this recipe, there will be 600 calories consumed by eating 4 mini muffins.