

MA 101 Problem Solving

1. In the movie *Die Hard With a Vengeance* the hero was told that in order to stop an explosion from taking place he would have to place a plastic jug with exactly four gallons of water in it on a scale. The wrong weight would set off the big bang. Unfortunately the villain had left the hero only two jugs, one that would hold exactly 3 gallons and one that would hold exactly 5 gallons. There was a fountain nearby with lots of water in it. Explain how to get exactly four gallons into the five gallon container. (No, there is no measuring cup.)

2. A mathematical census taker is collecting names and ages of family members. She knocks on the door of an overly protective and grumpy man, who reluctantly tells her his age, the age of his wife, and the fact that he has three daughters.

Census Taker: What are each of their ages, rounded to whole numbers, please?

Grumpy Man: Nunya!

Census Taker: Please?

Grumpy Man: Nunya Bizness!

Census Taker: How about a hint?

Grumpy Man: See that house number across the street?

Census Taker: Yes, I see it.

Grumpy Man: The sum of their ages is that house number.

Census Taker: I'm sorry, that's not enough information.

Grumpy Man: The product of their ages is 36.

Census Taker: Hmm. That's still not enough information. How about one more hint?

Grumpy Man: My oldest daughter is outside shooting baskets. Now git!

Census Taker: Thank you very much! That's all the information I need.

Find the ages of his three daughters. (They are whole numbers.)

Explain your reasoning, clearly outlining your strategy.

3. The grumpy man in Question 2 lives on a farm. You find out from him that he has only pigs and chickens and want to know exactly how many of each he has. He doesn't tell you that (no surprise), but he does reveal that he has a total of 50 of these animals. He also reveals that the total number of legs of the animals is 140. Every animal has the usual number of legs.

Solve this problem using **at least** two different strategies, clearly explaining your reasoning. How many different ways can you think to solve it?

4. Find all 8-digit numbers comprised of two 1's, two 2's, two 3's, and two 4's with exactly four digits between the 4's, three digits between the 3's, two digits between the 2's, and one digit between the 1's.

5. The number 10 can be expressed as the sum of four odd numbers in three ways:

$$10 = 7 + 1 + 1 + 1$$

$$10 = 5 + 3 + 1 + 1$$

$$10 = 3 + 3 + 3 + 1$$

In how many ways can 20 be expressed as the sum of eight odd numbers?