**The Mystery Bags Game**

The game that the king of the land loves best is the mystery bags game. First, his jester takes one or more empty bags and fills each bag with the same amount of gold. These bags of equal weight are called the “mystery bags.” Next, the jester digs into his collection of lead weights. He takes out his pan balance and places some combination of mystery bags and lead weights on the two pans so that the two sides balance.

The game is to figure out the weight of each mystery bag.

*Your Task*

The game may sound rather easy, but it can get very difficult for the king. See if you can win the mystery bags game in the various situations described here by figuring out how much gold there is in each mystery bag.

Explain how you know you are correct. You may want to draw diagrams to show what’s going on. (The picture at the beginning of this assignment shows what the situation in Question 1 might look like.)

1. There are 3 mystery bags on one side of the balance and 51 ounces of lead weights on the other side.
2. There are 1 mystery bag and 42 ounces of weights on one side, and 100 ounces of weights on the other side.
3. There are 8 mystery bags and 10 ounces of weights on one side, and 90 ounces of weights on the other side.
4. There are 3 mystery bags and 29 ounces of weights on one side, and 4 mystery bags on the other side.
5. There are 11 mystery bags and 65 ounces of weights on one side, and 4 mystery bags and 100 ounces of weights on the other side.
6. There are 6 mystery bags and 13 ounces of weights on one side, and 6 mystery bags and 14 ounces of weights on the other side. (The jester could get in a lot of trouble for this one!)
7. There are 15 mystery bags and 7 ounces of weights on both sides. (At first, the king thought this one was easy, but then he found it to be incredibly hard.)
8. The king wants to be able to win easily all of the time, without calling you in.

Therefore, your final task in this assignment is to describe in words a procedure by which the king can find out how much is in a mystery bag in any situation.

**You’re the Jester**

1. Here are some simple that might have come mystery bags games. Solve each equation for *M*, which represents the weight of each mystery bag.
   1. M + 16 = 43
   2. 12M = 60
   3. 27 + 9M = 90
2. The equations in the next group are a bit more complicated. For each equation, do two things.

• Describe how the jester must place the mystery bags and lead weights so that the equation will be a representation of the situation.

• Find the weight of one mystery bag and explain how you got your answer.

* 1. 5M + 24 = 51 + 2M
  2. 43M + 37 = 56M + 24
  3. 12M + 15 = 5M + 62

1. Make up two equations of your own like those in Question 2. Describe the jester’s setup for each of your equations, and find the weight of one mystery bag in each case.