Puzzle of the Week
Pan Balance – 5

A pan balance tells you when its two sides are carrying the same amount of weight or whether one side is heavier than the other.

THE CHALLENGE: You have a 24-pound bag of flour. You need to measure out 9 pounds of the flour using a large pan balance which has no markings and no weights. How can you do it?

EXPLORATION: What other amounts of flour can you measure in this situation? Experiment with different starting amounts of flour and see what amounts you can create.

Puzzle of the Week
Pan Balance – 5 – Notes

THE CHALLENGE: In general, you can divide any amount you have into two piles of equal weight.

You can start by taking the 24 pounds of flour and pouring it out onto the pan balance until you have 12 pounds on each side. Put the two piles on the table. Take one of the 12-pound piles and split it into two equal piles of 6 pounds each. Put those two piles on the table. Take one of the 6 pound piles and split it into two equal piles of 3 pounds each. Put those two piles on the table.

At this point, you have four piles of flour that are 12 pounds, 6 pounds, 3 pounds, and 3 pounds. You can combine these in any way you like. In particular, you can make 9 pounds by combining the 6-pound pile with one of the 3-pound piles.

After reaching those last four piles, another way to create 9 pounds is to pour off 3 pounds from the 12-pound pile to balance with one of the 3 pound piles.

EXPLORATION: By combining 3, 6, and 12 in various ways, you can get the following pound amounts: 3, 6, 9, 12, 15, 18, 21, and 24.

Extrapolating from the example of starting with 24, it is clear we can start with any number, divide it by two as many times as possible and then create any amount that is a multiple of that smallest amount. For example, if we start with 20, we can divide it by two twice to get 5, and then be able to make any amount that is a multiple of 5.