**Main Problem #5**

Topic: *Multiplying Two Fractions*

Problem: It’s Spring and your mom needs your help planting a variety of roses in her rectangular garden. She wants to plant red, pink, white and orange roses, but before she could do that, she needs your help calculating and separating the amount of space for each rose bush. The garden measure $\frac{9}{3}$ meters by $\frac{8}{4}$ meters. For her garden, your mom wants the red roses to cover half of the garden area, the pink roses to cover a quarter of the garden, the white roses to cover an eight of the garden, and the orange roses to cover the remaining area.

Q1. What is the area of the garden?

Q2. Draw a model showing how much space each rose bush will cover in the garden.

Q3. Using your drawing from Q2, calculate the area of each rose patch.

A1. Since the garden has a rectangular form, its area can be calculated by multiplying its length by its width. Therefore, the area of the garden is $\frac{9}{3}⋅\frac{8}{4}=\frac{72}{12}=6$meters squared. To simplify work, students could have converted the side lengths into whole numbers; 3 meters by 2 meters.

A2. The red roses cover half of the garden, the pink roses cover a fourth, the white roses cover an eighth, and the orange roses cover the remaining part. The remaining part can be found by finding the difference between 1 and the sum of all the known fractions. The reason we choose 1 is because the entire/whole area is covered (or shaded) by roses. Therefore, $1-(\frac{1}{2}+\frac{1}{4}+\frac{1}{8})=x$. Using our knowledge of LCM, we get $1-(\frac{4}{8}+\frac{2}{8}+\frac{1}{8})=1-\frac{7}{8}=\frac{1}{8} =x$. The orange roses cover an eighth of the garden.

The drawing for this question looks like this:

3 meters

2 meters

Q3. To calculate the dimensions of each rose bush, we must first calculate the area using the given information. We can solve for each area by multiplication of unit fractions. Note: It is best to keep the fractions unsimplified.

* Red covers half, therefore area is $6⋅\frac{1}{2}=3$meters squared.
* White covers a fourth, therefore area is $6⋅\frac{1}{4}=\frac{6}{4}=1\frac{2}{4}$meters squared.
* Orange and white cover an eighth each, therefore the area for each is $6⋅\frac{1}{8}=\frac{6}{8}=\frac{2}{4}$meters squared.

According to our drawing, the red covers covers half the area. Depending on how you drew it, one of the side lengths will be half. In this case, the red measure 2 meters by $1\frac{1}{2}$meters, it could also be 3 meters by 1 meter. Therefore the area for the red is $2⋅1\frac{1}{2}=3$ meters squared.

To solve for the remaining area, students can either solve for the areas manually by approximating the distances, or think about the size of each patch. If you notice, the pink rose patch is half the size of the red rose patch since $\frac{1}{4}$is half of $\frac{1}{2}$. The same rule can applies to the area of the white and orange rose patches. Therefore, the area of the pink rose patch $1\frac{1}{2}$(or $\frac{3}{2}$) meters squared, and the area for the other patches are $\frac{3}{4}$meters squared each.

If students did not notice this, then they could’ve solved for the areas manually. The width and the length for the pink rose patch are half of the garden’s length and width. Therefore, its area is $1⋅\frac{3}{2}=\frac{3}{2}$meters squared. Solving for the areas of the orange and white rose patch, we notice that their combined area is equal to that of the pink rose patch. This means that the areas for the orange and white rose are half of the pink rose patch. Therefore, their areas are $\frac{3}{2}⋅\frac{1}{2}=\frac{3}{4}$meters squared.