**Main Problem #8**

Topic: *Multiplying Fractions by Whole Numbers*

Problem: Your friend Veronica is making some delicious Peruvian Rice Pudding for her birthday party and would like your help preparing the dish. She bought all the ingredients from her local market and she’s ready to start cooking. One serving of Veronica’s rice pudding contains:

* $\frac{1}{2}$cup of short grain rice
* $1\frac{1}{4}$cups of water
* $\frac{3}{5}$of a cinnamon stick
* $1\frac{2}{4}$cups of evaporated milk
* $\frac{1}{3}$table spoon of vanilla extract
* $\frac{2}{3}$of one clove

Veronica is expecting guests so she will have to increase the quantity of each ingredient to accommodate her guest.

Q1. If Veronica is expecting 8 guests, how many of each ingredient would she need? 14 guests? 20 guests? Express answers as mixed numbers.

Q2. If Veronica only has $\frac{7}{3}$cloves left, what is the maximum number of rice puddings that she can make?

Q3. If Veronica only has $4\frac{2}{4}$cups of evaporated milk and $2\frac{4}{5}$cinnamon sticks left, which ingredient will she run out of first assuming she has enough of the other 4 ingredients?

A1. We apply the formula $n⋅\frac{a}{b}=\frac{n⋅a}{b}$ to solve the first question.

(8 guests)

Rice: $8⋅\frac{1}{2}=\frac{8}{2}=4$cups

Water: $8⋅1\frac{1}{4}=8⋅\frac{5}{4}=\frac{40}{4}=10$cups

Cinnamon: $8⋅\frac{3}{5}=\frac{24}{5}=3\frac{1}{5}$sticks

Milk: $8⋅1\frac{2}{4}=8⋅\frac{6}{4}=\frac{48}{4}=12$cups

Vanilla: $8⋅\frac{1}{3}=\frac{8}{3}=2\frac{2}{3}$tablespoons

Clove: $8⋅\frac{2}{3}=\frac{16}{3}=5\frac{1}{3}$cloves

(14 guests)

Rice: $14⋅\frac{1}{2}=\frac{14}{2}=7$cups

Water: $14⋅1\frac{1}{4}=14⋅\frac{5}{4}=\frac{70}{4}=17\frac{2}{4}$cups

Cinnamon: $14⋅\frac{3}{5}=\frac{42}{5}=8\frac{2}{5}$sticks

Milk: $14⋅1\frac{2}{4}=14⋅\frac{6}{4}=\frac{84}{4}=21$cups

Vanilla: $14⋅\frac{1}{3}=\frac{14}{3}=4\frac{2}{3}$tablespoons

Clove: $14⋅\frac{2}{3}=\frac{28}{3}=9\frac{1}{3}$cloves

(20 guests)

Rice: $20⋅\frac{1}{2}=\frac{20}{2}=10$cups

Water: $20⋅1\frac{1}{4}=20⋅\frac{5}{4}=\frac{100}{4}=25$cups

Cinnamon: $20⋅\frac{3}{5}=\frac{60}{5}=12$sticks

Milk: $20⋅1\frac{2}{4}=20⋅\frac{6}{4}=\frac{120}{4}=30$cups

Vanilla: $20⋅\frac{1}{3}=\frac{20}{3}=6\frac{2}{3}$tablespoons

Clove: $20⋅\frac{2}{3}=\frac{40}{3}=13\frac{1}{3}$cloves

A2. If students have yet to review division of fractions, they should be encouraged to try these two techniques:

Addition until condition is met. We stop counting when the total is above $\frac{7}{3}$.

$\frac{2}{3}+\frac{2}{3}=\frac{4}{3}$(good) i=2

$\frac{2}{3}+\frac{2}{3}+\frac{2}{3}=\frac{6}{3}$(good) i=3

$\frac{2}{3}+\frac{2}{3}+\frac{2}{3}+\frac{2}{3}=\frac{8}{3}$(bad) i=4

Therefore the max number of rice puddings that Veronica can make with $\frac{7}{3}$cloves is 3.

Multiplication until condition is met. We stop when total is above $\frac{7}{3}$.

$2⋅\frac{2}{3}=\frac{4}{3}$(good) i=2

$3⋅\frac{2}{3}=\frac{6}{3}$(good) i=3

$4⋅\frac{2}{3}=\frac{8}{3}$(bad) i=4

Therefore the max number of rice puddings that Veronica can make with $\frac{7}{3}$cloves is 3.

A3. To find out which ingredient will run out first (limiting reagent), we can either subtract ingredients until one of them arrives to 0 (very inefficient), or multiply both quantities of ingredients (serving amounts) until they equal the amount we have (best approach).

Each serving has $\frac{3}{5}$of a cinnamon stick and$1\frac{2}{4}$cups of evaporated milk. We have $4\frac{2}{4}$cups of evaporated milk and $2\frac{4}{5}$cinnamon sticks left. To start, let's convert everything into improper fractions.

Required: $\frac{3}{5}$of a cinnamon stick and$\frac{6}{4}$cups of evaporated milk

Have: $\frac{14}{5}$of a cinnamon stick and$\frac{18}{4}$cups of evaporated milk

i=2 (two servings) (good)

C: $2⋅\frac{3}{5}=\frac{6}{5}$

M: $2⋅\frac{6}{4}=\frac{12}{4}$

i=3(three servings)

C: $3⋅\frac{3}{5}=\frac{9}{5}$

M: $3⋅\frac{6}{4}=\frac{18}{4}$ (Looks like only have enough to make 3 servings)

Therefore, the evaporated milk will run out first.