

## Using Fractions, Decimals, Percents in Problem Solving Activity Background

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### **Alignment with State and National Standards:**

#### **Maine Learning Results: *Numbers & Number Sense (Middle Grades 5-8)***

A1. Use numbers in a variety of equivalent and interchangeable forms (e.g., integer, fraction, decimal, percent, exponential, and scientific notation) in problem solving. (Maine Department of Education, 1997, p. 41)

#### **NCTM Principles and Standards for School Mathematics: *Number & Operations (Grades 6-8)***

G1. Understand numbers, ways of representing numbers, relationships among numbers, and number systems.

- work flexibly with fractions, decimals, and percents to solve problems
- compare and order fractions, decimals, and percents efficiently and find their approximate locations on a number line (National Council of Teachers of Mathematics., 2000, p. 214)

### **Activity Background / Context**

Extensive research has been conducted concerning the teaching and learning of rational number concepts. This research suggests that students need to develop understandings of fractions through the use of multiple models such as area or region models, length models, or set models. Area models can include circular or rectangular models depicted through the use of fraction circles, grid or dot paper, geo-boards, or paper folding to name a few. Length models can include fraction bars, fraction strips, or single and double number lines. Set models can use counters or other manipulatives or icons to create a group representing the whole. It also suggests that in order to develop fraction sense, students need models that allow students to develop mental images for fraction size. Students can then use this understanding of fraction size to work with fractions - and then decimals and percents - in meaningful ways (Cramer et al., 1997, Cramer and Henry, 2002). Additionally, NCTM PSSM states that “these models offer students concrete representations of abstract ideas and support students’ meaningful use of representations and their flexible movement among them to solve problems.” (PSSM, 2000, p 216) This activity illustrates how interactive applets can be used to help students develop mental images to conceptualize fractions, decimals, and percents and apply this understanding to a problem solving context.

### **References**

Cramer, Kathleen, et al. The Rational Number Project Fraction Lessons: Level 1 and Level 2. Dubuque, Iowa: Kendall/Hunt Publishing Co, 1997.

Cramer, Kathleen, and Apryl Henry. “Using Manipulative Models to Build Number Sense for Addition of Fractions.” Making Sense of Fractions, Ratios, and Proportions. Ed. Bonnie Litwiller. Reston, VA: NCTM, 2002.

Maine Department of Education. (1997). *State of Maine Learning Results*. Augusta, ME.

National Council of Teachers of Mathematics. (2000). *Principles and standards for school mathematics*. Reston, VA: NCTM.

## Using Fractions, Decimals, Percents in Problem Solving

### Using EDC's Comparing Fractions Applet

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1. Launch Browser
2. Type in the Internet address for EDC's Comparing Fractions interactive mathematics tool.  
[http://www2.edc.org/cope/projsupport/mistm/comp\\_fractions.htm](http://www2.edc.org/cope/projsupport/mistm/comp_fractions.htm)
3. This displays an applet that can be used to model situations that require thinking about parts of a whole. The tool then displays the representation and numerical ways to express the amount selected. The rational number can be shown as a common fraction, decimal fraction, or percent of the whole.

**Comparing Fractions**

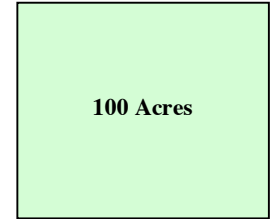
| Fraction 1   | Show | Fraction 2   |
|--|------|--|
| Parts Selected: <input style="width: 40px;" type="text"/>  |      | Parts Selected: <input style="width: 40px;" type="text"/>  |
| Number of equal parts of the whole: <input style="width: 40px;" type="text"/>                                      |      | Number of equal parts of the whole: <input style="width: 40px;" type="text"/>                                      |
| Show fraction <input type="checkbox"/> Show decimal <input type="checkbox"/> Show percent <input type="checkbox"/> |      | Show fraction <input type="checkbox"/> Show decimal <input type="checkbox"/> Show percent <input type="checkbox"/> |

4. There are text entry boxes for two values for each scenario (Fraction 1 and Fraction 2), the top for the number of parts selected and the bottom number for the number of parts that the whole is being divided into. All four boxes must be filled in prior to showing the representation. You must click in the *number of equal parts of the whole* and enter that value prior to entering the *parts selected* value.
5. After the entry boxes have been filled, click the **Show** button.

## Using Fractions, Decimals, Percents in Problem Solving

### **Problem Context:**

John and Susan Berube own a square plot of land that is 100 acres. They have decided to gift some of the land to organizations in their hometown that support healthy living. In order to help with their decision-making, they drew a representation of the land and began discussing the amount they would give to each organization.



The organizations and purposes are listed below:

- the recreation department for sports fields
- the local farmers organization for a community garden
- the town for a park with walking paths

As they discussed their plans, they couldn't decide how to best divide the land and the exact amount that each organization would receive. You have been called in to help with the decision-making. They have provided the following tool to assist during the discussion:

### Comparing Fractions

|   |   |
|---|---|
| Parts Selected: <input style="width: 30px;" type="text" value="1"/>                     | Parts Selected: <input style="width: 30px;" type="text" value="1"/>                     |
| Number of equal parts of the whole: <input style="width: 30px;" type="text" value="1"/> | Number of equal parts of the whole: <input style="width: 30px;" type="text" value="1"/> |

**Fraction 1**

Show fraction 
Show decimal 
Show percent

Show

**Fraction 2**

Show fraction 
Show decimal 
Show percent

### **Part I. – Explore the tool**

Explore the text entry boxes, show button, and check boxes. **\*Note:** you must type in an entry box other than the first “parts selected” box to begin using the tool.

Summarize in your own words what you discovered about the tool:

Name: \_\_\_\_\_

Date: \_\_\_\_\_

### **Part II. – Explore Some Scenarios**

John and Susan Berube began by discussing a few options. These options are listed below. Use one side of the applet to explore John’s idea and the other side of the applet to explore Susan’s idea.

#### ***Example:***

John first thought was that they could give 10 of the 100 acres to the town for a park and Susan wanted to give 30 of the 100 acres of the land to the town instead.

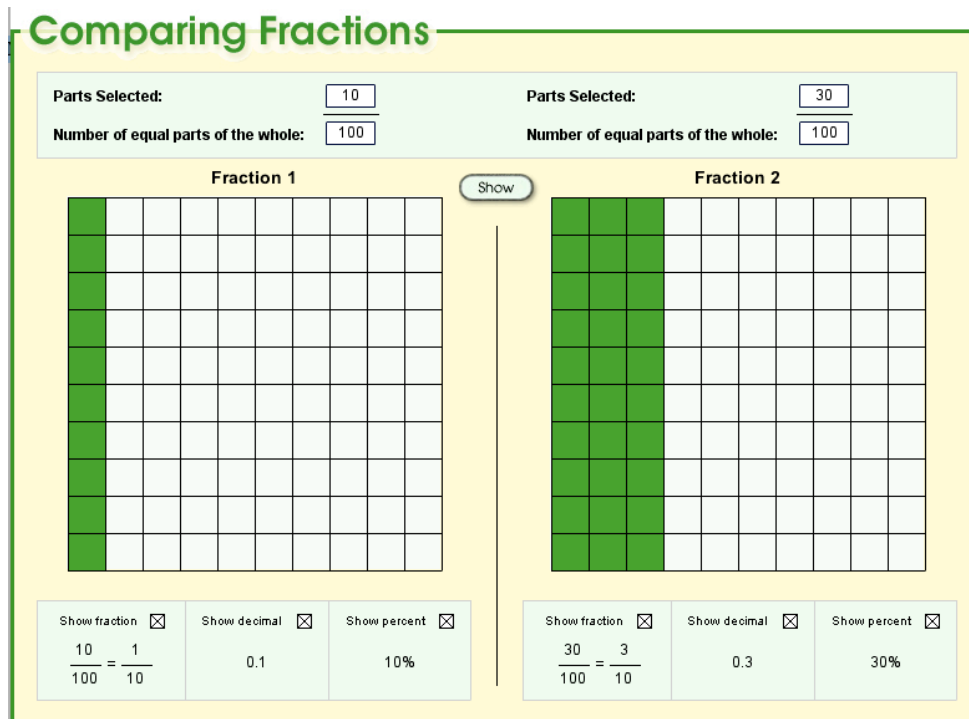
Which person would be giving the greatest percent of the land to the town? Explain your thinking using words, symbols, and representations.

#### ***Possible Solution:***

*In this case, John would be giving a lesser percentage of the land to the town since 10 of 100 acres is 10% of the land where Susan suggested 30 of 100 acres which is 30%. I know that “out of 100” means percent so 10 acres **out of 100** acres is 10 **percent** and 30 acres **out of 100** acres is 30 **percent**.*

*You can also see that more of the area is shaded in on Fraction 2. Since there the 100 acres are equally divided into 100 pieces, each piece is 1 acre. There are only 10 acres shaded in on Fraction 1 (representing John’s idea) while there are 30 acres shaded in on Fraction 2 (representing Susan’s idea.)*

*I also notice that 1 of every row of 10 is shaded in Fraction 1 which is 1/10 of the land where 3 of every row of 10 is shaded in Fraction 2 which is 3/10 of the total land.*



Name: \_\_\_\_\_

Date: \_\_\_\_\_

1.) John is thinking that he would like to give 90 acres to the farmers while Susan wants to give 70 acres to the farmers.

a.) What fraction of the land does John want to give to the farmers? \_\_\_\_\_

b.) What percent of the land does John want to give to the farmers? \_\_\_\_\_

c.) What fraction of the land does Susan want to give to the farmers? \_\_\_\_\_

d.) What percent of the land does Susan want to give to the farmers? \_\_\_\_\_

e.) What percent will be remaining if Susan gives 70 acres to the farmers? \_\_\_\_\_

Explain your thinking using words, symbols, and representations.

2.) John is now proposing  $\frac{9}{25}$  of the land for sports fields and Susan is proposing to give 12 out of the 100 acres for sports fields. Which person would be giving the most land to the recreation department for sports fields? Explain how you know using words, symbols, and representations.

3.) John wants to give 28 of the 100 acres to the town for a park and Susan wants to give  $\frac{1}{4}$  of the land to the town instead.

Which person would be giving the least land to the town? \_\_\_\_\_

Explain your thinking using words, symbols, and representations.

Name: \_\_\_\_\_

Date: \_\_\_\_\_

**Part III. Final Proposal**

John and Susan finally came up with a plan after trying out lots of different scenarios.

Here is the plan:

- Susan wanted to make sure that the recreation department had  $\frac{2}{5}$  of the land for children to play sports on.
- John wanted 15 of the 100 acres to go to the town for the park.
- They both wanted to give 12 % of the land to the local farmers organization for a community garden.
- Finally, they wanted at least  $\frac{1}{3}$  of the land left for them to build a house on.

A.) First, they want you to figure out which organizations received the most, least, and middle amount of land and explain how you know using words, symbols, and representations.

Recreation Department: \_\_\_\_\_

Town Park: \_\_\_\_\_

Community Garden \_\_\_\_\_

Explanation:

B.) Next, they want you to figure out if their proposal is possible and if not what they could do differently to make it all work out with as little change to the plan as possible. Justify your reasoning and include a representation to help support your answer.

