Recipes that Exchange

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Summary	The lesson focuses on a function that multiplies input by two but also changes the ingredient to another type of ingredient.
Goals	1. Introduce liter/dollar as an intensive quantity. 2. Introduce dollars/hour as an intensive quantity.
Materials	Overheads, Handouts
Keywords	Full Class Discussion Interpretation of Equations Inverse Relations Linear Functions Mapping Number Lines Production of Tables

Introduction:

We will work with a function that multiplies the input by two. However, there will be an exchange of units or ingredients.

It may help to consider the following table:

Multiplication	**Factors**	**Example**
Scalar:	At least one of the factors is a pure number.	$3 \times 2 = 6$ $3\$ \times 2 = 6\$$
Exchange:	One of the factors is a "per" ingredient.	$3h \times 2\$/h = \$6$ $3\$ \times 2 \text{ cokes}/\$ = 6 \text{ cokes}$
Cartesian: The factors combine into another ingredient.	Neither factor is a pure number; neither is a "per" ingredient.	3 shirts × 2 pants = 6 outfits $3 \text{ ft} \times 2 \text{ ft} = 6 \text{ ft}^2$

In this lesson we deal with multiplication that uses an exchange function.

Activity Plan:

1. Two Cokes per dollar [Whole Class]

    On the overhead show the students the picture of 2 cokes and a dollar bill (page 1).

    Ask them what it might mean. Eventually move to a discussion of "two cokes per dollar" and the many ways of saying and writing the idea.

    Then fill out the Table on the overhead of page 2 in a group discussion. Spend at least 15-20 minutes filling in the table with them.

2. Handout—Two cokes per dollar

    On the handout (page 3) explain the example in row (a) and work through the beginning of the example in row (b).

    Then allow them to fill out the table.

    Problem (d) has a non-integral input!

    Example (e) requires inferring the number of dollars paid for 8 cokes.

    Example (f) also works inversely. However, no integral value will produce 3 cokes.

    Use the overhead on page 4 to discuss the mapping of the function.

3. Homework—Two dollars per hour (Page 5)

    The homework follows the class structure very closely. However, it employs another context and rate: $2.00/h for work done.

Overhead: Multiplication that Exchanges Ingredients

$\frac{\text{2 cokes}}{\text{1 dollar}}$ two cokes for a dollar

$\frac{\text{2 cokes}}{\text{dollar}}$ two cokes for each dollar

$2\ \frac{\text{cokes}}{\text{dollar}}$ two cokes for every dollar

2 cokes/$ two cokes per dollar

$2\ \frac{\text{cokes}}{\$}$

Overhead: Another Times 2 Table **(Page 2)**

$t(k) = k \times 2$

In	Out			
k	$t(k)$	How you read $t(k)$	What $t(k)$ means	Result
\$0	$t(\$0)$	t for 0 dollars; cokes for \$0	\$0 x 2 $\frac{\text{cokes}}{\text{dollar}}$	0 cokes
\$1	$t(\$1)$	t for 1 dollar; cokes for \$1		
\$2				
\$3				
\$4				
\$5				
\$6				
\$7				
\$8				

Name: _____ Date: _____

t is a recipe to find out how many cokes you get for *k* dollars.

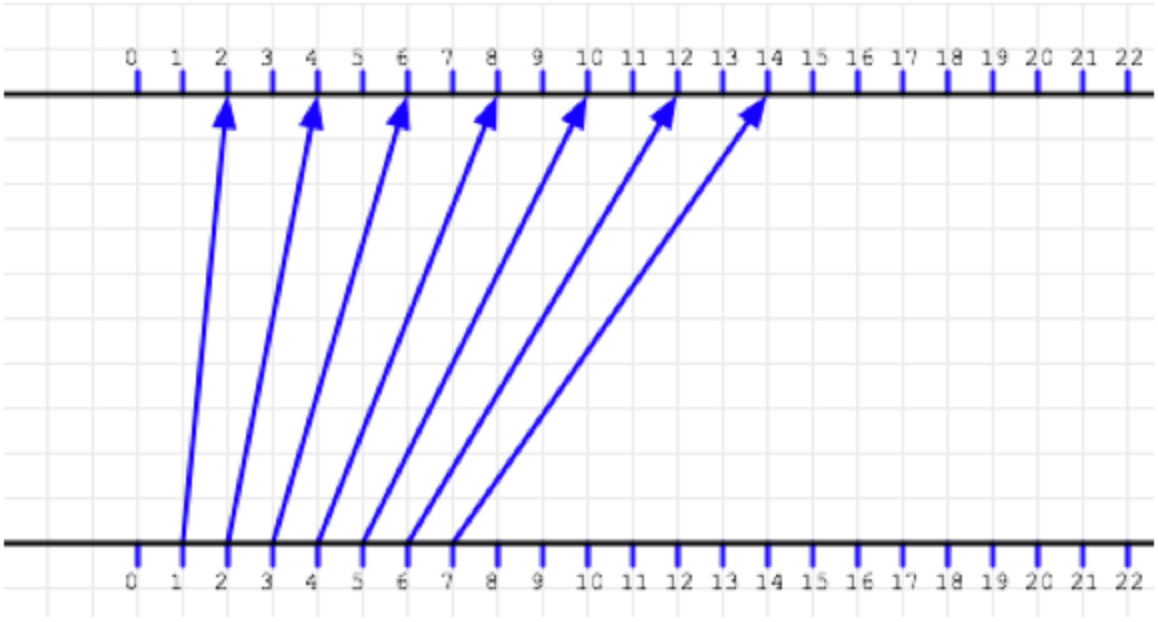
$$t(k) = k \times 2 \frac{\text{cokes}}{\text{dollar}}$$

The table below has expressions and their interpretations.
Complete the table.

Row	Expression	The interpretation of the expression
a.	*t*($1.00)	$1.00 x 2 $\frac{\text{cokes}}{\text{dollar}}$ The number of cokes you get for one dollar: 2 cokes.
b.	*t*($3.00)	
c.	*t*($15.00)	
d.	*t*($.50) One half dollar	
e.		8 cokes
f.		3 cokes

Overhead: Showing the Exchange Function as a Mapping

$$t(k) = k \times 2 \frac{\text{cokes}}{\text{dollar}}$$



Overhead and Homework **(Page 5)**

Name: _____ Date: _____

s is a recipe to find out how much money you get paid for *k* hours of work.

$$s(k) = k \text{ x } 2\frac{\$}{h}$$

The table below has expressions and their interpretations.
Complete the table.

Row	Expression	The interpretation of the expression
a.	$s(1h)$	$1h \text{ x } 2\frac{\$}{h}$ How much you earn in one hour: $2.00
b.	$s(3h)$	
c.	$s(15h)$	
d.	$s(1/2\ h)$ One half hour	
e.		$8.00
f.		$3.00