



Using Drawings to Model Equivalent Ratios

HABITS OF MIND

- Model with mathematics.
- Use appropriate tools strategically.

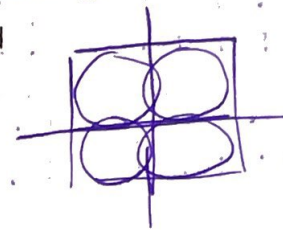
Kerri and her friends are going hiking. Kerri invites her friends to meet at her house for a quick breakfast before heading out on their hike. She wants to offer yogurt to her friends.

She knows that one yogurt pack has four yogurts that can feed four people.

- 1 Draw a model to answer each question. **Explain your reasoning.**

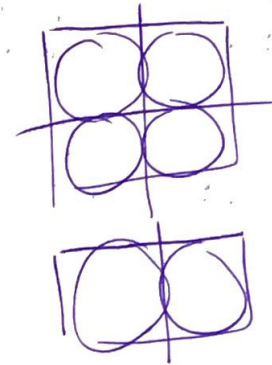
- (a) What is the relationship between the yogurt pack and the number of people it will feed?

one yogurt pack (4) can feed 4 people



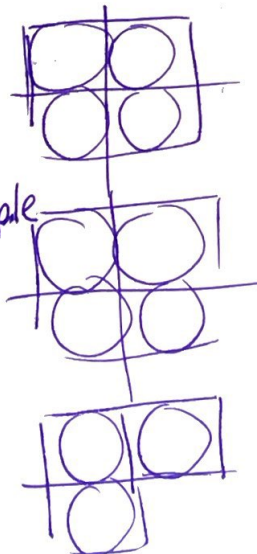
- (b) If Kerri invites 6 friends, how many yogurt packs will she need?

One yogurt pack feeds 4 people
so Kerri will need 2 extra
yogurts which is $\frac{1}{2}$ a pack



- (c) If Kerri has $2\frac{3}{4}$ yogurt packs, how many friends can she feed?

One pack feeds 4 people
Two feeds 8 people
The extra $\frac{3}{4}$ feeds 3 people
for a total of 11 people





➤ Let's consider a different variety pack.

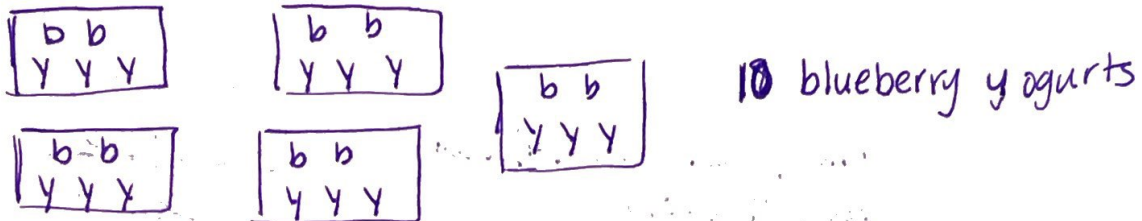
In one yogurt variety pack, two out of every five yogurts are blueberry.

blueberry yogurt →

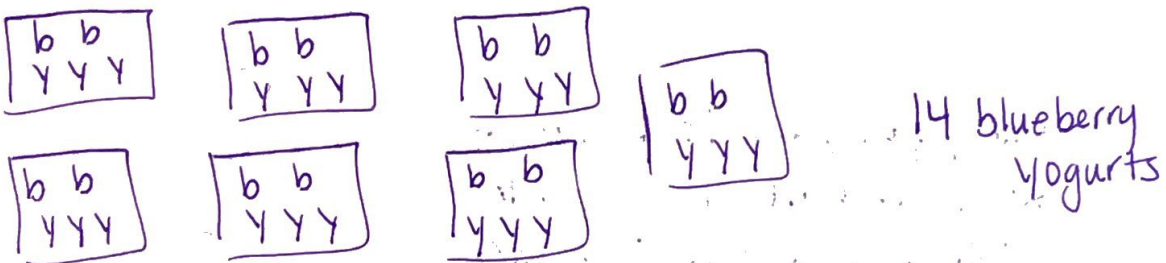


2 Draw a model to answer each question. **Explain your reasoning.**

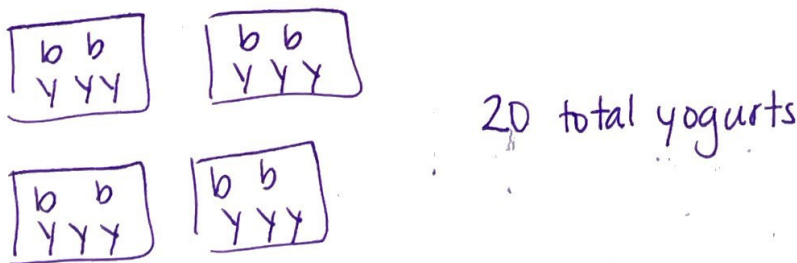
(a) How many yogurts are blueberry yogurts when there are a total of 25 yogurts?



(b) How many yogurts are blueberry yogurts when there are a total of 35 yogurts?



(c) How many total yogurts are there when 8 yogurts are blueberry?



ASK YOURSELF...

Do you see a pattern?

As you solved these problems, you determined *equivalent ratios*. **Equivalent ratios** are ratios that represent the same part-to-part or part-to-whole relationship.



Tape Diagrams

Let's consider another way to model equivalent ratios using a visual representation.

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The local bakery sells muffins in variety packs of blueberry, pumpkin, and bran muffins. They always sell the muffins in the ratio of 3 blueberry muffins : 2 pumpkin muffins : 1 bran muffin.

- 1 Write the ratio that expresses each relationship. Identify each as a part-to-part or a part-to-whole ratio.

a Blueberry muffins to total muffins

b Pumpkin muffins to total muffins

c Bran muffins to total muffins

d Blueberry muffins to pumpkin muffins

e Bran muffins to pumpkin muffins

f Blueberry muffins to bran muffins

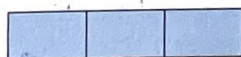
REMEMBER...

Don't forget to label each quantity with the unit of measure!

You can represent a ratio by drawing the objects themselves, or you can use a *tape diagram*. A **tape diagram** illustrates number relationships by using rectangles to represent ratio parts.

- 2 The tape diagram shown represents the ratio of each type of muffin. What does each small rectangle represent in the given tape diagram?

Blueberry



Pumpkin



Bran



Each rectangle represents 1 muffin

A total of 6 muffins in the variety pack



Tape diagrams provide a visual representation of ratios that you can use to solve problems.

WORKED EXAMPLE

Suppose you purchase an 18-pack of muffins. How many blueberry, pumpkin, and bran muffins will you purchase?

There are 6 muffins represented in the tape diagram, and you want 18 total muffins that are in the same ratio.

Therefore, to determine how many muffins you need to maintain the same ratio, you can divide 18 by 6.

$$18 \div 6 = 3$$

Each rectangle represents 3 muffins.

Blueberry

Pumpkin

Bran

From the tape diagram, you can see that there are 9 blueberry muffins, 6 pumpkin muffins, and 3 bran muffins.

- 3** Is the ratio 9 : 6 : 3 equivalent to 3 : 2 : 1? **Explain how you know.**

Yes, each value was multiplied by 3

> Use the tape diagram to answer each question.

- 4** Suppose you purchase a 36-pack of muffins. How many blueberry, pumpkin, and bran muffins will you receive?

6 × 3 = 18 blueberry
6 × 2 = 12 pumpkin
6 × 1 = 6 bran

36 ÷ 6 = 6
↓
amount of each rectangle

Blueberry

Pumpkin

Bran

= 36 total muffins

- 5** Suppose you wanted 20 pumpkin muffins in your variety pack. How many total muffins will be in your variety pack?

10 × 6 = 60 total muffins

Blueberry

Pumpkin

Bran

= 20 muffins

20 ÷ 2 = 10



- 6 The table shows the number of muffins in specific sized variety packs. Complete just the missing cells in the columns for the 6-pack and 36-pack of muffins.

Total Number of Muffins	6	12	18	24	36
Number of Blueberry Muffins	3	$\frac{1}{2}$ 6	9	$\frac{1}{2}$ 12	18
Number of Pumpkin Muffins	2	$\frac{1}{3}$ 4	6	$\frac{1}{3}$ 8	12
Number of Bran Muffins	1	$\frac{1}{6}$ 2	3	$\frac{1}{6}$ 4	6

- 7 Analyze the completed columns in the table.

- (a) What do you notice about the numbers?

The blueberry muffins are $\frac{1}{2}$ the total
 The pumpkin muffins are $\frac{1}{3}$ of the total
 The bran muffins are $\frac{1}{6}$ of the total

- (b) How could you have determined the number of each type of muffin in the 18-pack without using the tape diagram?

Multiply the original 6 pack by 3

- (c) How could you have determined the number of each type of muffin in the 36-pack without using the tape diagram?

Multiply the original 6 pack by 6

- (d) Use what you noticed about the numbers in the table to determine how many of each muffin type are in a 12-pack and in a 24-pack of muffins.

Explain your strategy.

I used my info from part A



Rates and Proportions

You just used tape diagrams as a visual representation to solve ratio problems. What other strategies can you use?

HABITS OF MIND

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Coach Roberts wants to encourage her swim team to increase their speed. She will give an award to the member of the swim team who can swim the most laps in 20 minutes after practice this week. The table records the results from this week's practice.

Student	Number of Laps in Specified Time
Kaye	4 laps in 5 minutes
Susan	7 laps in 10 minutes
Doug	1 lap in 2 minutes
Mako	3 laps in 4 minutes

- 1 Explain how Tia's reasoning and Lisa's reasoning about who will win the award are incorrect.

Tia

Susan will definitely win the award because she swam the most laps.



Lisa

It took Susan the longest time to swim her laps. She will not win the award.



$$K \quad \frac{4 \text{ laps}}{5 \text{ min}} \times 4 = \frac{16 \text{ laps}}{20 \text{ min}}$$

$$D \quad \frac{1 \text{ lap}}{2 \text{ min}} \times 10 = \frac{10 \text{ laps}}{20 \text{ min}}$$

$$S \quad \frac{7 \text{ laps}}{10 \text{ min}} \times 2 = \frac{14 \text{ laps}}{20 \text{ min}}$$

$$M \quad \frac{3 \text{ laps}}{4 \text{ min}} \times 5 = \frac{15 \text{ laps}}{20 \text{ min}}$$

Each quantity in the table is a *rate*. A **rate** is a ratio that compares two quantities measured in different units. The rate for each student in this situation is the number of laps per amount of time.