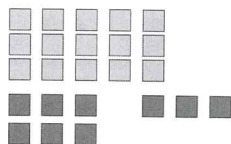
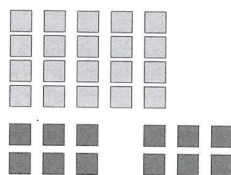


That makes a total of 6 red tiles.
These represent 6 petunias.
The ratio of daisies to petunias is 10:6.

- Add a group of 5 yellow tiles.
You now have 15 yellow tiles.
Add another group of 3 red tiles.
You now have 9 red tiles.
These represent 9 petunias.
The ratio of daisies to petunias is 15:9.



- Add a group of 5 yellow tiles.
You now have 20 yellow tiles.
Add another group of 3 red tiles.
You now have 12 red tiles.
These represent 12 petunias.
The ratio of daisies to petunias is 20:12.



- You can use a table and patterns to find the ratios.

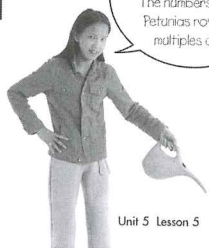
There are 5 daisies for every 3 petunias.
10 daisies are 2 groups of 5 daisies.
15 daisies are 3 groups of 5 daisies.
20 daisies are 4 groups of 5 daisies.

So, to keep the balance, you need the same numbers of groups of petunias.

Daisies	5	10	15	20
Petunias	3	6	9	12

The ratios of daisies to petunias are:
10:6, 15:9, and 20:12
Each ratio can be written as 5:3.
So, we say that 5:3, 10:6, 15:9, and 20:12
are **equivalent ratios**.

The numbers
in the Daisies row
are multiples of 5.
The numbers in the
Petunias row are
multiples of 3.



Unit 5 Lesson 5 181

REACHING ALL LEARNERS

Alternative Explore

Present the following problem: There are 30 students in the class. Each group of 3 students needs 2 dice. How many dice does the class need? Have students use concrete materials to help them solve the problem. (Answer: 20 dice)

Extension

Have students choose a ratio from question 1 and find two quantities in the classroom with the same ratio.

Common Misconception

- Students have difficulty writing equivalent ratios.

How to Help: Relate equivalent ratios to earlier work with equivalent fractions. Remind students that to find an equivalent fraction, we multiply or divide the numerator and denominator by the same non-zero number. Emphasize that to find equivalent ratios, we multiply or divide each term of the ratio by the same non-zero number.

Sample Solutions

- 6 : 2, 12 : 4
 - 2 : 1, 8 : 4
 - 2 : 4, 3 : 6
 - 10 : 12, 15 : 18
 - 6 : 10, 12 : 20
 - 8 : 18, 12 : 27
 - 14 : 16, 21 : 24
 - 16 : 6, 24 : 9
 - 2 : 2, 3 : 3
 - 4 : 10, 6 : 15
- Multiply both terms by 5 or multiply both terms by 4.
 - Multiply both terms by 10, or divide both terms by 2, then multiply the terms by 5.
 - Multiply both terms by 5.
 - Multiply both terms by 2.

Present *Explore*. Suggest students record each set of ratios in a table to help them see and extend the patterns. You may wish to provide pairs of students with 60 red and 40 blue tiles to help them find different tile groupings.

DURING

Explore

Ongoing Assessment: Observe and Listen

Ask questions, such as:

- How many red squares and blue squares are there? (60 red squares, 40 blue squares)
- What ratios can you name to compare the red and blue squares?
(red to blue, 60 : 40; blue to red, 40 : 60)
- Suppose you group the squares in 2s by colour. What ratios could you name?
(Red groups to blue groups, 30 : 20; blue groups to red groups, 20 : 30; red groups to all groups, 30 : 50; blue groups to all groups, 20 : 50)

- What is the next size of group you can make? Explain.
(Groups of 4; both 60 and 40 can be divided exactly by 4.)
- Why can you not make groups of 3?
(60 can be divided exactly by 3, but 40 cannot.)
- How can you tell that groups of 5 can be made?
(Both 60 and 40 are divisible by 5. Any number that ends in 0 is divisible by 5.)
- What is the greatest number you can put in each group? (20) What would the ratio of red groups to blue groups be? (3 : 2)
- How do you know 3 : 2 is the lowest ratio?
(3 and 2 have no common factors other than 1.)
- Suppose you add 60 red squares. How many blue squares would you have to add to keep the ratio the same?
(40 blue squares)

3. a) 7 : 14 and 1 : 2 are equivalent because 7 and 14 can be divided by 7 to get 1 and 2.
 b) 6 : 9 and 3 : 2 are not equivalent because 6 can be divided by 2 to get 3, but 9 cannot be divided by 2 exactly.
 c) 1 : 10 and 4 : 40 are equivalent because 1×4 is 4 and 10×4 is 40.
4. The ratio of pink to white beads is 30 : 35. I divided 30 and 35 by 5 to get the equivalent ratio 6 : 7. Then I multiplied 6 and 7 by 2 to get 12 : 14, by 3 to get 18 : 21, and by 4 to get 24 : 28. Ginger could make a necklace with 6 pink and 7 white, 12 pink and 14 white, 18 pink and 21 white, or 24 pink and 28 white beads.

5.

Number of Players	Total Number of Cards Dealt	Ratio of Players to Cards Dealt
3	15	3 : 15
4	20	4 : 20
5	25	5 : 25
6	30	6 : 30

6. b) There are 8 teams and 32 players. $32 \div 8 = 4$
 Each team has 4 students.
7. I have to multiply the first term of the ratio by 4 to get 20 players. So I have to multiply the second term by 4 to get the number of soccer balls: $2 \times 4 = 8$

Practice

1. Write 2 equivalent ratios for each ratio.
 a) 3 : 1 b) 4 : 2 c) 1 : 2 d) 5 : 6 e) 3 : 5
 f) 4 : 9 g) 7 : 8 h) 8 : 3 i) 1 : 1 j) 2 : 5
2. Write an equivalent ratio with 20 as one of the terms.
 a) 4 : 5 b) 2 : 8 c) 7 : 4 d) 10 : 3
 20 : 25 or 16 : 20 20 : 80 or 5 : 20 35 : 20 20 : 6
3. Are the ratios in each pair equivalent? Explain how you know.
 a) 7 to 14 and 1 to 2 b) 6 : 9 and 3 : 2 c) 1 to 10 and 4 to 40
 Yes No Yes
4. The table shows the number of beads used to make a necklace.
 Ginger wants to make a smaller necklace using the same ratio of pink to white beads. How many different necklaces could Ginger make? How do you know? **4 necklaces**
- | Colour | Number |
|--------|--------|
| Pink | 30 |
| White | 35 |
5. In a card game, each player is dealt 5 cards. Make a table to show the total number of cards dealt for each number of players from 3 to 6. Write each ratio of players to cards dealt.
- | Number of Players | Total Number of Cards Dealt |
|-------------------|-----------------------------|
| | |
| | |
| | |
| | |
6. Ms. Olivier's class plays a game in teams. Each team has the same number of students. The ratio of teams to players is 8 : 32.
 a) How many students are in Ms. Olivier's class? **32 students**
 b) How many students are on each team? **4 students**
7. Atiba plays for the Linden Woods Vipers in the Winnipeg Youth Soccer League. The ratio of players to soccer balls at practice sessions is 5 : 2.
 How many soccer balls are needed for 20 players? **8 soccer balls**
8. The word "fun" has a vowel-to-consonant ratio of 1 : 2.
 a) Find 3 words with a vowel-to-consonant ratio of 2 : 3. **Tooth, books, laugh**
 b) Choose a vowel-to-consonant ratio and find 3 words for it.



- What would be the new ratio of red squares to blue squares? (120 : 80)
- How many squares of each colour would you add to get the next ratio?
(60 red and 40 blue)
- How many times could we add 60 red squares and 40 blue squares without changing the ratio?
(As many times as we like)

AFTER

Connect

Invite volunteers to use Colour Tiles on the overhead projector to share the ratios they found. Introduce the term *equivalent ratios*. Record each set in a table. Have students examine each table. Ask questions, such as:

- What patterns do you see in the tables?
(In each table, the terms are divided by 2, 4, 5, 10, and 20.)

- How do you know each table cannot be further extended by dividing?
(The last ratio in each table is the lowest possible ratio.)
- How could you write equivalent ratios for 60 : 40 with greater numbers?
(Multiply each term by 2, 3, 4, and so on.)

Practice

Counters are required for question 12.

Assessment Focus: Question 4

Students should understand that they will need fewer beads to make a smaller necklace. Therefore, they must find a ratio whose terms are less than 30 and 35. One way to do this is to write the ratio in simplest form, then multiply by 2, 3, and 4 to form other equivalent ratios.

9. Su Mei's recipe for bean salad calls for 3 cans of lima beans, 2 cans of pinto beans, and 1 can of kidney beans. Su Mei is making bean salad for her family reunion. Suppose she uses 9 cans of lima beans.

- a) How many cans of pinto beans will she use? **6**
b) How many cans of kidney beans will she use? **3**

10. Katherine has diabetes.

At each meal, she must estimate the mass in grams of carbohydrates she plans to eat, then inject the appropriate amount of insulin.

Katherine needs 1 unit of insulin for 15 g of carbohydrates.

Katherine's lunch has 60 g of carbohydrates.

How many units of insulin should Katherine inject?

4 units

11. To make a jug of plant fertilizer, Malaika uses 6 cups of water and 3 scoops of fertilizer.

Bart uses 8 cups of water and 5 scoops of fertilizer.

Will Malaika's and Bart's plant fertilizer have the same strength? **No**
Explain.

12. Use counters to find all the ratios that are equivalent to 2 : 3 and have a second term that is less than 40. List the ratios.



Math Link

Your World

A contrast ratio is associated with televisions and computer monitors. It is a measure of the difference between the brightest and darkest colours displayed on a screen. A high contrast ratio, such as 800 : 1, delivers a better image than a low contrast ratio, such as 150 : 1.



Reflect

Write two ratios that are equivalent.
Explain how you know they are equivalent.
Write two ratios that are not equivalent.
Explain how you know they are not equivalent.

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8. b) 1 : 3; back, math, rust

9. a) The ratio of cans of lima beans to pinto beans is 3 : 2.
I multiply the first term by 3 to get 9.

So, I multiply the second term by 3: $2 \times 3 = 6$

Su Mei will use 6 cans of pinto beans.

- b) The ratio of cans of lima beans to kidney beans is 3 : 1.

I multiply the first term by 3 to get 9.

So, I multiply the second term by 3: $1 \times 3 = 3$

Su Mei will use 3 cans of kidney beans.

10. The ratio of insulin to carbohydrates is 1 : 15.

I multiply the second term by 4 to get 60.

So, I multiply the first term by 4: $1 \times 4 = 4$

Katherine should inject 4 units of insulin.

11. Malaika: $6 : 3 = 2 : 1 = 8 : 4$

Using the same amount of water, Malaika would use

4 scoops of fertilizer. Bart's fertilizer will be stronger.

12. The equivalent ratios for 2 : 3 with a second term less than 40 are 4 : 6, 6 : 9, 8 : 12, 10 : 15, 12 : 18, 14 : 21, 16 : 24, 18 : 27, 20 : 30, 22 : 33, 24 : 36, and 26 : 39.

REFLECT: 7 : 9 and 14 : 18 are equivalent ratios because

$$7 \times 2 = 14 \text{ and } 9 \times 2 = 18.$$

6 : 7 and 12 : 16 are not equivalent ratios because

$$6 \times 2 = 12 \text{ but } 7 \times 2 = 14, \text{ not } 16.$$

Math Link

Have students find the contrast ratio for a television or computer monitor they have at home, or search for the information on the Internet.

ASSESSMENT FOR LEARNING

What to Look For

Conceptual Understanding

- ✓ Students explain that equivalent ratios are ratios that are equal.

Procedural Knowledge

- ✓ Students can find equivalent ratios by multiplying the terms of a ratio by the same numbers.
- ✓ Students can find equivalent ratios by dividing the terms of a ratio by the same numbers.

Problem-Solving Skills

- ✓ Students can solve simple ratio problems.

What to Do If You Don't See It

Adjust Instruction

Provide students with four sheets of blue paper and two sheets of white paper. Have students name the ratio of blue to white sheets. Have students tear each sheet in half, name the new ratio of blue to white pieces, and repeat. Then have students put pieces of the same colour together in twos and name the ratio of blue to white. Repeat for groups of four.