M9

Equivalent Ratios

6.1 and 6.2

- A ratio describes the relationship between different amounts. A ratio can describe the relationship between two (or more) parts of a group = **part-to-part ratio**, or between one part and the whole group = **part-to-whole ratio.**
- A ratio can be described as a sentence, expression, or a fraction

Example 1a): There are 5 puppies, 3 kittens, 2 bunnies and 20 fish in a pet store.

To describe the relationship between bunnies and puppies we can write a sentence:

The ratio of bunnies to puppies is 2 to 5. OR The ratio of puppies to bunnies is 5 to 2.

We can write an expression: 2 : 5 OR 5 : 2

We can write a fraction: $\frac{2}{5}$ OR $\frac{5}{2}$

- It is very important to write the numbers in the same orders as the words.
- It is necessary to reduce the ratio to its lowest terms.

1b) Use a fraction to express the ratio of fish to bunnies: $\frac{20}{2}$ or $\frac{10}{1}$

1c) Use an expression to write the ratio of kittens to all pets: 3 : 30 -> 1 : 10

Ratios in the Simplest Form

- Find the GCF (= the greatest common factor) for all parts of the ratio.
- Divide each part of the ratio by the GCF.

Example: Express each ratio in its simplest form.

3: 24	15: 40	130: 39	4: 45
1 : 8	3 : 8	10 : 3	4 : 45

Cannot Reduce

Equivalent Ratios

- Multiply each part of the ratio by the same natural number (= positive integer).
- Or divide each part of the ratio by a factor that is common to every part of the ratio.

Example 1: Determine three other ratios that are equivalent to the given ratio.

3:4	×2 6:8	×3 9:12	×10 30:40
5:10	10:20	15:30	50:100
1:3	2:6	3:9	10:30
7:9	14:18	21:27	70:90

Example 2: Fill in the missing information that ensures that all ratios in a row are equivalent.

3:7	6: 14	15: 35	9 :21
5 :3	25: 15	50:30	10: 6
1:3	25: 75	3 :9	8 :24

Problem Solving with Ratios

Examples:

1. There are 120 seeds in a packet. The ratio of fireweed to lupine is 5:3. How many lupine seeds are in the packet?

Fireweed ↑ → Lupine

① 5 : 3 → Total number of parts (5+3 = 8)

② $\frac{120}{8} = 15$ (120 ← Total, 8 ← parts) → 1 part is 15 seeds

③ Lupine has 3 parts ⇒ 3 × 15 = 45 seeds

∴ There are 45 seeds in the packets

2. There are 3000 seats in the stadium. The ratio of local fans to out-of-town fans is 13:2. How many guests are present at the game if the stadium is sold out. What assumptions do you make?

3000 seats

Local : out of town = Guests

① 13 : 2 → Total parts (13+2 = 15)

② $\frac{3000}{15} = 200$ (3000 → Total seats, 15 → total parts) ⇒ 200 seats per part

③ number of Guests : 2 × 200 = 400

∴ There are 400 guests at the Stadium

Assumption : because the game is sold out, I assume every person who Purchased went to the game.

Unit Ratios

- A unit ratio has the second part equal to 1.
- To convert a ratio to unit ratio, divide both parts in the ratio by the second number.

Example: Express each ratio as a unit ratio.

$\div 24$ 3: 24 $\div 24$	15: 5	10: 2	5: 3
$\frac{1}{8}$: 1 or 0.125 : 1	3 : 1	5 : 1	$1.\overline{6}$: 1 ($1.6\overline{7}$)

Part-to-Whole Ratios

- When the second number in a ratio represents the size of the entire group we can represent the ratio as a percent. A percent is a special type of a part-to-whole ratio when the second part is represented by a hundred.

Example:

a) There are 2 puppies for every 5 pets in a store:

Puppies: all pets = 2:5 = $\frac{2}{5}$ and as a percent: $\frac{2 \times 20}{5 \times 20} = \frac{40}{100}$ = 40 %

($20 = \frac{100}{5}$)

b) There are 4 containers of strawberry yogurt, 1 container of vanilla yogurt, and 5 containers of mixed-berry yogurt in the fridge. What is the ratio of strawberry yogurt to all yogurt in the fridge? Express this ratio as a fraction, expression, and a percent.

4 = SY 1 = VY 5 = MB 4 + 1 + 5 = 10 (Total yogurt)

4 : 10, $\frac{4}{10}$, 40 % → reduced = 2 : 5, $\frac{2}{5}$, 40%

Three-Part Ratios

- Three-part and multiple-part ratios cannot be expressed as a fraction.
- Three-part and multiple-part ratios can be expressed in their simplest form by dividing by the GCF of every part.
- Three-part and multiple-part ratios are not usually expressed as unit ratios.