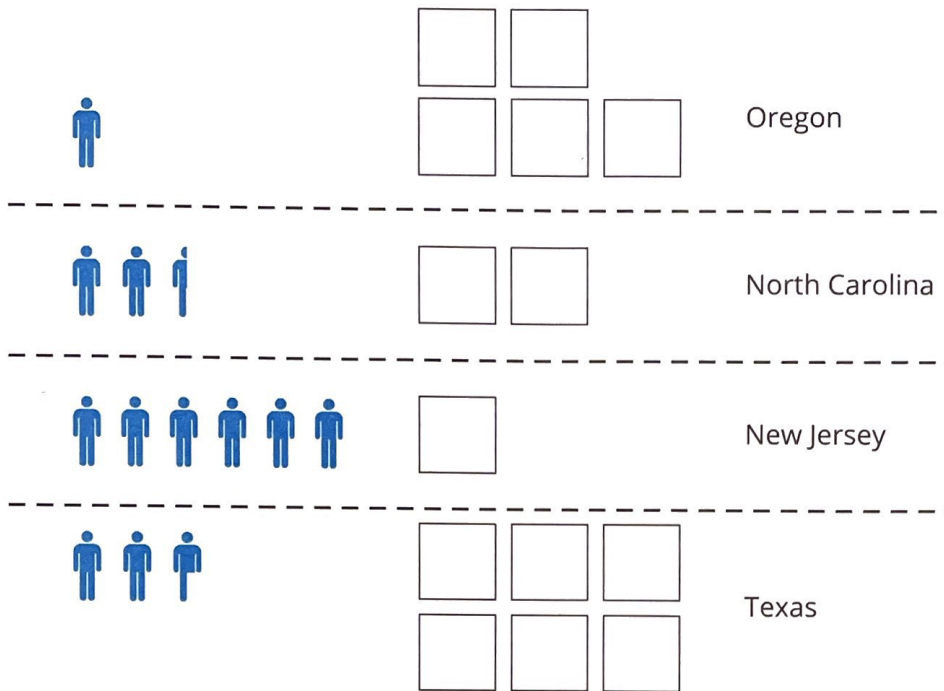




I'm Your Density

Population density is a ratio that compares people to square miles. The graph shown gives the approximate population density of four U.S. states in 2019.

- 1 Which of the states shown has the greatest population density? Which state has the least population density? **Explain what this means in your own words.**



$$\frac{200 \text{ people}}{5 \text{ mi}^2} = \frac{40 \text{ people}}{1 \text{ mi}^2}$$

$$\frac{600 \text{ people}}{2 \text{ mi}^2} = \frac{300 \text{ people}}{1 \text{ mi}^2}$$

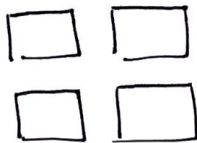
$$\frac{1200 \text{ people}}{1 \text{ mi}^2}$$

$$\frac{600 \text{ people}}{6 \text{ mi}^2} \approx \frac{100 \text{ people}}{1 \text{ mi}^2}$$

Key:

$\approx$ 200 people
 = 1 square mile

New Jersey has the greatest population density = a lot of people in a little amount of land
 Oregon has the least population density = less people in more land.



California

$$\frac{1000 \text{ people}}{4 \text{ mi}^2} = \frac{250 \text{ people}}{1 \text{ mi}^2}$$

- 2 What is the population density of your state or your city? How does this compare with other states or cities in the United States?

California is about in the middle of the given states.



ACTIVITY 1

MATHia CONNECTION

• Introduction to Ratio Tables

Ratios

TOPIC 1

LESSON 4

Getting Started

1

Activity 2

3

Talk the Talk

Introduction to Ratio Tables

Your weight on the Earth is the measure of the amount of gravitational attraction exerted on you by the Earth. The Moon has a weaker gravitational force than the Earth.

HABITS OF MIND

- Model with mathematics.
- Use appropriate tools strategically.

The ratio of weight on Earth : weight on the Moon is approximately 60 lb : 10 lb.

You can use ratio tables to show how two quantities are related. Ratio tables are another way to organize information.

WORKED EXAMPLE

The table represents three equivalent ratios of weight on Earth (lb) : weight on the Moon (lb). Start with the ratio of 60 lb on Earth : 10 lb on the Moon.

Weight on Earth (lb)	60	30	90
Weight on the Moon (lb)	10	5	15

Diagram illustrating the relationships between the ratios in the table:

- From 60 to 30: $\div 2$ (indicated by a red arrow)
- From 10 to 5: $\div 2$ (indicated by a red arrow)
- From 30 to 90: $\times 3$ (indicated by a blue arrow labeled "add")
- From 5 to 15: $\times 3$ (indicated by a blue arrow labeled "add")

THINK ABOUT...

How do the numbers in the table relate to each other?

- 1 Verify that the three ratios shown are equivalent. **Explain your reasoning.**

$$\frac{60}{10} \div \frac{10}{10} = \frac{6}{1}$$

$$\frac{30}{5} \div \frac{5}{5} = \frac{6}{1}$$

$$\frac{90}{15} \div \frac{15}{15} = \frac{6}{1}$$

All ratios simplify to $\frac{6}{1}$.

- 2 Can you show a different strategy to determine the ratio of 90 lb on Earth : 15 lb on the Moon?

You could have multiplied the ratio $\frac{30}{5}$ by $\frac{3}{3}$



- Consider the strategies used by Howard, Carla, Mitsu, and Ralph to determine the weight of a 120-pound person on the Moon.

Howard

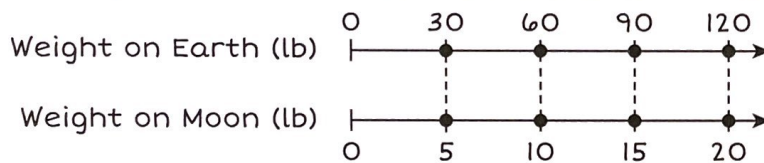


Weight on Earth (lb)	60	30	90	120
Weight on the Moon (lb)	10	5	15	20

$\times 2$

Carla

I also got a ratio of 120 lb on Earth : 20 lb on the Moon.



Mitsu



Weight on Earth (lb)	60	30	90	120
Weight on the Moon (lb)	10	5	15	20

add

add



Ralph

The difference between 90 and 120 is 30, so I just added 30 to 15 and got 45.

	60	30	90	120
Weight on Earth (lb)	60	30	90	120
Weight on the Moon (lb)	10	5	15	45

Diagram showing the relationship between Earth weight and Moon weight. The top row shows Earth weight (60, 30, 90, 120) and the bottom row shows Moon weight (10, 5, 15, 45). Arrows indicate a constant difference of +30 between the two rows for the last two columns (90 to 120 and 15 to 45).

- 3 Compare Howard's and Carla's strategies.

Howard scaled up by 2 from the $\frac{60}{10}$ ratio

Carla made a double number line and used intervals of 30 & 5 until she reached her amount

- 4 Explain Mitsu's reasoning. Then verify the ratio 120 lb on Earth : 20 lb on the Moon is a correct equivalent ratio.

Mitsu added together two different ratios

$$\frac{120}{20} = \frac{2}{2} = \frac{60}{10}$$

- 5 Explain why Ralph's reasoning is not correct.

Scaling up (or down) requires multiplication (or division)

You can't scale up by adding. You can only add two given ratios to get a third.



- 6 Mitsu said, "I see another equivalent ratio from Carla's work."

30 lb on Earth : 5 lb on the Moon
120 lb on Earth : 20 lb on the Moon
150 lb on Earth : 25 lb on the Moon

Is Mitsu correct? **Explain her reasoning.**



Mitsu is correct. She added the first two ratios to get the third ratio.

- 7 Show a different strategy to verify the equivalent ratio of 150 lb on Earth : 25 lb on the Moon. **Explain your reasoning.**

Weight on Earth (lb)	60	30	90	120	150
Weight on Moon (lb)	10	5	15	20	25

I can scale up $\frac{30}{5}$ by $\frac{5}{5}$ to get $\frac{150}{25}$



ACTIVITY 2

MATHia CONNECTION

- Using Tables to Determine Equivalent Ratios

Ratios

TOPIC 1

LESSON 4

Getting Started

1

Activity 2

3

Talk the Talk

Using Equivalent Ratio Tables

The school has planned a pizza party for the 6th grade tomorrow. Tracy is in charge of ordering the pizza for 450 students. The pizza parlor said two pizzas would serve 9 students. Tracy started a ratio table to help her determine how many pizzas to order for 450 students.

HABITS OF MIND

- Model with mathematics.
- Use appropriate tools strategically.

TOPIC 1

- Complete Tracy's table and explain her strategy to determine the number of pizzas needed for 450 students.

Pizzas	2	10	100
Students	9	45	450

Handwritten annotations: $\times 5$ (from 2 to 10), $\times 10$ (from 10 to 100), $\times 5$ (from 9 to 45), $\times 10$ (from 45 to 450).

- Complete the table to show the number of pizzas to order given the number of students. **Explain your calculations.**

Show rainbows

Pizzas	2	10	100	30	60	50	200	300
Students	9	45	450	135	270	225	900	1350

Handwritten annotations: $\times 30$ (from 100 to 30), $\div 2$ (from 30 to 60), $\div 2$ (from 60 to 120), $\times 2$ (from 120 to 240), $\times 10$ (from 240 to 200), $\times 30$ (from 200 to 300), $\div 2$ (from 300 to 150), $\times 2$ (from 150 to 300), $\times 10$ (from 300 to 3000).

- Use your table of values to answer each question. **Explain your calculations.**

- How many students will 12 pizzas feed?

$$2 + 10 = 12 \text{ pizzas}$$

$$9 + 45 = 54 \text{ students}$$

- How many students will 20 pizzas feed?

$$10 \times 2 = 20 \text{ pizzas}$$

$$45 \times 2 = 90 \text{ students}$$

- How many students will 90 pizzas feed?

$$100 - 10 = 90 \text{ pizzas}$$

$$450 - 45 = 405 \text{ students}$$

THINK ABOUT...

How can you use the ratio of 10 pizzas to 45 students to help you figure out the other pizza amounts?