Connect and Reflect

Key Ideas

- A proportion is a relationship in which two ratios or two rates are equivalent.
- You can use words or fractions to show proportional relationships.

30 sit-ups in 2 minutes is an equivalent rate to 90 sit-ups in 6 minutes, or $\frac{30 \text{ sit-ups}}{2 \text{ min}} \overset{\times 3}{=} \frac{90 \text{ sit-ups}}{6 \text{ min}}$.

- You can use proportions to determine unknown values by
  - writing a proportion equation and determining the multiplier (or divisor) involved, or
  - using a unit rate.
- You can compare ratios or rates to determine whether quantities in a situation have a proportional relationship.

Practise

For help with #1 to #5, refer to Example 1 on pages 241–242.

1. Determine the value that makes each proportion statement true. Include the units. Show how you know.

a) $\frac{90 \text{ km}}{6 \text{ h}} = \frac{30 \text{ km}}{\blacksquare}$

b) $\frac{5 \text{ goals}}{2 \text{ games}} = \frac{\blacksquare}{24 \text{ games}}$

c) $\frac{12 \text{ beats}}{10 \text{ s}} = \frac{\blacksquare}{60 \text{ s}}$

2. Determine the missing value in each situation.

a) Dinner rolls are priced at 3 for 99¢. How much will 15 rolls cost?

b) Seven identical objects have a mass of 14 kg. What is the mass of 100 of these objects?

3. What is the unknown quantity in each case?

a) Two pens cost 94¢. How much will 21 pens cost?

b) A stack of 6 blocks is 24 cm high. How many blocks will it take to make a stack that is 2 m tall?

4. Matt is paid $58 for 5 h of babysitting. How much should he receive for 2 h?

5. Delia runs 300 m in 36 seconds.

a) How long will it take her to run 1000 m?

b) What assumptions did you make in your solution to part a)?

For help with #6 to #8, refer to Example 2 on pages 242–243.

6. Determine the missing value in each proportion. Show how you know.

a) $\frac{2}{3} = \frac{\blacksquare}{15}$

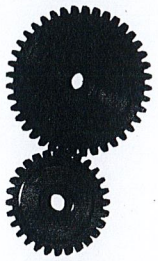
b) $\frac{\blacksquare}{8} = \frac{33}{24}$

c) $\frac{2}{\blacksquare} = \frac{5}{35}$

d) $\frac{20}{8} = \frac{45}{\blacksquare}$

7. A baseball player has a home run to strikeouts ratio of 3 : 17. How many home runs should he hit if he strikes out 187 times?

8. A small gear turns 18 times in the same time that a large gear turns 4 times. How many times will the large gear turn if the small gear turns 54 times?



For help with #9 and #10, refer to Example 3 on page 244.

9. Is each proportion statement below true? Show how you know.

a) $\frac{24}{15} = \frac{40}{25}$

b) $\frac{150 \text{ cars}}{20 \text{ min}} = \frac{525 \text{ cars}}{75 \text{ min}}$

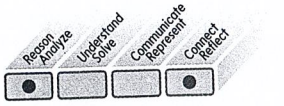
10. Determine whether each situation represents a proportional relationship. Show how you know.

a) If 10 beans have a mass of 17 g, then 30 beans have a mass of 51 g.

b) There are 13 boys and 15 girls in Owen's class, and there are 70 boys and 80 girls in the entire school.

c) On a map, 1 cm represents 25 km. Kendra wants to ride her bike 160 km. This distance is 6.4 cm on the map.

Apply



11. Richie and Sheena are running at the same speed around a track. Richie started first and had completed 6 laps when Sheena had completed 4 laps. Wendy and Jordan are watching.

a) Jordan says that a proportion can be used to determine how many laps Sheena will have finished when Richie has run 15 laps. Wendy says that a proportion cannot be used in this case. Who is right? Explain your thinking.

b) How many laps will Sheena have finished once Richie has completed 15 laps?

12. The student council is holding a carnival as a fundraiser. They are going to charge \$10 for 3 rides on the Wild Slider. What will it cost for 18 rides on Wild Slider?

13. Determine the missing value in each equivalent fraction.

a) $\frac{6}{\blacksquare} = \frac{15}{24} = \frac{\blacksquare}{20}$

b) $\frac{48 \text{ km}}{\$30} = \frac{588 \text{ km}}{\blacksquare} = \frac{\blacksquare}{\$64}$

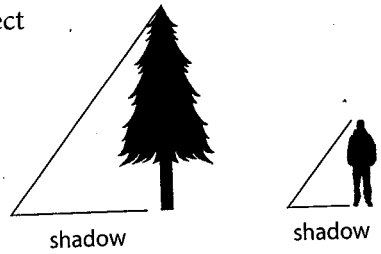
14. A breakfast cereal contains corn, wheat, and rice in the ratio of 3 to 4 to 2. If a box of cereal contains 225 g of corn, how much rice does it contain?

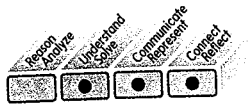
15. Reina drives 55 km from West Vancouver to Squamish in 45 minutes and then stops for lunch. After lunch she drives another 60 km from Squamish to Whistler in 50 minutes.

a) Does this represent a proportional relationship? Show how you know.

b) What would Reina's driving time from Squamish to Whistler have to be for this situation to represent a proportional relationship?

16. ✓ **Competency Check** The height of an object compared to the length of its shadow is constant for all objects at any given time.



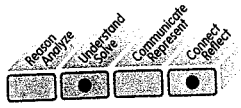


a) If a student who is 1.5 m tall casts a 1.08-m shadow, what is the height of a tree that casts a 9-m shadow?

b) Approximately how long will the shadow be for a 50-m tall tower if a 2.4-m tall post beside it casts a 1.3-m shadow?

c) Explain why this situation shows a proportional relationship.

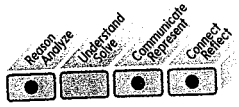
17. The dosage of medicine for a child is 2.5 mL for every 3 kg of a child's mass. What is the dose, in millilitres, for a child with a mass of 16.5 kg?



Extend

18. David can saw a log into 3 pieces in 7 min. If he continues sawing at a constant rate, how long will it take him to saw a similar log into 6 pieces?

19. A wildlife biologist wants to know how many trout are in a lake. He captures and tags 24 trout and releases them back into the lake. Two weeks later he returns and captures 30 trout and finds that 5 of them are tagged. He uses the following ratios to estimate the number of fish in the lake:



$$\frac{\text{fish recaptured with tags}}{\text{total fish recaptured}} = \frac{\text{fish caught and tagged}}{\text{total fish in lake}}$$

a) How many fish does he estimate are in the lake?

b) Why can a proportion be used in this situation? What assumptions are being made?

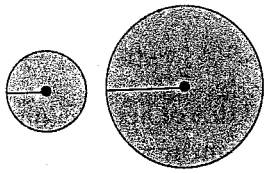
20. Simone estimates that frogs eat 6 insects per hour and that dragonflies eat 9 insects per hour. He also assumes that frogs rest for 8 h each day and dragonflies rest for 13 h each day.

a) Determine the daily rate of insects eaten by a frog and a dragonfly. Which one eats more insects per day?

b) How many insects would a dragonfly eat in a week?

c) How many insects would a frog eat in August?

21. A circle has a radius that is twice that of another circle.



a) What is the ratio of their circumferences?

b) What is the ratio of their areas?