GRADE 7 ACCELERATED · UNIT 5 · LESSONS 10–11

# Multi-Step Proportion Problems

**MA.7.AR.4.5**

I can solve a problem that takes two or more proportional steps, including a unit conversion, and compare two rates given in different units.

# Warm-Up

1. $1\,\text{kg} = 2.204\,\text{lb}$. How many pounds is 4 kg?
2. At $1\,\text{cm} : 50\,\text{km}$, 3 cm on the map is how many km?
3. Find the value: $3 \times 2.5 + 1.5$
4. A car goes 180 miles in 3 hours. Its speed in miles per hour?

# Warm-Up

1. $1\,\text{kg} = 2.204\,\text{lb}$. How many pounds is 4 kg? **8.816 lb**
2. At $1\,\text{cm} : 50\,\text{km}$, 3 cm on the map is how many km? **150 km**
3. Find the value: $3 \times 2.5 + 1.5$ **9**
4. A car goes 180 miles in 3 hours. Its speed in miles per hour?

   **60 miles per hour**

# Vocabulary

**unit rate**

how much of one quantity per 1 of the other — 23 miles per 1 gallon

**proportional**

two quantities whose ratio stays the same: double one, the other doubles

**per**

for each 1 — the word that marks a unit rate

# Notes

## I. One unit rate, used twice

$23 \times 17.5 = 402.5$ mi per tank

$1{,}207 \div 402.5 \approx 3$ tanks

# Notes

## II. Compare rates in one unit

$$100 \text{ km/h} \times 0.62 = 62 \text{ mi/h} \qquad 62 < 65$$

**Same unit first. Then compare.**

# Notes

## III. Scale a recipe, then check the pantry

$$k = \frac{30}{12} = 2.5 \qquad 2.5 \times 1\frac{1}{2} = 3\frac{3}{4} \text{ cups} > 3$$

Paint $1:2:3$, 4 gal of the first: $k = 4$, $6 \text{ parts} \times 4 = 24$ gal

# Example 1

$$1\,\text{mi} = 1.61\,\text{km}.$$

Runner A does 5 mi in 40 min; runner B does 9 km in 45 min.

**Find each speed in km/h. Who is faster?**

# Example 1

$5 \times 1.61 = 8.05$ km  $40$ min $= \frac{2}{3}$ h

$8.05 \div \frac{2}{3} = 12.075$

$9 \div \frac{3}{4} = 12$

$12.075 > 12$

**Answer: A ≈ 12.08 km/h, B = 12 km/h: A**

# Your Turn

$$1\text{ mi} = 1.61\text{ km}.$$

Runner A does 4 mi in 30 min; runner B does 7 km in 35 min.

Find each speed in km/h. Who is faster?

# Your Turn

$$1\text{ mi} = 1.61\text{ km}.$$

Runner A does 4 mi in 30 min; runner B does 7 km in 35 min.

Find each speed in km/h. Who is faster?

$$4 \times 1.61 = 6.44 \qquad 6.44 \div \frac{1}{2} = 12.88$$

$$7 \div \frac{7}{12} = 12$$

**Answer: A = 12.88 km/h, B = 12 km/h: A**

# Example 2

A recipe for 8 servings uses $2\frac{1}{2}$ cups of rice.

**How much rice for 20 servings? With 5 cups on hand, how many servings can be made?**

# Example 2

$$k = \frac{20}{8} = 2.5 \qquad 2.5 \times 2\frac{1}{2} = 6\frac{1}{4}$$

$$5 \div 2\frac{1}{2} = 2 \qquad 2 \times 8 = 16$$

**Answer: 6¼ cups; 16 servings**

# Your Turn

A recipe for 6 servings uses $1\frac{1}{2}$ cups of rice.

How much rice for 12 servings?

With $4\frac{1}{2}$ cups on hand, how many servings?

# Your Turn

A recipe for 6 servings uses $1\frac{1}{2}$ cups of rice.

How much rice for 12 servings?

With $4\frac{1}{2}$ cups on hand, how many servings?

$$k = \frac{12}{6} = 2 \qquad 2 \times 1\frac{1}{2} = 3$$

$$4\frac{1}{2} \div 1\frac{1}{2} = 3 \qquad 3 \times 6 = 18$$

**Answer: 3 cups; 18 servings**

# Whiteboards · Question 1 of 9

A car gets 28 miles per gallon. Its tank holds 15 gal.

**How far does it go on a full tank?**

**Answer it.**

# Whiteboards · Question 1 of 9

A car gets 28 miles per gallon. Its tank holds 15 gal.

**How far does it go on a full tank?**

$$28 \times 15 = 420$$

**Answer: 420 mi**

# Whiteboards · Question 2 of 9

A printer prints 35 pages per minute. A job is 1,400 pages.

**How long does the job take?**

**Answer it.**

# Whiteboards · Question 2 of 9

A printer prints 35 pages per minute. A job is 1,400 pages.

**How long does the job take?**

$$1{,}400 \div 35 = 40$$

**Answer: 40 min**

# Whiteboards · Question 3 of 9

Mia earns $14.50 per hour at a shop 2 mi from home, 6 h a day for 5 days.

**How much does she earn?**

**Answer it.**

# Whiteboards · Question 3 of 9

Mia earns $14.50 per hour at a shop 2 mi from home, 6 h a day for 5 days.

**How much does she earn?**

$$6 \times 5 = 30 \qquad 30 \times 14.50 = 435$$

**Answer: $435**

# Whiteboards · Question 4 of 9

A car gets 30 miles per gallon with a 12-gal tank. It makes a 900-mi trip.

**How many tanks of gas does the trip use? (Part of a tank counts as a whole tank.)**

**A.** 2

**B.** 75

**C.** 25

**D.** 3

**Answer it.**

# Whiteboards · Question 4 of 9

A car gets 30 miles per gallon with a 12-gal tank. It makes a 900-mi trip.

**How many tanks of gas does the trip use? (Part of a tank counts as a whole tank.)**

$$30 \times 12 = 360 \text{ mi per tank}$$

$$900 \div 360 = 2.5 \rightarrow 3 \text{ tanks}$$

**Answer: D — 3 tanks**

# Whiteboards · Question 5 of 9

A cereal has 12 g of protein per 100 g.

**How many grams of protein in 1 kg?**

**Answer it.**

# Whiteboards · Question 5 of 9

A cereal has 12 g of protein per 100 g.

**How many grams of protein in 1 kg?**

$1{,}000 \div 100 = 10$ $10 \times 12 = 120$

**Answer: 120 g**

# Whiteboards · Question 6 of 9

$1\text{ mi} = 1.61\text{ km}$.

Cyclist A rides 12 km in 50 min; cyclist B rides 7 mi in 45 min.

**Who is faster?**

**A.** Tie: 12 and 12

**B.** A: 12 > 7

**C.** B: 15.0 > 14.4

**D.** A: 14.4 > 11.27

**Answer it.**

# Whiteboards · Question 6 of 9

$1\text{ mi} = 1.61\text{ km}$.

Cyclist A rides 12 km in 50 min; cyclist B rides 7 mi in 45 min.

**Who is faster?**

$$\text{A}: 50\text{ min} = \frac{5}{6}\text{ h} \qquad 12 \div \frac{5}{6} = 14.4\text{ km/h}$$

$$\text{B}: 7 \times 1.61 = 11.27\text{ km} \qquad 11.27 \div \frac{3}{4} \approx 15.03\text{ km/h}$$

**Answer: C — cyclist B**

# Whiteboards · Question 7 of 9

Paint is mixed white : blue : grey = $2:4:5$.

A batch uses 8 gal of white.

**How many gallons is the whole batch?**

**Answer it.**

# Whiteboards · Question 7 of 9

Paint is mixed white : blue : grey = $2:4:5$.

A batch uses 8 gal of white.

**How many gallons is the whole batch?**

$$k = \frac{8}{2} = 4 \qquad 2 + 4 + 5 = 11 \text{ parts}$$

$$11 \times 4 = 44$$

**Answer: 44 gal**

# Whiteboards · Question 8 of 9

A plan is drawn at $1\text{ in} : 4\text{ ft}$; a room is 2 in by 2.5 in on it.

$1\text{ ft} = 0.305\text{ m}$.

**Find the room's area in square meters.**

**Answer it.**

# Whiteboards · Question 8 of 9

A plan is drawn at $1\text{ in} : 4\text{ ft}$; a room is 2 in by 2.5 in on it.

$1\text{ ft} = 0.305\text{ m}$.

**Find the room's area in square meters.**

$2 \times 4 = 8\text{ ft}$ $\quad$ $2.5 \times 4 = 10\text{ ft}$

$8 \times 0.305 = 2.44$ $\quad$ $10 \times 0.305 = 3.05$ $\quad$ $2.44 \times 3.05 = 7.442$

**Answer: About 7.44 $m^2$**

# Whiteboards · Question 9 of 9

$1\text{ mi} = 1.61\text{ km}$.

A 300-km drive.

Car A averages 50 mi/h; car B averages 75 km/h.

**Which car gets there first, and by how long? Explain.**

**Write your answer in sentences.**

# Whiteboards · Question 9 of 9

$1\text{ mi} = 1.61\text{ km}$.

A 300-km drive.

Car A averages 50 mi/h; car B averages 75 km/h.

**Which car gets there first, and by how long? Explain.**

$$50 \times 1.61 = 80.5 \text{ km/h}$$

$$300 \div 80.5 \approx 3.73 \text{ h} \qquad 300 \div 75 = 4 \text{ h}$$

**Answer: Car A: 80.5 km/h against 75, so about 3.73 h against 4 h — about 16 minutes sooner.**

# Independent Set

1. A car gets 32 miles per gallon and its tank holds 14 gal. How far does it go on a tank?
2. That car makes a 1,000-mi trip. How many tanks of gas does it use? (Part of a tank counts as a whole tank.)
3. A recipe for 4 servings uses $1\frac{1}{4}$ cups of rice. How much rice for 10 servings?
4. $1\text{ km} = 0.62\text{ mi}$. A train does 120 km/h; a bus does 70 mi/h. Which is faster? Show the speeds in one unit.
5. Juice is mixed orange : mango : water = $3:2:5$. A batch uses 9 cups of orange. How many cups is the whole batch?
6. A plan is drawn at $1\text{ in} : 6\text{ ft}$; a room is 2 in by 3.5 in on it. Find the room's real area.

# IXL

1. Open IXL and start today's skills.
2. Work on paper where the question needs work. The answer box does not show it.
3. Every skill listed is required, to a SmartScore of 67. Due by the Unit 5 test.

**Today's skills — all required**

Compare rates: word problems — VVS

Multi-step problems with customary or metric unit conversions — UCT