

Name _____

Date _____

14.2 Scale drawings, maps and plans — worked answers

Use knowledge of scaling to interpret maps and plans, converting between distances on a drawing and real distances. · 57 questions

A · Fluency — Convert between drawing lengths and real lengths.

- 1** A plan uses the scale 1 cm represents 2 m. A wall is 3 cm long on the plan. How long is the real wall, in metres?

Answer: 6
Every centimetre stands for 2 m, so multiply: $3 \times 2 = 6$ m.
- 2** A plan uses the scale 1 cm represents 4 m. A wall is 5 cm long on the plan. How long is the real wall, in metres?

Answer: 20
Every centimetre stands for 4 m, so multiply: $5 \times 4 = 20$ m.
- 3** A plan uses the scale 1 cm represents 10 m. A wall is 7 cm long on the plan. How long is the real wall, in metres?

Answer: 70
Every centimetre stands for 10 m, so multiply: $7 \times 10 = 70$ m.
- 4** A plan uses the scale 1 cm represents 50 m. A wall is 2 cm long on the plan. How long is the real wall, in metres?

Answer: 100
Every centimetre stands for 50 m, so multiply: $2 \times 50 = 100$ m.
- 5** A plan uses the scale 1 cm represents 25 m. A wall is 6 cm long on the plan. How long is the real wall, in metres?

Answer: 150
Every centimetre stands for 25 m, so multiply: $6 \times 25 = 150$ m.
- 6** A plan uses the scale 1 cm represents 100 m. A wall is 4 cm long on the plan. How long is the real wall, in metres?

Answer: 400
Every centimetre stands for 100 m, so multiply: $4 \times 100 = 400$ m.
- 7** A plan uses the scale 1 cm represents 5 m. A wall is 8 cm long on the plan. How long is the real wall, in metres?

Answer: 40
Every centimetre stands for 5 m, so multiply: $8 \times 5 = 40$ m.

- 8** A plan uses the scale 1 cm represents 20 m. A wall is 9 cm long on the plan. How long is the real wall, in metres?
Answer: 180
Every centimetre stands for 20 m, so multiply: $9 \times 20 = 180$ m.
- 9** A plan uses the scale 1 cm represents 3 m. A wall is 12 cm long on the plan. How long is the real wall, in metres?
Answer: 36
Every centimetre stands for 3 m, so multiply: $12 \times 3 = 36$ m.
- 10** A plan uses the scale 1 cm represents 2 m. A wall is 15 cm long on the plan. How long is the real wall, in metres?
Answer: 30
Every centimetre stands for 2 m, so multiply: $15 \times 2 = 30$ m.
- 11** A plan uses the scale 1 cm represents 4 m. A path is 24 m long. How long is it on the plan, in centimetres?
Answer: 6
Going the other way, divide: $24 \div 4 = 6$ cm.
- 12** A plan uses the scale 1 cm represents 10 m. A path is 60 m long. How long is it on the plan, in centimetres?
Answer: 6
Going the other way, divide: $60 \div 10 = 6$ cm.
- 13** A plan uses the scale 1 cm represents 50 m. A path is 150 m long. How long is it on the plan, in centimetres?
Answer: 3
Going the other way, divide: $150 \div 50 = 3$ cm.
- 14** A plan uses the scale 1 cm represents 6 m. A path is 36 m long. How long is it on the plan, in centimetres?
Answer: 6
Going the other way, divide: $36 \div 6 = 6$ cm.
- 15** A plan uses the scale 1 cm represents 25 m. A path is 200 m long. How long is it on the plan, in centimetres?
Answer: 8
Going the other way, divide: $200 \div 25 = 8$ cm.
- 16** A plan uses the scale 1 cm represents 5 m. A path is 45 m long. How long is it on the plan, in centimetres?
Answer: 9
Going the other way, divide: $45 \div 5 = 9$ cm.
- 17** A plan uses the scale 1 cm represents 100 m. A path is 300 m long. How long is it on the plan, in centimetres?
Answer: 3
Going the other way, divide: $300 \div 100 = 3$ cm.

- 18** A plan uses the scale 1 cm represents 12 m. A path is 84 m long. How long is it on the plan, in centimetres?

Answer: 7

Going the other way, divide: $84 \div 12 = 7$ cm.

- 19** A plan uses the scale 1 cm represents 8 m. A path is 72 m long. How long is it on the plan, in centimetres?

Answer: 9

Going the other way, divide: $72 \div 8 = 9$ cm.

- 20** A plan uses the scale 1 cm represents 20 m. A path is 500 m long. How long is it on the plan, in centimetres?

Answer: 25

Going the other way, divide: $500 \div 20 = 25$ cm.

- 21** A map has scale 1 : 100. A line is 4 cm long on the map. What real distance is that, in centimetres?

Answer: 400

A scale of 1 : 100 means one unit on the map is 100 of the same units in real life: $4 \times 100 = 400$ cm.

- 22** A map has scale 1 : 200. A line is 3 cm long on the map. What real distance is that, in centimetres?

Answer: 600

A scale of 1 : 200 means one unit on the map is 200 of the same units in real life: $3 \times 200 = 600$ cm.

- 23** A map has scale 1 : 50. A line is 6 cm long on the map. What real distance is that, in centimetres?

Answer: 300

A scale of 1 : 50 means one unit on the map is 50 of the same units in real life: $6 \times 50 = 300$ cm.

- 24** A map has scale 1 : 1000. A line is 5 cm long on the map. What real distance is that, in centimetres?

Answer: 5000

A scale of 1 : 1000 means one unit on the map is 1000 of the same units in real life: $5 \times 1000 = 5000$ cm.

- 25** A map has scale 1 : 500. A line is 2 cm long on the map. What real distance is that, in centimetres?

Answer: 1000

A scale of 1 : 500 means one unit on the map is 500 of the same units in real life: $2 \times 500 = 1000$ cm.

- 26** A map has scale 1 : 20. A line is 7 cm long on the map. What real distance is that, in centimetres?

Answer: 140

A scale of 1 : 20 means one unit on the map is 20 of the same units in real life: $7 \times 20 = 140$ cm.

- 27** A map has scale 1 : 100. A line is 5 cm on the map. What real distance is that, in metres?

Answer: 5

$5 \times 100 = 500$ cm, and there are 100 cm in a metre, so $500 \div 100 = 5$ m.

- 28** A map has scale 1 : 1000. A line is 8 cm on the map. What real distance is that, in metres?

Answer: 80

$8 \times 1000 = 8000$ cm, and there are 100 cm in a metre, so $8000 \div 100 = 80$ m.

- 29** A map has scale 1 : 500. A line is 6 cm on the map. What real distance is that, in metres?

Answer: 30

$6 \times 500 = 3000$ cm, and there are 100 cm in a metre, so $3000 \div 100 = 30$ m.

- 30** A map has scale 1 : 200. A line is 9 cm on the map. What real distance is that, in metres?

Answer: 18

$9 \times 200 = 1800$ cm, and there are 100 cm in a metre, so $1800 \div 100 = 18$ m.

- 31** A map has scale 1 : 2000. A line is 3 cm on the map. What real distance is that, in metres?

Answer: 60

$3 \times 2000 = 6000$ cm, and there are 100 cm in a metre, so $6000 \div 100 = 60$ m.

- 32** A map has scale 1 : 10000. A line is 4 cm on the map. What real distance is that, in metres?

Answer: 400

$4 \times 10000 = 40000$ cm, and there are 100 cm in a metre, so $40000 \div 100 = 400$ m.

B · Reasoning — What a scale means, and which way to go.

- 33** What does a scale of 1 : 500 mean?

- ☐ The map is 500 cm wide
- ☐ 1 unit on the map is 500 of the same units in real life
- ☐ The map is 500 times bigger than real life
- ☐ 500 maps fit in real life

Answer: 1 unit on the map is 500 of the same units in real life

The units cancel, which is why a ratio scale works in centimetres, inches or anything else.

- 34** Going from a map distance to a real distance, you ...

- ☐ divide by the scale
- ☐ multiply by the scale
- ☐ add the scale
- ☐ subtract the scale

Answer: multiply by the scale

Real life is bigger than the map, so the number must grow.

- 35** Going from a real distance to a map distance, you ...

- ☐ divide by the scale
- ☐ multiply by the scale
- ☐ add the scale
- ☐ subtract the scale

Answer: divide by the scale

The map is smaller, so the number must shrink.

- 36** Why does a scale drawing keep every angle the same?

- ☐ Angles are always the same
- ☐ Because every length is multiplied by the same number, so the shape does not distort
- ☐ Because it is drawn on paper
- ☐ Angles do change

Answer: Because every length is multiplied by the same number, so the shape does not distort

Scaling one direction only would stretch the shape; scaling every direction equally does not.

37 On a scale drawing, is a scale of 1 : 100 smaller than 1 : 50?

- ☐ Yes
☐ No

Answer: Yes

1 : 100 shrinks real life more, so the drawing is smaller. The bigger the second number, the smaller the picture.

38 A scale is written “1 cm represents 5 m”. As a ratio that is ...

- ☐ 1 : 5
☐ 1 : 50
☐ 1 : 500
☐ 1 : 5000

Answer: 1 : 500

Both sides must be in the same units: 5 m = 500 cm, so 1 : 500.

39 Why must both sides of a ratio scale be in the same units?

- ☐ It looks neater
☐ Otherwise the ratio means nothing
☐ So the numbers are small
☐ They need not be

Answer: Otherwise the ratio means nothing

1 : 500 is a pure number; it only makes sense once the units match.

40 Does a scale drawing of a house have the same shape as the house?

- ☐ Yes
☐ No

Answer: Yes

Same shape, different size — that is what mathematically similar means, and it is exactly the idea in section 14.6.

41 A model is built at 1 : 20. A real car is 4 m long. The model is ...

- ☐ 80 m
☐ 20 cm
☐ 4 cm
☐ 80 cm

Answer: 20 cm

4 m = 400 cm, and $400 \div 20 = 20$ cm.

42 On a map with scale 1 : 25 000, 1 cm represents ...

- ☐ 25 m
☐ 250 m
☐ 2.5 km
☐ 25 km

Answer: 250 m

25 000 cm = 250 m. This is the scale of a typical walking map.

C · Challenge — Ratio scales, unit changes and areas.

- 43** A map has scale 1 : 50 000. Two towns are 6 cm apart on the map. How many kilometres apart are they?

Answer: 3

$6 \times 50\,000 = 300\,000$ cm. There are 100 000 cm in a kilometre, so $300\,000 \div 100\,000 = 3$ km.

- 44** A map has scale 1 : 25 000. Two villages are 8 km apart. How many centimetres apart are they on the map?

Answer: 32

8 km = 800 000 cm, and $800\,000 \div 25\,000 = 32$ cm.

- 45** A plan of a room uses 1 cm to 25 cm. The room is 4 m wide. How wide is it on the plan, in centimetres?

Answer: 16

4 m = 400 cm, and $400 \div 25 = 16$ cm.

- 46** A model aeroplane is made at a scale of 1 : 72. Its wingspan is 50 cm. What is the real wingspan, in metres?

Answer: 36

$50 \times 72 = 3600$ cm, and $3600 \div 100 = 36$ m.

- 47** A garden plan uses 1 cm to 2 m. A rectangular lawn measures 6 cm by 4 cm on the plan. What is its real area, in square metres?

Answer: 96

The real lawn is $6 \times 2 = 12$ m by $4 \times 2 = 8$ m, so the area is $12 \times 8 = 96$ m². The plan area is $6 \times 4 = 24$ cm², and the real area is not 24×2 . Lengths scale by 2, so areas scale by $2 \times 2 = 4$, and $24 \times 4 = 96$ m².

- 48** A plan uses 1 cm to 3 m. A room is 15 m by 9 m. What are its dimensions on the plan, in centimetres? Give the longer one.

Answer: 5

$15 \div 3 = 5$ cm and $9 \div 3 = 3$ cm, so the longer one is 5 cm.

- 49** Two scales are offered for a plan: 1 : 100 and 1 : 250. Which gives the larger drawing? Answer with the second number.

Answer: 100

1 : 100 shrinks less, so it gives the larger drawing.

D · Word problems — Maps, models, architects and surveyors.

- 50** A walking map has scale 1 : 25 000. A footpath measures 12 cm on the map. How long is it, in kilometres?

Answer: 3

$12 \times 25\,000 = 300\,000$ cm = 3 km.

- 51** An architect draws a house at 1 cm to 2 m. The house is 14 m long. How long is the drawing, in centimetres?

Answer: 7

$14 \div 2 = 7$ cm.

- 52** A model railway is built at 1 : 76. A real carriage is 19 m long. How long is the model, in centimetres?

Answer: 25

19 m = 1900 cm, and $1900 \div 76 = 25$ cm.

- 53** On a plan of a school, the hall is 9 cm long. The scale is 1 cm to 4 m. How long is the hall, in metres?

Answer: 36

$$9 \times 4 = 36 \text{ m.}$$

- 54** A map of an island uses 1 cm to 500 m. The island is 7 cm across on the map. How many kilometres is that?

Answer: 3.5

$$7 \times 500 = 3500 \text{ m, and } 3500 \div 1000 = 3.5 \text{ km.}$$

- 55** A plan of a swimming pool uses 1 : 200. The pool is 10 cm long on the plan. How long is the real pool, in metres?

Answer: 20

$$10 \times 200 = 2000 \text{ cm} = 20 \text{ m} \text{ — an Olympic pool is 50 m, so this is a training pool.}$$

- 56** A surveyor's plan uses 1 : 1000. A field boundary is 250 m long. How long is it on the plan, in centimetres?

Answer: 25

$$250 \text{ m} = 25\,000 \text{ cm, and } 25\,000 \div 1000 = 25 \text{ cm.}$$

- 57** Two towns are 4.5 cm apart on a 1 : 200 000 map. How many kilometres apart are they?

Answer: 9

$$4.5 \times 200\,000 = 900\,000 \text{ cm, and } 900\,000 \div 100\,000 = 9 \text{ km.}$$