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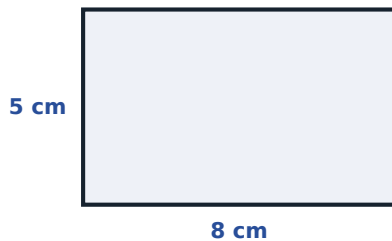
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## 15.1 Perimeter and area of rectangles — worked answers

Find the perimeter and area of rectangles and squares, work backwards from a given area or perimeter, and understand what congruent means. · 67 questions

### A · Fluency — Perimeters, areas and missing sides.

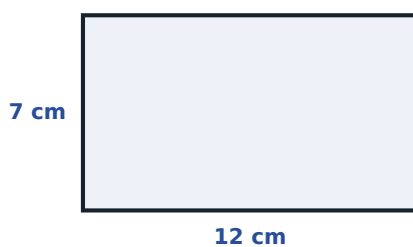
- 1 A rectangle is 8 cm long and 5 cm wide. What is its **perimeter**, in centimetres?



**Answer: 26**

Perimeter is the distance all the way round:  $8 + 5 + 8 + 5 = 26$  cm. Or use  $2 \times (8 + 5) = 26$  cm.

- 2 A rectangle is 12 cm long and 7 cm wide. What is its **perimeter**, in centimetres?



**Answer: 38**

Perimeter is the distance all the way round:  $12 + 7 + 12 + 7 = 38$  cm. Or use  $2 \times (12 + 7) = 38$  cm.

- 3 A rectangle is 9 cm long and 4 cm wide. What is its **perimeter**, in centimetres?



**Answer: 26**

Perimeter is the distance all the way round:  $9 + 4 + 9 + 4 = 26$  cm. Or use  $2 \times (9 + 4) = 26$  cm.

- 4 A rectangle is 15 cm long and 6 cm wide. What is its **perimeter**, in centimetres?



**Answer: 42**

Perimeter is the distance all the way round:  $15 + 6 + 15 + 6 = 42$  cm. Or use  $2 \times (15 + 6) = 42$  cm.

- 5 A rectangle is 11 cm long and 3 cm wide. What is its **perimeter**, in centimetres?



**Answer: 28**

Perimeter is the distance all the way round:  $11 + 3 + 11 + 3 = 28$  cm. Or use  $2 \times (11 + 3) = 28$  cm.

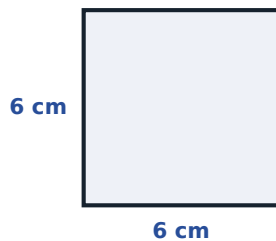
- 6 A rectangle is 20 cm long and 8 cm wide. What is its **perimeter**, in centimetres?



**Answer: 56**

Perimeter is the distance all the way round:  $20 + 8 + 20 + 8 = 56$  cm. Or use  $2 \times (20 + 8) = 56$  cm.

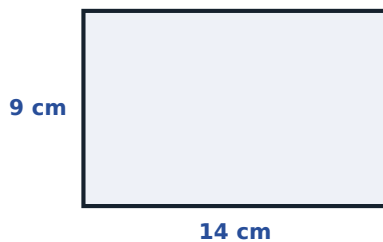
- 7 A rectangle is 6 cm long and 6 cm wide. What is its **perimeter**, in centimetres?



**Answer: 24**

Perimeter is the distance all the way round:  $6 + 6 + 6 + 6 = 24$  cm. Or use  $2 \times (6 + 6) = 24$  cm.

- 8 A rectangle is 14 cm long and 9 cm wide. What is its **perimeter**, in centimetres?



**Answer: 46**

Perimeter is the distance all the way round:  $14 + 9 + 14 + 9 = 46$  cm. Or use  $2 \times (14 + 9) = 46$  cm.

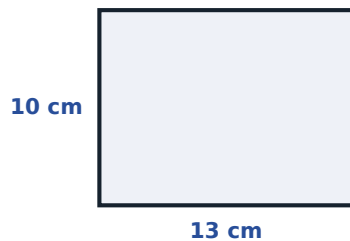
- 9 A rectangle is 25 cm long and 4 cm wide. What is its **perimeter**, in centimetres?



**Answer: 58**

Perimeter is the distance all the way round:  $25 + 4 + 25 + 4 = 58$  cm. Or use  $2 \times (25 + 4) = 58$  cm.

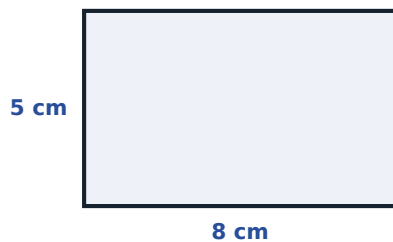
- 10 A rectangle is 13 cm long and 10 cm wide. What is its **perimeter**, in centimetres?



**Answer: 46**

Perimeter is the distance all the way round:  $13 + 10 + 13 + 10 = 46$  cm. Or use  $2 \times (13 + 10) = 46$  cm.

- 11 A rectangle is 8 cm long and 5 cm wide. What is its **area**, in square centimetres?



**Answer: 40**

Area of a rectangle is length  $\times$  width:  $8 \times 5 = 40$  cm<sup>2</sup>.

- 12** A rectangle is 12 cm long and 7 cm wide. What is its **area**, in square centimetres?



**Answer: 84**

Area of a rectangle is length  $\times$  width:  $12 \times 7 = 84 \text{ cm}^2$ .

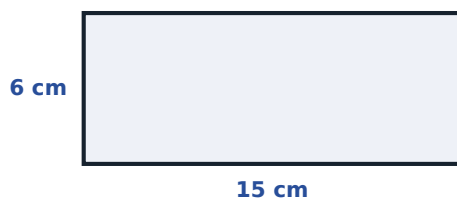
- 13** A rectangle is 9 cm long and 4 cm wide. What is its **area**, in square centimetres?



**Answer: 36**

Area of a rectangle is length  $\times$  width:  $9 \times 4 = 36 \text{ cm}^2$ .

- 14** A rectangle is 15 cm long and 6 cm wide. What is its **area**, in square centimetres?



**Answer: 90**

Area of a rectangle is length  $\times$  width:  $15 \times 6 = 90 \text{ cm}^2$ .

- 15** A rectangle is 11 cm long and 3 cm wide. What is its **area**, in square centimetres?



**Answer: 33**

Area of a rectangle is length  $\times$  width:  $11 \times 3 = 33 \text{ cm}^2$ .

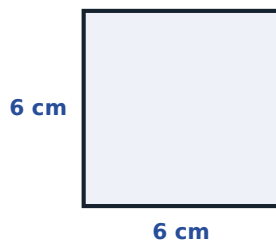
- 16** A rectangle is 20 cm long and 8 cm wide. What is its **area**, in square centimetres?



**Answer: 160**

Area of a rectangle is length  $\times$  width:  $20 \times 8 = 160 \text{ cm}^2$ .

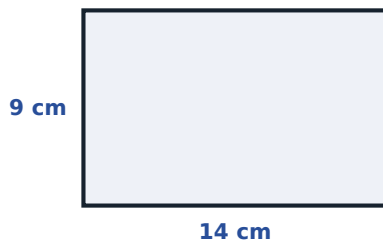
- 17** A rectangle is 6 cm long and 6 cm wide. What is its **area**, in square centimetres?



**Answer: 36**

Area of a rectangle is length  $\times$  width:  $6 \times 6 = 36 \text{ cm}^2$ .

- 18** A rectangle is 14 cm long and 9 cm wide. What is its **area**, in square centimetres?



**Answer: 126**

Area of a rectangle is length  $\times$  width:  $14 \times 9 = 126 \text{ cm}^2$ .

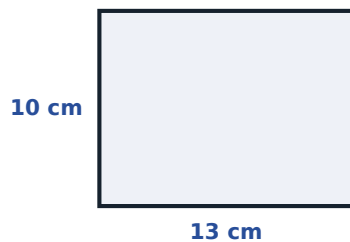
- 19** A rectangle is 25 cm long and 4 cm wide. What is its **area**, in square centimetres?



**Answer: 100**

Area of a rectangle is length  $\times$  width:  $25 \times 4 = 100 \text{ cm}^2$ .

- 20** A rectangle is 13 cm long and 10 cm wide. What is its **area**, in square centimetres?



**Answer: 130**

Area of a rectangle is length  $\times$  width:  $13 \times 10 = 130 \text{ cm}^2$ .

- 21** A square has sides of 3 cm. What is its perimeter, in centimetres?

**Answer: 12**

All four sides are equal:  $4 \times 3 = 12 \text{ cm}$ .

- 22** A square has sides of 5 cm. What is its perimeter, in centimetres?

**Answer: 20**

All four sides are equal:  $4 \times 5 = 20 \text{ cm}$ .

- 23** A square has sides of 7 cm. What is its perimeter, in centimetres?

**Answer: 28**

All four sides are equal:  $4 \times 7 = 28$  cm.

- 24** A square has sides of 9 cm. What is its perimeter, in centimetres?

**Answer: 36**

All four sides are equal:  $4 \times 9 = 36$  cm.

- 25** A square has sides of 12 cm. What is its perimeter, in centimetres?

**Answer: 48**

All four sides are equal:  $4 \times 12 = 48$  cm.

- 26** A square has sides of 6 cm. What is its perimeter, in centimetres?

**Answer: 24**

All four sides are equal:  $4 \times 6 = 24$  cm.

- 27** A square has sides of 11 cm. What is its perimeter, in centimetres?

**Answer: 44**

All four sides are equal:  $4 \times 11 = 44$  cm.

- 28** A square has sides of 8 cm. What is its perimeter, in centimetres?

**Answer: 32**

All four sides are equal:  $4 \times 8 = 32$  cm.

- 29** A square has sides of 3 cm. What is its area, in square centimetres?

**Answer: 9**

$3 \times 3 = 9$  cm<sup>2</sup>.

- 30** A square has sides of 5 cm. What is its area, in square centimetres?

**Answer: 25**

$5 \times 5 = 25$  cm<sup>2</sup>.

- 31** A square has sides of 7 cm. What is its area, in square centimetres?

**Answer: 49**

$7 \times 7 = 49$  cm<sup>2</sup>.

- 32** A square has sides of 9 cm. What is its area, in square centimetres?

**Answer: 81**

$9 \times 9 = 81$  cm<sup>2</sup>.

- 33** A square has sides of 12 cm. What is its area, in square centimetres?

**Answer: 144**

$12 \times 12 = 144$  cm<sup>2</sup>.

- 34** A square has sides of 6 cm. What is its area, in square centimetres?

**Answer: 36**

$6 \times 6 = 36$  cm<sup>2</sup>.

- 35** A square has sides of 11 cm. What is its area, in square centimetres?

**Answer: 121**

$11 \times 11 = 121$  cm<sup>2</sup>.

- 36** A square has sides of 8 cm. What is its area, in square centimetres?

**Answer: 64**

$8 \times 8 = 64 \text{ cm}^2$ .

- 37** A rectangle has area  $48 \text{ cm}^2$  and length 8 cm. What is its width, in centimetres?

**Answer: 6**

Area = length  $\times$  width, so width = area  $\div$  length:  $48 \div 8 = 6 \text{ cm}$ .

- 38** A rectangle has area  $72 \text{ cm}^2$  and length 9 cm. What is its width, in centimetres?

**Answer: 8**

Area = length  $\times$  width, so width = area  $\div$  length:  $72 \div 9 = 8 \text{ cm}$ .

- 39** A rectangle has area  $90 \text{ cm}^2$  and length 15 cm. What is its width, in centimetres?

**Answer: 6**

Area = length  $\times$  width, so width = area  $\div$  length:  $90 \div 15 = 6 \text{ cm}$ .

- 40** A rectangle has area  $56 \text{ cm}^2$  and length 8 cm. What is its width, in centimetres?

**Answer: 7**

Area = length  $\times$  width, so width = area  $\div$  length:  $56 \div 8 = 7 \text{ cm}$ .

- 41** A rectangle has area  $120 \text{ cm}^2$  and length 12 cm. What is its width, in centimetres?

**Answer: 10**

Area = length  $\times$  width, so width = area  $\div$  length:  $120 \div 12 = 10 \text{ cm}$ .

- 42** A rectangle has area  $84 \text{ cm}^2$  and length 12 cm. What is its width, in centimetres?

**Answer: 7**

Area = length  $\times$  width, so width = area  $\div$  length:  $84 \div 12 = 7 \text{ cm}$ .

### **B · Reasoning — What the units mean, and what congruent really says.**

- 43** What is the difference between perimeter and area?

- ☐ There is none
- ☐ Perimeter is the distance round the edge; area is the space inside
- ☐ Area is the distance round the edge
- ☐ Perimeter is always bigger

**Answer: Perimeter is the distance round the edge; area is the space inside**

Perimeter is a length, measured in cm. Area is measured in  $\text{cm}^2$ , because it is a length multiplied by a length.

- 44** Why is area measured in square centimetres?

- ☐ Because shapes are square
- ☐ Because it counts how many 1 cm by 1 cm squares fit inside
- ☐ Because of the formula
- ☐ It is just a name

**Answer: Because it counts how many 1 cm by 1 cm squares fit inside**

That is literally what the unit means, and it is why the formula is a multiplication.

**45** Two rectangles both have area  $24 \text{ cm}^2$ . Must they be the same shape?

- ☐ Yes
- ☐ No — 6 by 4 and 12 by 2 both give 24
- ☐ Only if they are squares
- ☐ There is not enough information

**Answer: No — 6 by 4 and 12 by 2 both give 24**

Equal areas do not force equal shapes. Their perimeters differ: 20 cm and 28 cm.

**46** Two shapes are **congruent**. That means ...

- ☐ they have the same area
- ☐ corresponding sides and angles are equal
- ☐ they are both rectangles
- ☐ one is bigger than the other

**Answer: corresponding sides and angles are equal**

Same shape and same size. Equal areas alone are not enough.

**47** If two rectangles are congruent, do they have the same perimeter?

- ☐ Yes
- ☐ No

**Answer: Yes**

Every corresponding side is equal, so the sums are equal too.

**48** If two rectangles have the same perimeter, must they be congruent?

- ☐ Yes
- ☐ No

**Answer: No**

6 by 4 and 7 by 3 both have perimeter 20 cm, but their areas are  $24 \text{ cm}^2$  and  $21 \text{ cm}^2$ .

**49** What does a square have that a rectangle in general does **not**?

- ☐ four right angles
- ☐ all four sides equal
- ☐ two pairs of parallel sides
- ☐ opposite sides equal

**Answer: all four sides equal**

The other three are true of *every* rectangle, so none of them is the extra property. Equal sides is what makes it a square.

**50** The perimeter of a rectangle is  $2(l + w)$ . Why not  $2l + w$ ?

- ☐ It is a typo
- ☐ There are two lengths and two widths
- ☐ Because  $l$  is bigger
- ☐  $2l + w$  also works

**Answer: There are two lengths and two widths**

Opposite sides of a rectangle are equal, so each measurement is used twice.

**51** A rectangle has area  $36 \text{ cm}^2$ . Which pair of sides is impossible?

- ☐ 6 and 6
- ☐ 9 and 4
- ☐ 12 and 3
- ☐ 8 and 5

**Answer: 8 and 5**

$8 \times 5 = 40$ , not 36. The other three all multiply to 36.

- 52 Does doubling both sides of a rectangle double its area?

☐ Yes  
☐ No

**Answer: No**

It multiplies the area by 4, because both of the two lengths in the product have doubled. Unit 14.6 met the same idea.

### C · Challenge — Working backwards, and counting the possibilities.

- 53 A rectangle has perimeter 30 cm and length 9 cm. What is its width, in centimetres?

**Answer: 6**

Two lengths use  $2 \times 9 = 18$  cm, leaving  $30 - 18 = 12$  cm for the two widths, so the width is  $12 \div 2 = 6$  cm.

- 54 A rectangle has perimeter 44 cm and width 8 cm. What is its area, in square centimetres?

**Answer: 112**

Two widths use  $2 \times 8 = 16$  cm, leaving  $44 - 16 = 28$  cm, so the length is  $28 \div 2 = 14$  cm. The area is  $14 \times 8 = 112$  cm<sup>2</sup>.

- 55 A square has area 49 cm<sup>2</sup>. What is its perimeter, in centimetres?

**Answer: 28**

The side is the square root of 49, which is 7 cm, so the perimeter is  $4 \times 7 = 28$  cm.

- 56 A square has perimeter 36 cm. What is its area, in square centimetres?

**Answer: 81**

The side is  $36 \div 4 = 9$  cm, so the area is  $9 \times 9 = 81$  cm<sup>2</sup>.

- 57 A rectangle 12 cm by 5 cm is cut into two congruent rectangles by one straight cut across the length. What is the area of each piece, in square centimetres?

**Answer: 30**

The whole area is  $12 \times 5 = 60$  cm<sup>2</sup>, and congruent pieces are equal, so each is  $60 \div 2 = 30$  cm<sup>2</sup>.

- 58 How many rectangles with whole-number sides have an area of 24 cm<sup>2</sup>, if 6 by 4 and 4 by 6 count as the same one?

**Answer: 4**

The factor pairs of 24 are  $1 \times 24$ ,  $2 \times 12$ ,  $3 \times 8$  and  $4 \times 6$  — four of them.

- 59 A rectangle has length 3 times its width and a perimeter of 32 cm. What is its area, in square centimetres?

**Answer: 48**

The perimeter is made of 2 widths and 2 lengths, which is  $2 + 6 = 8$  widths. So the width is  $32 \div 8 = 4$  cm, the length is  $3 \times 4 = 12$  cm, and the area is  $12 \times 4 = 48$  cm<sup>2</sup>.

### D · Word problems — Gardens, carpets, pitches and paths.

- 60 A garden is 14 m long and 9 m wide. How many metres of fencing are needed to go all the way round?

**Answer: 46**

$2 \times (14 + 9) = 46$  m.

- 61** A rectangular room is 5 m by 4 m. How many square metres of carpet are needed?

**Answer: 20**

$$5 \times 4 = 20 \text{ m}^2.$$

- 62** A football pitch is 100 m by 64 m. What is its area, in square metres?

**Answer: 6400**

$$100 \times 64 = 6400 \text{ m}^2.$$

- 63** A picture frame is 30 cm by 20 cm. What length of wood, in centimetres, goes round it?

**Answer: 100**

$$2 \times (30 + 20) = 100 \text{ cm}.$$

- 64** A wall is 6 m by 3 m. Paint covers 9 m<sup>2</sup> per tin. How many tins are needed?

**Answer: 2**

$$\text{The wall is } 6 \times 3 = 18 \text{ m}^2, \text{ and } 18 \div 9 = 2 \text{ tins}.$$

- 65** A rectangular field is 80 m long and has an area of 3600 m<sup>2</sup>. How wide is it, in metres?

**Answer: 45**

$$3600 \div 80 = 45 \text{ m}.$$

- 66** Tiles are 20 cm squares. How many are needed to cover a floor 2 m by 3 m?

**Answer: 150**

$$\text{The floor is } 200 \text{ cm by } 300 \text{ cm, so it takes } 200 \div 20 = 10 \text{ tiles along and } 300 \div 20 = 15 \text{ tiles down: } 10 \times 15 = 150 \text{ tiles}.$$

- 67** A path 1 m wide runs round the outside of a square lawn of side 10 m. What is the area of the whole square including the path, in square metres?

**Answer: 144**

$$\text{The outer square has side } 10 + 1 + 1 = 12 \text{ m, so its area is } 12 \times 12 = 144 \text{ m}^2.$$