

Area of Rectangles, Triangles, Parallelograms and Trapezia

Solutions

For Pearson Edexcel GCSE Mathematics (1MA1) • Foundation tier

Each question is shown in grey, followed by the working, one step per line. The final answer is in a box. *Marks* shows how the marks are usually given in the exam, and **Tip** points out a common mistake.

1 (2 marks)

Here is a triangle.

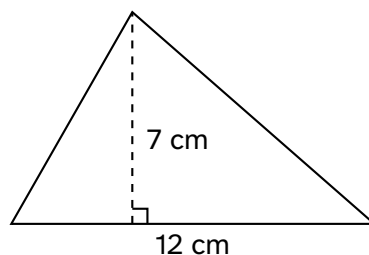


Diagram **NOT** accurately drawn

Work out the area of the triangle.

Area of a triangle = $\frac{1}{2} \times \text{base} \times \text{perpendicular height}$

Base = 12 cm, perpendicular height = 7 cm

$$\frac{1}{2} \times 12 \times 7 = 6 \times 7 = 42 \text{ cm}^2$$

Answer: 42 cm²

Tip: Don't forget the $\frac{1}{2}$. $12 \times 7 = 84$ is the most common wrong answer.

Marks: 1 mark for $\frac{1}{2} \times 12 \times 7$. 1 mark for 42.

2 (2 marks)

Here is a trapezium.

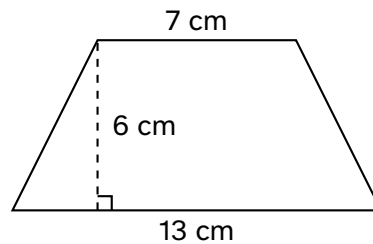


Diagram **NOT** accurately drawn

Work out the area of the trapezium.

$$\text{Area of a trapezium} = \frac{1}{2}(a + b)h$$

The parallel sides are $a = 7$ and $b = 13$.

The perpendicular height is $h = 6$.

$$7 + 13 = 20$$

$$\frac{1}{2} \times 20 \times 6 = 60 \text{ cm}^2$$

Answer: 60 cm²

Tip: Add the two parallel sides **first**, then halve and multiply by the height. Don't multiply all three numbers together.

Marks: 1 mark for $\frac{1}{2}(7 + 13) \times 6$. 1 mark for 60.

3 (2 marks)

A parallelogram has an area of 72 cm²

The base of the parallelogram is 12 cm.

Work out the perpendicular height of the parallelogram.

Area of a parallelogram = base $\times$ perpendicular height

$$12 \times \text{height} = 72$$

$$\text{Height} = 72 \div 12 = 6 \text{ cm}$$

Answer: 6 cm

Marks: 1 mark for $72 \div 12$. 1 mark for 6.

4 (2 marks)

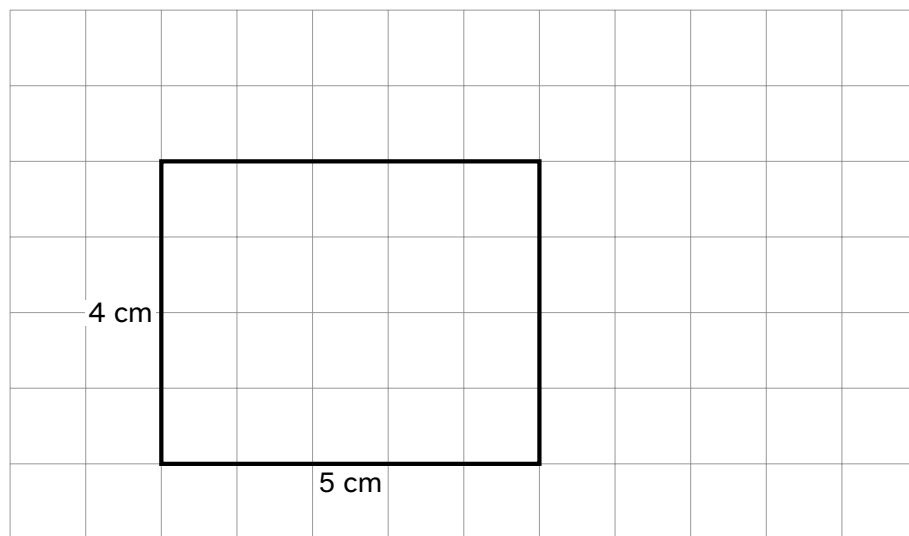
On the centimetre grid, draw a rectangle that has an area of 20 cm^2 and a perimeter of 18 cm.

Look for two numbers that multiply to give 20 (the area): 1×20 , 2×10 , 4×5

The perimeter is $2 \times (\text{length} + \text{width}) = 18$, so $\text{length} + \text{width} = 9$.

Only $4 + 5 = 9$ works.

So draw a rectangle 5 cm long and 4 cm wide.



Answer: A rectangle 5 cm by 4 cm

Tip: Check both conditions: $5 \times 4 = 20$ ✓ and $5 + 4 + 5 + 4 = 18$ ✓. A 2×10 rectangle has the right area but a perimeter of 24 cm.

Marks: 2 marks for a 5 cm by 4 cm rectangle. 1 mark for a rectangle with area 20 cm^2 or perimeter 18 cm.

5 (3 marks)

A rectangle is 9 cm long and 4 cm wide.
A triangle has the same area as the rectangle.
The base of the triangle is 8 cm.
Work out the perpendicular height of the triangle.

Area of the rectangle: $9 \times 4 = 36 \text{ cm}^2$

The triangle also has area 36 cm^2 .

Let the height be h .

$$\frac{1}{2} \times 8 \times h = 36$$

$$4h = 36$$

$$h = 36 \div 4 = 9 \text{ cm}$$

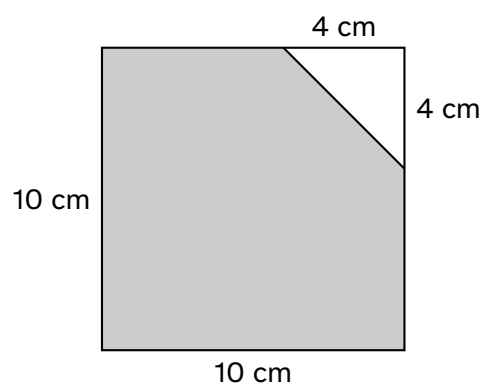
Answer: 9 cm

Tip: Using base $\times$ height without the $\frac{1}{2}$ gives 4.5 cm, which is wrong.

Marks: 1 mark for 36. 1 mark for $4h = 36$. 1 mark for 9.

6 (3 marks)

The diagram shows a square with a corner cut off.



*Diagram **NOT** accurately drawn*

Work out the area of the shaded region.

Area of the whole square: $10 \times 10 = 100 \text{ cm}^2$

The cut-off corner is a right-angled triangle with base 4 cm and height 4 cm.

Area of the triangle: $\frac{1}{2} \times 4 \times 4 = 8 \text{ cm}^2$

Shaded area: $100 - 8 = 92 \text{ cm}^2$

Answer: 92 cm^2

Marks: 1 mark for 100. 1 mark for 8. 1 mark for 92.

7 (3 marks)

The perpendicular height of a triangle is 3 times the length of its base.

The area of the triangle is 54 cm^2

Work out the length of the base of the triangle.

Let the base be b cm. Then the height is $3b$ cm.

$$\text{Area} = \frac{1}{2} \times b \times 3b = \frac{3}{2}b^2$$

$$\frac{3}{2}b^2 = 54$$

$$b^2 = 54 \div 1.5 = 36$$

$$b = \sqrt{36} = 6$$

Check: base 6 cm, height 18 cm, area $\frac{1}{2} \times 6 \times 18 = 54$ ✓

Answer: 6 cm

Tip: You can also try values: base 5 gives $\frac{1}{2} \times 5 \times 15 = 37.5$ (too small), base 6 gives $\frac{1}{2} \times 6 \times 18 = 54$ ✓. Don't forget the $\frac{1}{2}$.

Marks: 1 mark for $\frac{1}{2} \times b \times 3b = 54$ (or a trial such as $\frac{1}{2} \times 5 \times 15$). 1 mark for $b^2 = 36$. 1 mark for 6.

8 (5 marks)

Sam is going to cover a rectangular floor with square tiles.
The floor is 4.2 m long and 3 m wide.
Each tile is 30 cm by 30 cm.
Tiles are sold in boxes of 10
Each box costs £16.50

Work out the total cost of the tiles Sam needs to buy.

Change the floor sizes into cm: $4.2 \text{ m} = 420 \text{ cm}$ and $3 \text{ m} = 300 \text{ cm}$.

Tiles along the length: $420 \div 30 = 14$

Tiles along the width: $300 \div 30 = 10$

Number of tiles: $14 \times 10 = 140$

Number of boxes: $140 \div 10 = 14$

Cost: $14 \times 16.50 = £231$

Answer: £231

Tip: Change everything into the same units first. Dividing 4.2 by 30 will give a silly answer.

Marks: 1 mark for changing units. 1 mark for 14 or 10. 1 mark for 140. 1 mark for 14 boxes. 1 mark for £231.

9 (4 marks)

Here are a trapezium and a rectangle.

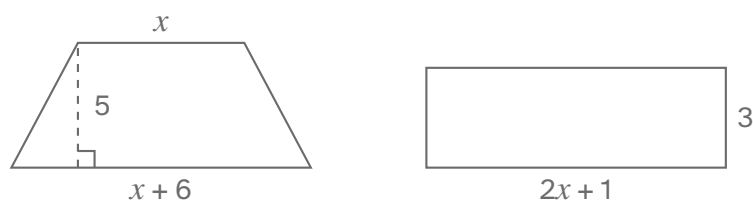


Diagram **NOT** accurately drawn

All measurements are in centimetres.

The trapezium and the rectangle have the same area.

Work out the area of the rectangle.

Area of the trapezium: $\frac{1}{2}(x + x + 6) \times 5 = \frac{1}{2}(2x + 6) \times 5 = 5(x + 3) = 5x + 15$

Area of the rectangle: $3(2x + 1) = 6x + 3$

The areas are equal: $6x + 3 = 5x + 15$

$x = 12$

Area of the rectangle: $6 \times 12 + 3 = 75 \text{ cm}^2$

Check: trapezium $\frac{1}{2}(12 + 18) \times 5 = 75 \text{ cm}^2$ ✓

Answer: 75 cm^2

Tip: The question asks for the **area**, not x . After finding $x = 12$, put it back into $3(2x + 1)$.

Marks: 1 mark for $5x + 15$ (or $\frac{1}{2}(2x + 6) \times 5$). 1 mark for $6x + 3$. 1 mark for $x = 12$. 1 mark for 75.
