**Problem of the Week: Week 3 (Sum1): Year 7: Geometry with sample solutions**

- Derive and apply formulae to calculate and solve problems involving: perimeter and area of triangles, parallelograms, trapezia, volume of cuboids (including cubes) and other prisms (including cylinders)
- Calculate and solve problems involving: perimeters of 2-D shapes (including circles), areas of circles and composite shapes

<u>Perimeter Possibilities</u>

8cm

3cm
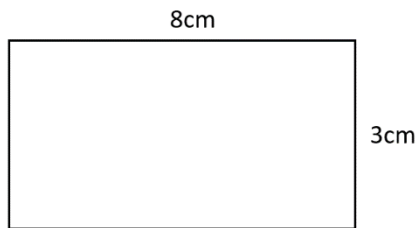
This rectangle has an area of 8 x 3 = 24 cm^2
It has a perimeter of 8 + 8 + 3 + 3 = 22 cm

How many different rectangles can you find with an area of 24 cm^2

For each one, draw the rectangle and work out it's perimeter.

What is the largest and the smallest perimeter ?

<u>Solution</u>

Area: 24 cm^2

Size	Perimeter
4 cm x 6 cm	20 cm
3 cm x 8 cm	22 cm
2 cm x 12 cm	28 cm
1 cm x 24 cm	50 cm

A key idea is that you can use fractions or decimals to get more solutions.

1.5 cm x 16 cm	35 cm
0.5 cm x 48 cm	97 cm
0.25 cm x 96 cm	192.5 cm

There are infinitely many perimeters you can make with an area of 24 as you can keep on multiplying the length by 2 and dividing the width by 2 so the perimeter keeps getting bigger.

To get the smallest possible perimeter it needs to be a square. The square root of 24 is approximately 4.898979486.

√24 cm x √24 cm	4√24 cm
4.898979486 cm x 4.898979486cm	19.59591794 cm

Garden Path

A rectangular lawn is surrounded by a garden path of constant width

The area of the lawn is exactly equal to the area of the path

The length and breadth of the lawn, and the width of the path are all whole numbers

What are the possible measurements?

Idea taken from 'Mathematical Journeys, Departure Points' (ATM)

https://www.atm.org.uk/Shop/KS4/Mathematical-Journeys---Departure-Points-Book/act065

Sample Solution

Dimensions of the lawn : Length = 4m and width = 6 m

Area of lawn = 4 x 6 = 24 m^2

Path width = 1 m gives total outer dimensions of length 6m and width 8m

Total area = 6 x 8 = 48 m^2

Area of path = 48 – 24 = 24 m^2

8m

Total area
6 x 8 = 48 m^2

6m

Lawn area
6 x 4 = 24 m^2

24m^2 4m   6m

Path area
48 – 24= 24m^2

Constant width of path = 1m

(Hint to find other solutions, look for pairs of multiplications where one is double the other)
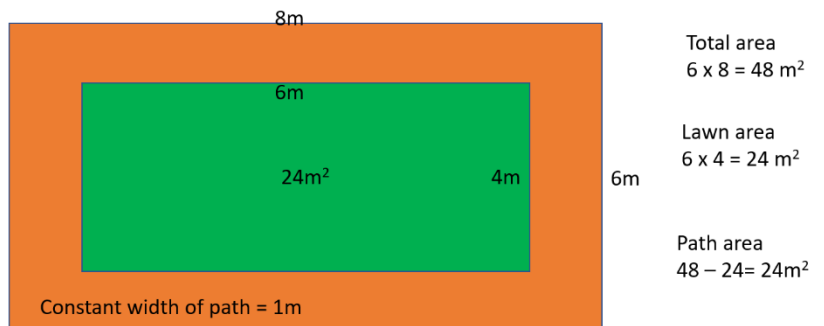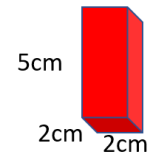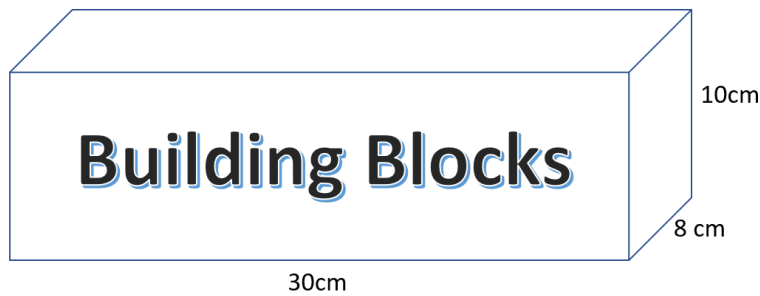
Building Blocks

Red wooden building blocks are to be packed into a cuboid box
The blocks are also cuboids
The blocks measure 5cm x 2cm x 2cm
The box measures 10cm x 30 cm x 8 cm

How many building blocks will fit in the large box?

A different sized green cuboid block is to be packed in the same sized box.
20 green building blocks fit in the packing box
What are the dimensions of the green block ?
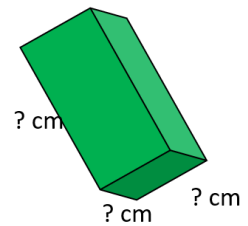
Solution

Red blocks are 5cm long, so will fit 6 along the length of the box

Red blocks are 2cm wide, so will fit 4 along the width of the box

6 x 4 = 24 red blocks per layer

Red blocks are 2cm high, so can fit 5 layers in the box

5 x 24 = 120 red blocks will fit into the box

There are 20 green blocks

If there were 10 block in 2 layers, this would give a height of 5cm per green block

If the blocks are 6 cm long, then 5 would fit into 30cm (6 x 5 = 30)

This would mean that we need two rows on 5 blocks in each layer, so the width must be 4cm

Dimensions of the green blocks are 6cm x 5cm x 4cm