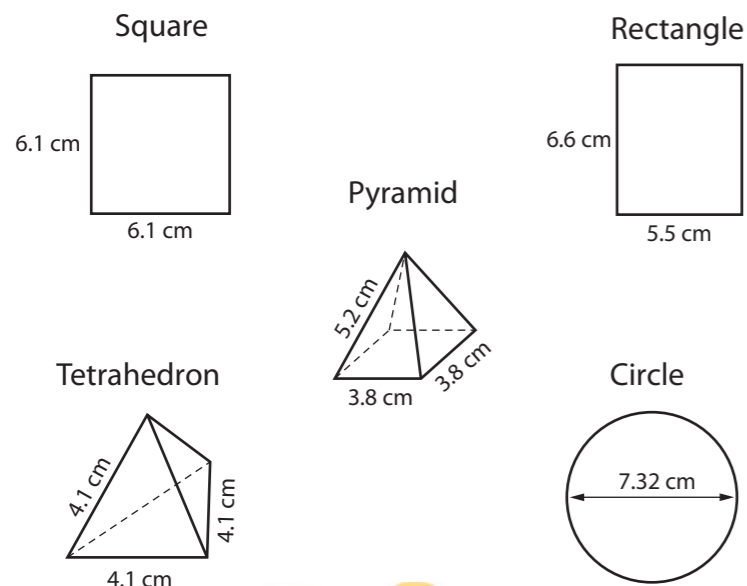# Tea bag design and production

According to the UK Tea Council, 165,000,000 cups of tea are drunk each day in Great Britain. As well as being a refreshing drink, it is believed to have many health benefits.

Tea bags were first introduced to Great Britain in 1953. Originally, they were rectangular or square in shape. Then, in 1992 circular teabags were introduced to match the shape of a mug. More recently, pyramidal and tetrahedral shapes have become popular.

Here are some tea bags and their dimensions.

Square
6.1 cm
6.1 cm

Rectangle
6.6 cm
5.5 cm

Pyramid
5.2 cm
3.8 cm
3.8 cm

Tetrahedron
4.1 cm
4.1 cm
4.1 cm

Circle
7.32 cm

Task 1

The tea bag is made from filter paper and dried tea leaves. It is sealed either with heat or vegetable gum.

1   Tea bags that are 3D, like the pyramid and tetrahedron, are made from nets of their shapes, filled with tea, and then sealed. Sketch the net for the:

   a Pyramid tea bag

   b Tetrahedron tea bag

2   Flat tea bags, like the square, rectangle and circle, are made from tea sandwiched between two large rolls of filter paper, sealed and cut into the tea bag shape.

   Use your nets from question 1 and this information to investigate:

   a Which tea bag shape requires the most seal?

   b Which tea bag shape requires the least seal?

Task 2

A tea bag manufacturer buys two rolls of filter paper, each of width 125 mm and length 20 m.

1   **a** How many of the square tea bags can fit across the width of one roll?

   b How many of the square tea bags can fit along the length of one roll?

   c Use what you know about how tea bags are made, from Task 1, and your answers to **1a** and **1b** to work out how many of the square tea bags can be made from the two rolls of filter paper.

2   **a** How many of the rectangular tea bags can fit across the width of one roll?

   (Think about how you may arrange the rectangles in different ways.)

   b Use what you know about how tea bags are made, as learnt in Task 1, and your answer to **2a** to work out how many of the rectangular tea bags can be made from the two rolls of filter paper.

3   Two circles of diameter 7.32 cm make a tea bag. Two circles of diameter 7.32 cm fit in a square of filter paper, like this:

   Use what you know about how tea bags are made to work out many of the circular tea bags can be made from the two rolls of filter paper.
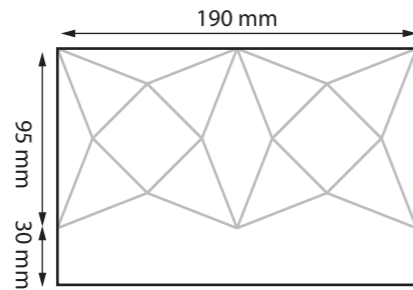
7.32 cm
7.32 cm
125 mm
125 mm
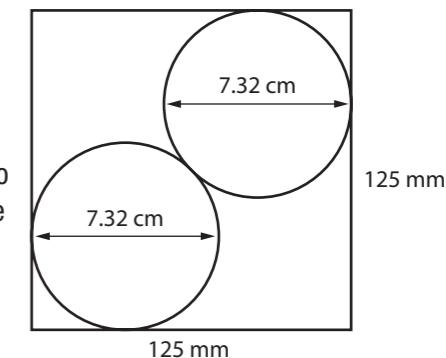
4 Two nets for the tetrahedral tea bag fit on a rectangle of filter paper, like this:

71 mm

125 mm
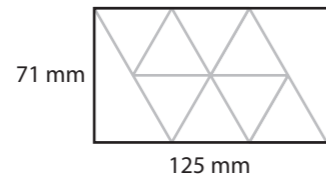
Use what you already know about how tea bags are made to work out how many tetrahedral tea bags can be made from the two rolls of filter paper.

5 Two nets of the pyramidal tea bag fit on a rectangle of filter paper, like this:

190 mm

95 mm

30 mm

How many pyramidal tea bags can be made from the two rolls of filter paper?

Task 3

1 The tea bag manufacturer fills each tea bag with between 2.6 g and 3.3 g of tea leaves. Use your calculations from Task 2 to work out how much tea the factory manager needs for the two rolls of filter paper if:

 a Square tea bags are filled with 3 g of tea

 b Rectangular tea bags are filled with 3.3 g of tea

 c Circular tea bags are filled with 3.2 g of tea

 d Tetrahedral tea bags are filled with 2.6 g of tea

 e Pyramidal tea bags are filled with 2.8 g of tea

Give your answers in kg to 2 decimal places.

2 The tea bag manufacturer pays 0.2 pence per gram of tea leaves. Use your answers to question 1 above to work out how much the tea leaves cost for the two rolls of filter paper if making:

 a Square tea bags

 b Rectangular tea bags

 c Circular tea bags

 d Tetrahedral tea bags

 e Pyramidal tea bags

Give your answers in sterling.

3 50 rolls of filter paper cost £32.50 (including delivery). How much do the 2 rolls cost the tea manufacturer?

Task 4

1 Use your answers to Task 2 and Task 3 to complete these sentences:

 a ____ [number] of square tea bags can be made from two rolls of filter paper for a total cost of _____ (filter paper and tea leaves)

 b ____ [number] of rectangular tea bags can be made from two rolls of filter paper for a total cost of _____ (filter paper and tea leaves)

 c ____ [number] of circular tea bags can be made from two rolls of filter paper for a total cost of _____ (filter paper and tea leaves)

 d ____ [number] of tetrahedral tea bags can be made from two rolls of filter paper for a total cost of _____ (filter paper and tea leaves)

 e ____ [number] of pyramidal tea bags can be made from two rolls of filter paper for a total cost of _____ (filter paper and tea leaves)

2 Use the sentences above to work out how much 1 tea bag of each shape costs to produce.

Task 5 (extension)

Use the internet or visit a supermarket to conduct a survey of the sale price of different shaped tea bags. Imagine you are the Commercial Director of the tea bag manufacturer. Use the information you have collected in your survey and Tasks 1–4 to write a short report for the Board of the company recommending two shapes of tea bag to make. Give reasons for your decisions, and use mathematical calculations to support them.

HOW DID YOU FIND THESE TASKS?

- What did you find easy or difficult about these tasks?
- Did you work on your own, in pairs or in groups, and how did this help or hinder your approach and success with these tasks?
- What did you learn about how maths is used and applied in real-world situations?