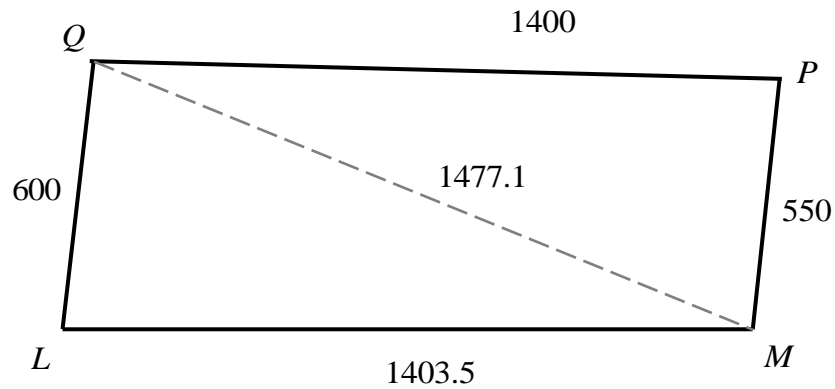


Trigonometry refresher & cosine rule extension questions

1. Granite worktop

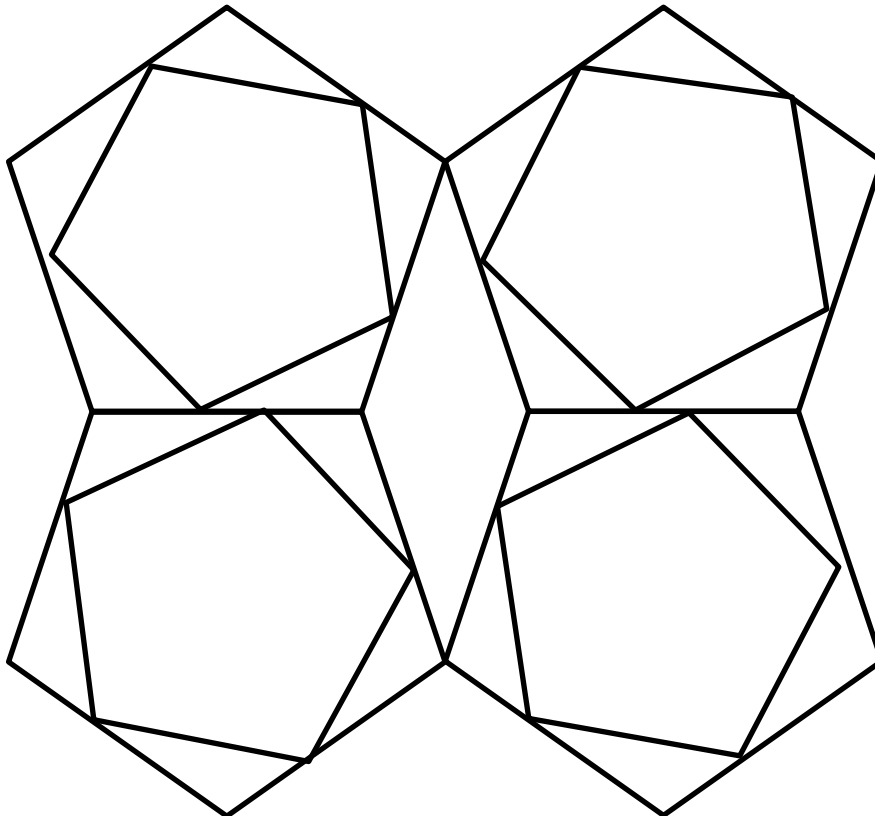
A kitchen fitter is measuring the size of granite worktop he needs for a kitchen. The house is very old and its walls are not perpendicular so he measures the lengths of all four sides plus one diagonal measurement (lengths are millimetres; NOT drawn to scale):



- Calculate all the angles and mark them on the diagram
- What is the length of the diagonal LP ?
- What is the area of the top surface? The worktop is 28 mm thick, the density of granite is 2.75 g/cm^3 and he can carry 70 kg. Will he be able to carry it?
- His supplier has a half-price offcut of length 1420 mm and width 600 mm. Will it be big enough?

2. (Challenge question)

Sebastian the carpet fitter is laying carpet in the new *PentagonLand* store. The carpet is a tessalated array of regular pentagons with each piece a different colour. He has completed most of the floor but has run out of carpet for the last two pieces (a Sugar Pink rhombus and a Honey Mousse triangle) and is asking his friend Phillip at nearby *HexagonLand* if he has any spare off-cuts.



The edges of the large pentagons are 3 m long.

- (a) What are the angles in the central rhombus?
- (b) How long are the diagonals of the rhombus? Use two different methods and check they agree.
- (c) Phillip says he has a spare hexagon in *Sugar Pink* that is 5 m “across flats”. Is this big enough to make the rhombus?

(d) As you can see, the smaller pentagons were accidentally laid down *slightly twisted*. Sebastian needs enough carpet for one triangle; one of the sides is 1.2 m long.

- Sketch the triangle (not to scale), showing the length of both the short sides.
- Calculate the length of the long side (to 4 decimal places).
- Calculate the unknown angles (to 2 decimal places).
- Put all these values on your sketch.

He phones Phillip again. Phillip says he has a spare isosceles triangle in the *Honey Mousse* colour, cut across two corners of another hexagon, and its long side is 3 m.

(e) He consults his friends.

- Wlodek says it will fit “because $1.2\text{m}+1.8\text{m} = 3\text{m}$ ”
- Spomenka says it won't fit, “Phillip's triangle is too shallow, you have a bigger angle!”

Who is right? Do a rough sketch showing how Sebastian's triangle might best be cut out of the isosceles triangle. Is the off-cut big enough? (It may help to sketch the isosceles triangle to scale ($5\text{ cm} = 1\text{ m}$) and cut the other from a piece of card which you can lay over it, but you must do a calculation to get an accurate result.

Explain your logic: what criteria are you using to decide if one triangle fits inside the other?

This is the key to it all! Once you have decided what you need to calculate, the rest is easy. You must explain using a sketch.