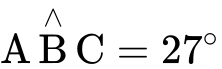
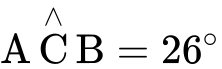
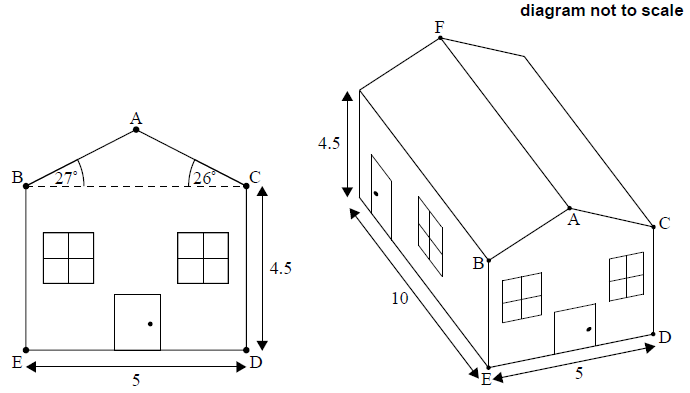
# 1.6 Approximation and estimation\_P\_2

**1a.** *[5 marks]*

Olivia’s house consists of four vertical walls and a sloping roof made from two rectangles. The height, , from the ground to the base of the roof is 4.5 m.

The base angles of the roof are  and .



The house is 10 m long and 5 m wide.

Find the length , giving your answer to **four significant figures**.



**1b.** *[3 marks]*

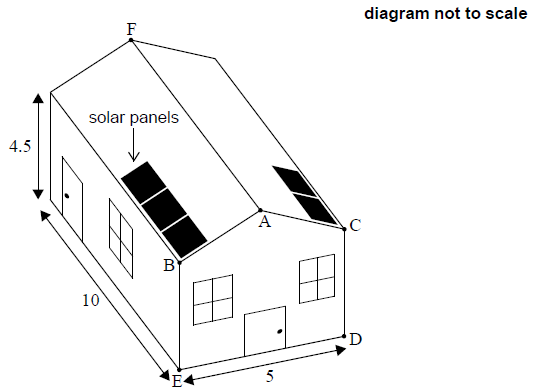
The length  is approximately 2.84 m.

Find the total area of the two rectangles that make up the roof.



**1c.** *[3 marks]*

Olivia decides to put solar panels on the roof. The solar panels are fitted to both sides of the roof.



Each panel is 1.6 m long and 0.95 m wide. All the panels must be arranged in uniform rows, with **the shorter edge** of each panel parallel to  or . Each panel must be at least 0.3 m from the edge of the roof and the top of the roof, .

Find the maximum number of complete panels that can be fitted to the whole roof.



**1d.** *[3 marks]*

Olivia estimates that the solar panels will cover an area of 29 m.

Find the percentage error in her estimate.



**1e.** *[2 marks]*

Olivia investigates arranging the panels, such that **the longer edge** of each panel is parallel to  or .  
  
State whether this new arrangement will allow Olivia to fit more solar panels to the roof. Justify your answer.

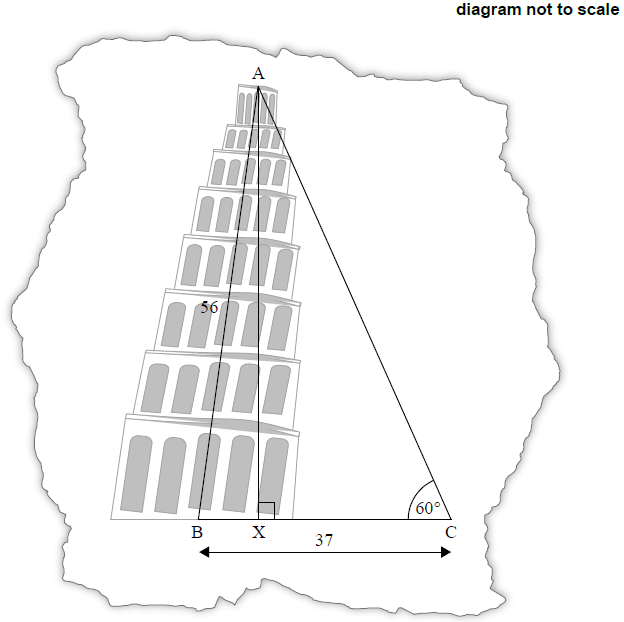


**2a.** *[5 marks]*

The Tower of Pisa is well known worldwide for how it leans.

Giovanni visits the Tower and wants to investigate how much it is leaning. He draws a diagram showing a non-right triangle, ABC.

On Giovanni’s diagram the length of AB is 56 m, the length of BC is 37 m, and angle ACB is 60°. AX is the perpendicular height from A to BC.



Use Giovanni’s diagram to show that angle ABC, the angle at which the Tower is leaning relative to the  
horizontal, is 85° to the nearest degree.



**2b.** *[2 marks]*

Use Giovanni's diagram to calculate the length of AX.



**2c.** *[2 marks]*

Use Giovanni's diagram to find the length of BX, the horizontal displacement of the Tower.



**2d.** *[2 marks]*

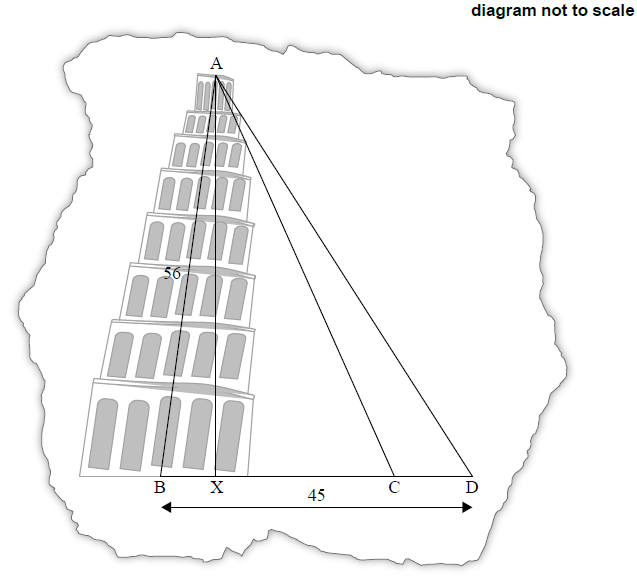
Giovanni’s tourist guidebook says that the actual horizontal displacement of the Tower, BX, is 3.9 metres.

Find the percentage error on Giovanni’s diagram.



**2e.** *[3 marks]*

Giovanni adds a point D to his diagram, such that BD = 45 m, and another triangle is formed.



Find the angle of elevation of A from D.

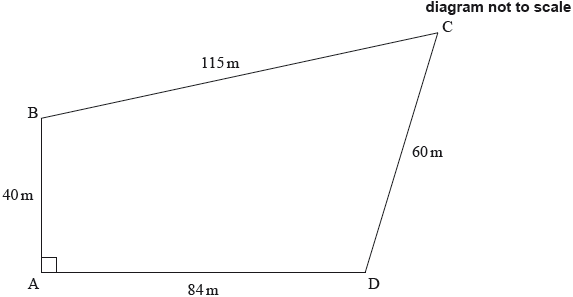


**3a.** *[2 marks]*

Abdallah owns a plot of land, near the river Nile, in the form of a quadrilateral ABCD.

The lengths of the sides are  and angle .

This information is shown on the diagram.



Show that  correct to the nearest metre.



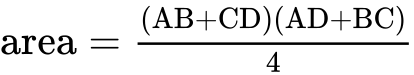
**3b.** *[4 marks]*

Find the area of ABCD.



**3c.** *[2 marks]*

The formula that the ancient Egyptians used to estimate the area of a quadrilateral ABCD is

.

Abdallah uses this formula to estimate the area of his plot of land.

Calculate Abdallah’s estimate for the area.



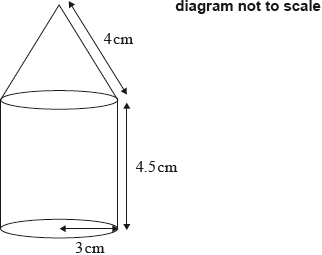
**3d.** *[2 marks]*

Find the percentage error in Abdallah’s estimate.



**4a.** *[6 marks]*

The following diagram shows a perfume bottle made up of a cylinder and a cone.



The radius of both the cylinder and the base of the cone is 3 cm.

The height of the cylinder is 4.5 cm.

The slant height of the cone is 4 cm.

(i)     Show that the vertical height of the cone is  cm correct to three significant figures.

(ii)     Calculate the volume of the perfume bottle.



**4b.** *[2 marks]*

The bottle contains  of perfume. The bottle is **not** full and all of the perfume is in the cylinder part.

Find the height of the perfume in the bottle.



**4c.** *[4 marks]*

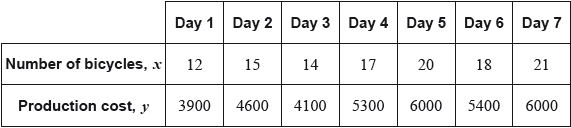
Temi makes some crafts with perfume bottles, like the one above, once they are empty. Temi wants to know the surface area of one perfume bottle.

Find the **total** surface area of the perfume bottle.



**5.** *[3 marks]*

The following table shows the number of bicycles, , produced daily by a factory and their total production cost, , in US dollars (USD). The table shows data recorded over seven days.



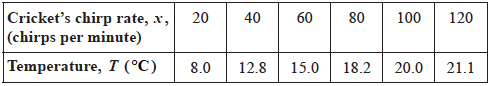
Estimate the total cost, **to the nearest USD**, of producing  bicycles on a particular day.



**6a.** *[4 marks]*

A biologist is studying the relationship between the number of chirps of the Snowy Tree cricket and the air temperature. He records the chirp rate, , of a cricket, and the corresponding air temperature, , in degrees Celsius.

The following table gives the recorded values.



Draw the scatter diagram for the above data. Use a scale of 2 cm for 20 chirps on the horizontal axis and 2 cm for 4**°**C on the vertical axis.



**6b.** *[2 marks]*

Calculate the air temperature when the cricket’s chirp rate is .



**7a.** *[4 marks]*

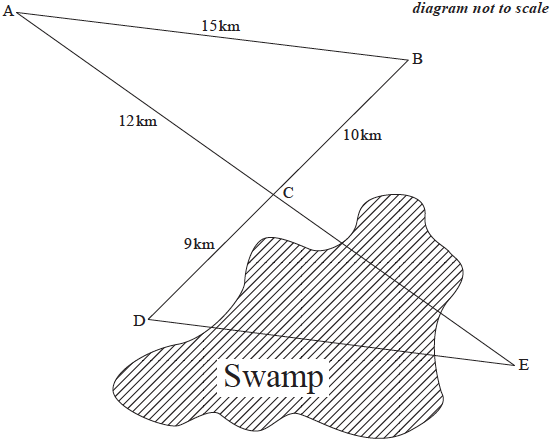
A surveyor has to calculate the area of a triangular piece of land, DCE.

The lengths of CE and DE cannot be directly measured because they go through a swamp.

AB, DE, BD and AE are straight paths. Paths AE and DB intersect at point C.

The length of AB is 15 km, BC is 10 km, AC is 12 km, and DC is 9 km.

The following diagram shows the surveyor’s information.



(i)     Find the size of angle .

(ii)     Show that the size of angle  is , correct to one decimal place.



**7b.** *[5 marks]*

The surveyor measures the size of angle  to be twice that of angle .

(i)     Using angle , find the size of angle .

(ii)     Find the length of .



**7c.** *[4 marks]*

Calculate the area of triangle .



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