Surname	Centre Number	Candidate Number
First name(s)		0

GCSE

3310U60-1

A21-3310U60-1

THURSDAY, 4 NOVEMBER 2021 – MORNING

MATHEMATICS – NUMERACY
UNIT 2: CALCULATOR-ALLOWED
HIGHER TIER

1 hour 35 minutes

ADDITIONAL MATERIALS

A calculator will be required for this paper.

A ruler, a protractor and a pair of compasses may be required.

INSTRUCTIONS TO CANDIDATES

Use black ink or black ball-point pen. Do not use gel pen or correction fluid.

You may use a pencil for graphs and diagrams only.

Write your name, centre number and candidate number in the spaces at the top of this page.

Answer **all** the questions in the spaces provided.

If you run out of space, use the additional page at the back of the booklet. Question numbers must be given for the work written on the additional page.

Take π as 3·14 or use the π button on your calculator.

INFORMATION FOR CANDIDATES

You should give details of your method of solution when appropriate.

Unless stated, diagrams are not drawn to scale.

Scale drawing solutions will not be acceptable where you are asked to calculate.

The number of marks is given in brackets at the end of each question or part-question.

In question **4**, the assessment will take into account the quality of your linguistic and mathematical organisation, communication and accuracy in writing.

For Examiner's use only		
Question	**Maximum Mark**	**Mark Awarded**
1.	**3**	
2.	**7**	
3.	**8**	
4.	**7**	
5.	**10**	
6.	**13**	
7.	**11**	
8.	**4**	
9.	**7**	
Total	**70**	

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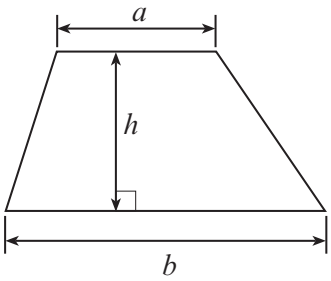
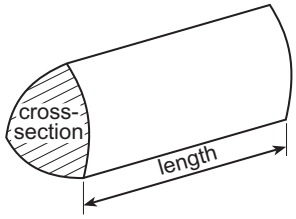
Formula List – Higher Tier

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

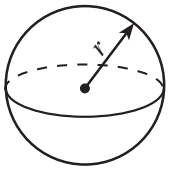


Volume of prism = area of cross-section × length



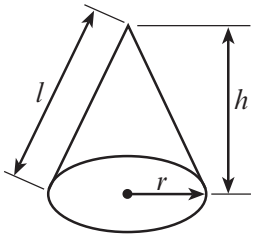
Volume of sphere $= \frac{4}{3}\pi r^3$

Surface area of sphere $= 4\pi r^2$



Volume of cone $= \frac{1}{3}\pi r^2 h$

Curved surface area of cone $= \pi r l$

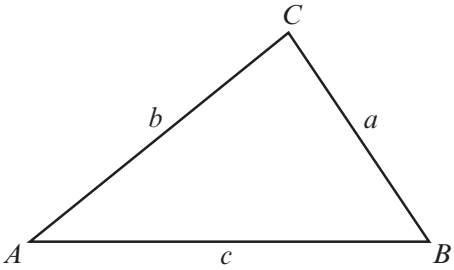


In any triangle ABC

Sine rule $\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$

Cosine rule $a^2 = b^2 + c^2 - 2bc \cos A$

Area of triangle $= \frac{1}{2}ab \sin C$



The Quadratic Equation

The solutions of $ax^2 + bx + c = 0$ where $a \neq 0$ are given by $x = \frac{-b \pm \sqrt{(b^2 - 4ac)}}{2a}$

Annual Equivalent Rate (AER)

AER, as a decimal, is calculated using the formula $\left(1 + \frac{i}{n}\right)^n - 1$, where i is the nominal interest rate per annum as a decimal and n is the number of compounding periods per annum.

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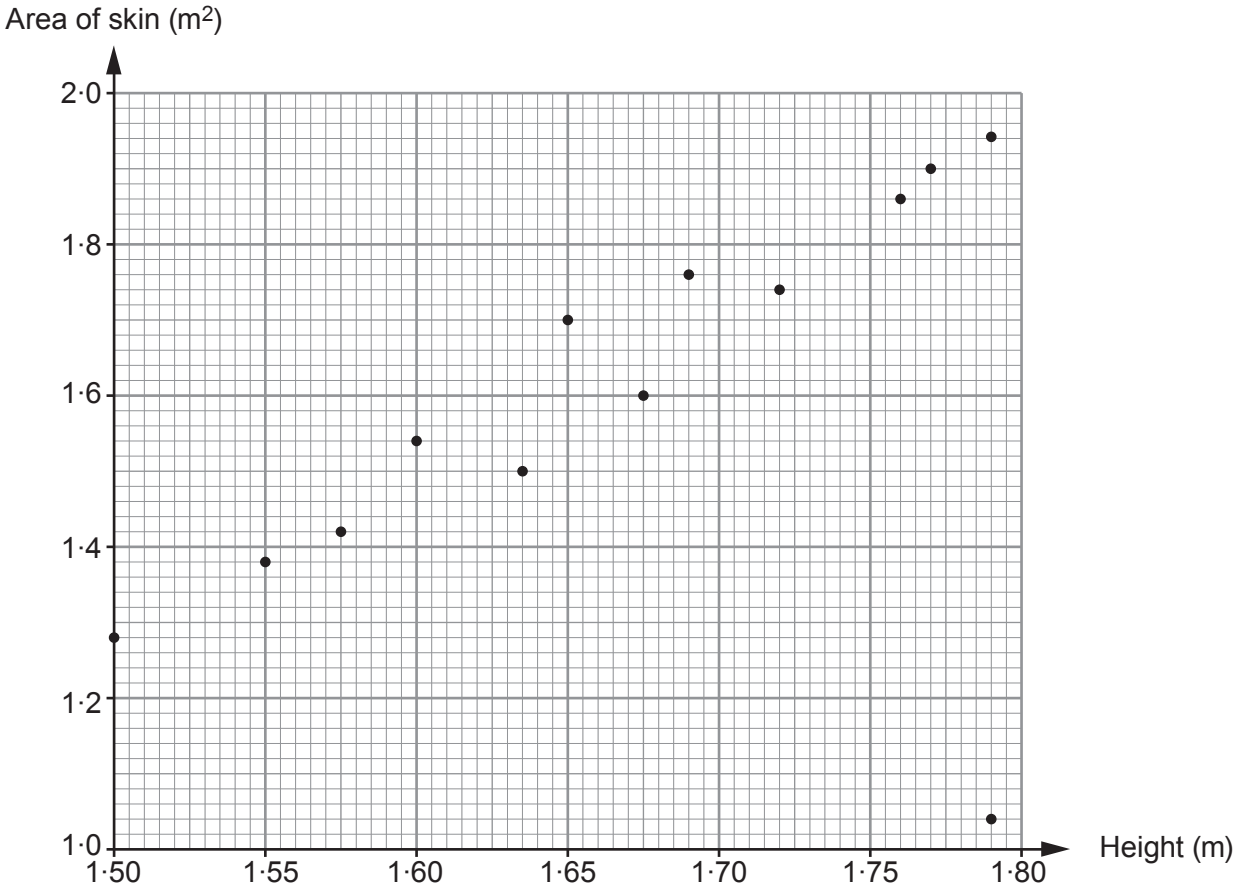
1. In a science lesson, 13 students calculated an estimate of the area of their skin.
The results are shown on the scatter diagram below.



Bryn is 1·50 m tall.
Abigail is 18% taller than Bryn.
Find Abigail's calculated estimate of the area of her skin. [3]

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Abigail's estimate of the area of her skin is ..... m^2

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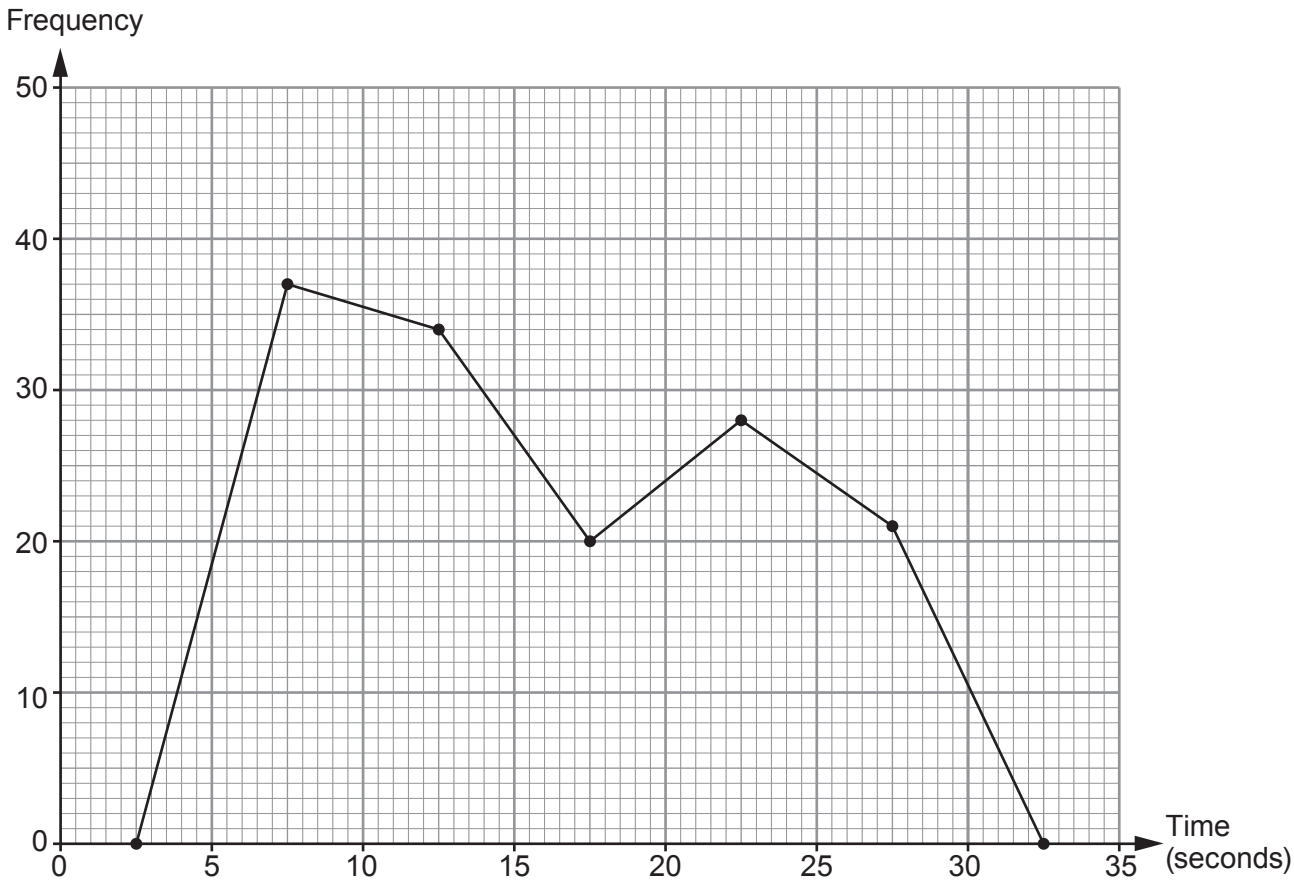
2. On Monday, Mrs Griffin recorded the time each of her students took to start a task.
She records her data in groups of equal width.
Mrs Griffin displays the results in a frequency polygon, as shown below.



(a) On Monday, how many students started the task? [2]

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(b) In which group is the median time taken to start the task? [2]

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(c) Mrs Griffin had set a target that students should start the task within 30 seconds.
Was the target met?
You must give a reason for your answer. [1]

Yes ☐ No ☐ Can't tell ☐

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(d) On Tuesday, the same students started the same task again.
25% of them started the task within 10 seconds.

Is this an improvement on the number of students who started the task within 10 seconds on Monday?
You must show all your working. [2]

Yes ☐ No ☐

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3.

Terra Rose currency exchange	
Buying currency	**Notes available**
£1 buys $1.36 (US dollars)	$5, $10, $20, $50, $100

Nerys is going on holiday to the USA for 13 days and then to Italy for 7 days.
She has saved a total of £500 to buy US dollars ($) and euros (€).

Nerys takes $\frac{13}{20}$ of her savings to buy US dollars from *Terra Rose* currency exchange.

She wants to buy as many dollars as possible.

Nerys plans to use all her remaining money to buy euros.

How many dollars will Nerys buy?
How much money, correct to the nearest penny, will she have left to buy euros?
You must show all your working. [8]

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Nerys will buy $ .....

She will have £ ..... left to buy euros.

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4. *In this question, you will be assessed on the quality of your organisation, communication and accuracy in writing.*

Elwyn makes 10 full jugs of fresh lemonade.
Each jug is cylindrical with internal measurements as follows:

- height 28 cm,
- base radius 5 cm.

Diagram not drawn to scale

Elwyn's drinking glasses each hold a serving of 170 cm^3 of lemonade.

He serves 80 people lemonade.

How many **full** jugs of lemonade does Elwyn have left over?
You must show all your working. [5 + 2 OCW]

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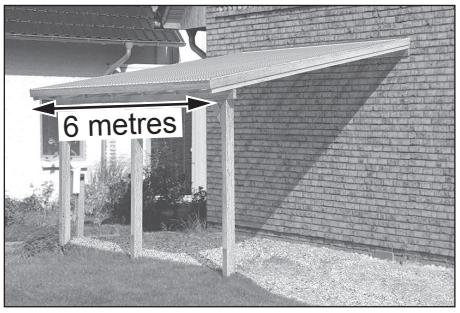
5. Mr Read is building a shelter against his house.

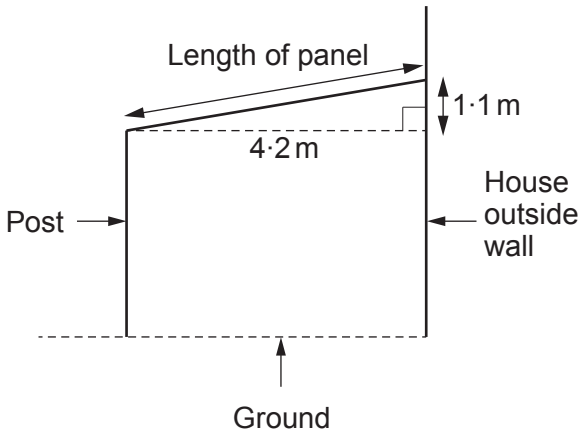


(a) The length of the shelter is 6 m.

He has drawn a sketch of the side view of the shelter, as shown below.

Mr Read has started to place some panels on his roof.
When fitted to the roof, each panel needs to slightly overlap the next panel.
The plan view of placing the first 3 panels is also shown below.

Side view



Incomplete plan view showing first 3 panels

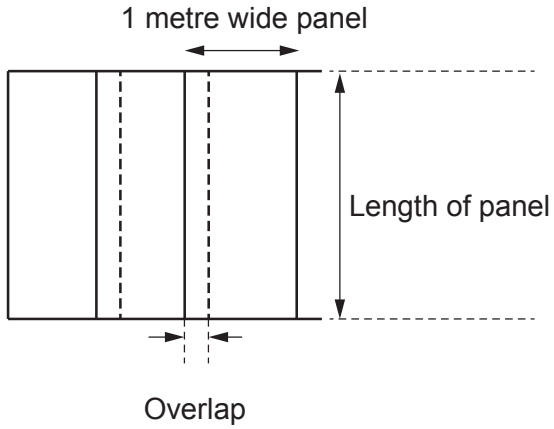


Diagram not drawn to scale

The shelter roof panels are 1 metre wide and can be bought in different lengths.

Length of panel	4·1 m	4·2 m	4·3 m	4·4 m	4·5 m	4·6 m
Cost per panel	£21	£22	£23	£24	£25	£26

Mr Read bought the cheapest suitable panels to build his shelter roof.
Calculate the cost of all of the panels Mr Read bought.
You **must** show all your working. [6]

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(b)

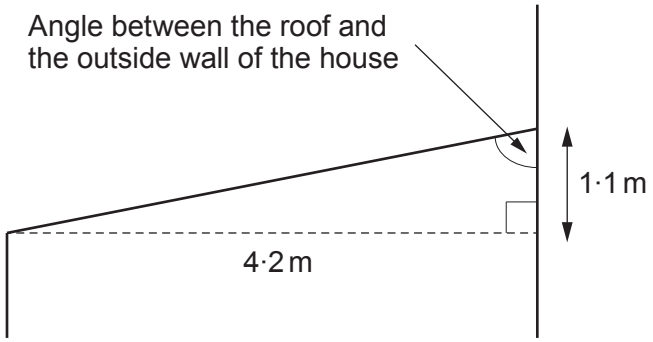

Diagram not drawn to scale

Calculate the size of the angle between the shelter roof and the outside wall of the house.
Give your answer correct to 3 significant figures. [4]

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6. Hannah is opening her own gym.
She has designed a logo that will be on her own brand of sports clothing.
She will sell the sports clothing in the gym.

(a) The design of the symmetrical logo is shown below.
It consists of:
- two sectors of circles, both of radius 1·5 cm,
- a straight line of length 4 cm connecting the centres of the two sectors,
- a parallel straight line of length 4 cm connecting the lower vertices of the sectors.

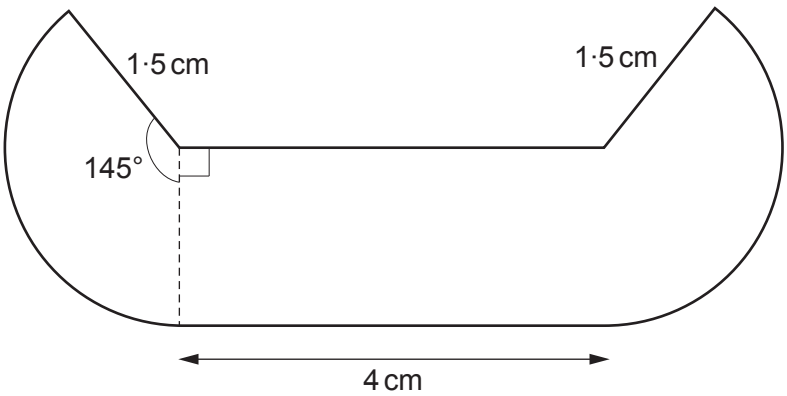

Diagram not drawn to scale

The logo will be stitched onto all the sports clothing.
Calculate the perimeter of the logo. [4]

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(b) (i) Calculate the area of the logo shown in part *(a)*. [3]

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(ii) An enlarged version of the logo will be painted on the front wall of the gym.
All the lengths on this logo will be 200 times as long as the lengths in her original design.

Use your answer to (i) to calculate the area of the logo painted on the front wall of the gym.
Give your answer in m^2. [3]

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(c) For the opening week, Hannah reduces the prices of her clothing range by 20%.
On the last day of the opening week, she reduces prices by a further 10%.

Opening week offer: 20% off all clothing

Last day promotion: all prices reduced by a further 10%

On the last day of the opening week, Hannah has a sports top priced at £9.72.
Calculate the original price of the sports top before the two reductions in price. [3]

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7. From its base on the Isle of Anglesey, an aircraft has to collect emergency hospital equipment from Birmingham to deliver to Cardiff.

Details of the journey are shown in the diagram below.

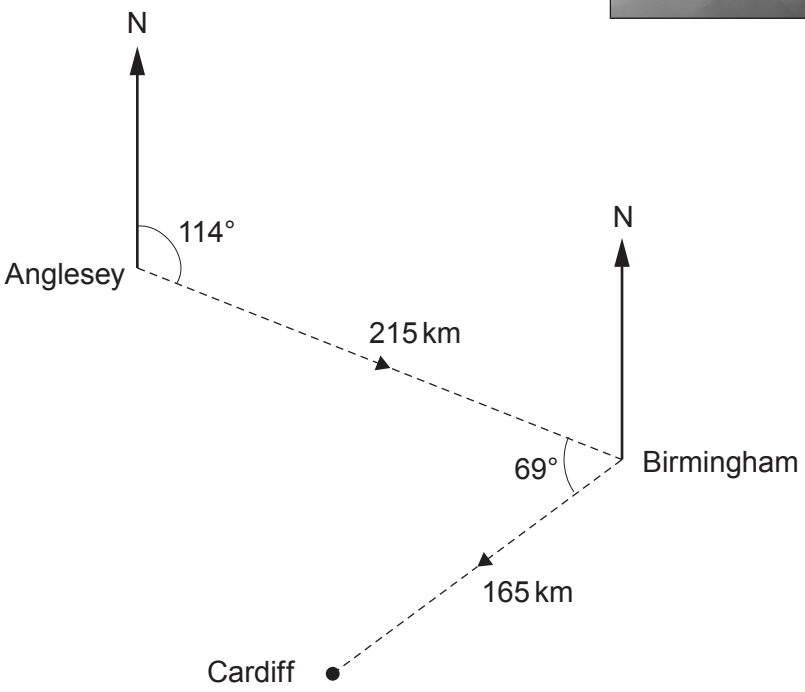

Diagram not drawn to scale

(a) On what bearing did the aircraft fly from Birmingham to Cardiff?
Circle your answer. [1]

069º 135º 225º 235º 291º

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(b) From Cardiff, the aircraft flies directly back to its base on Anglesey.

(i) The flight from Cardiff to Anglesey takes 30 minutes.
Calculate the average speed of the aircraft from Cardiff to Anglesey.
Give your answer in km/h. [5]

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(ii) Calculate the bearing of the return journey from Cardiff to Anglesey. [5]

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8. Melissa wants to buy a new car. The car she'd like to buy is priced at £17 000.
Melissa needs to take out a loan to buy the car.

Melissa is considering taking out a loan of £17 000 from her bank.
The bank will charge her interest on the loan, at a rate of 0·25% per month.

Melissa wants to calculate the monthly payments required to pay off the loan.
The formula she will use is:

$$\textit{Monthly payment} = \frac{r \times L}{1-(1+r)^{-n}}$$

where,
r is the monthly interest rate written as a decimal,
L is the loan amount, and
n is the number of **months** required to pay off the loan.

Calculate the difference in the monthly payments if the loan is taken out over 4 years rather than 5 years. [4]

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TURN OVER.

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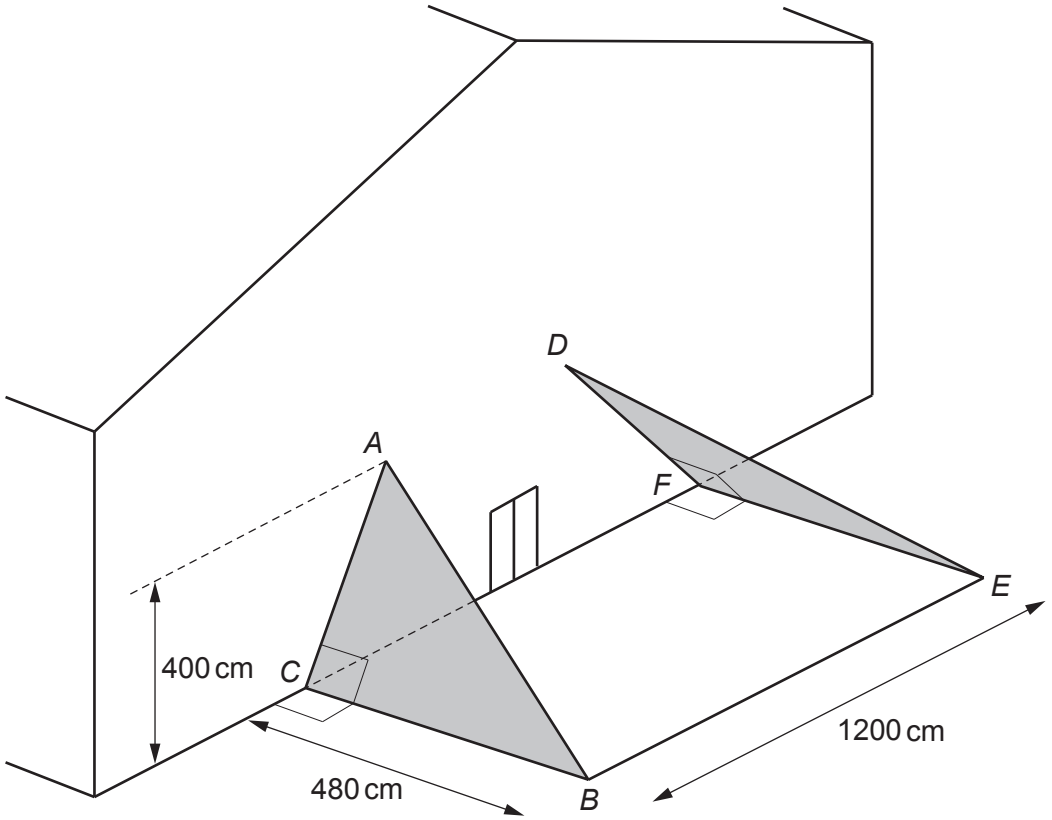
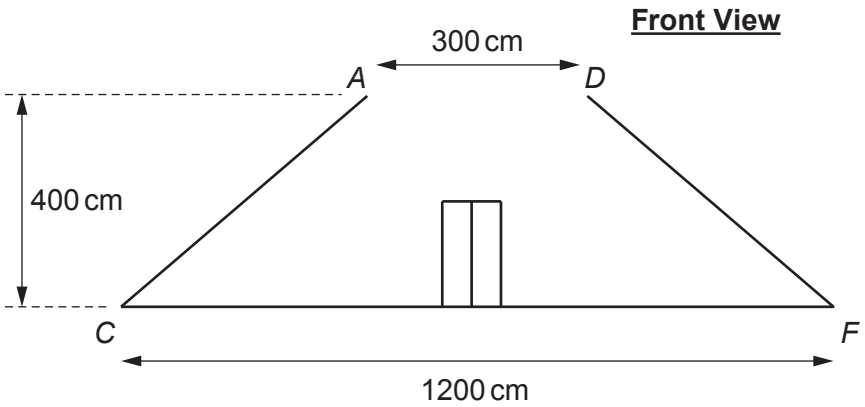
9. The entrance to a new hotel is to have two equal-sized sloping glass panels, symmetrically placed on either side of the main doors.

The glass panels, *ABC* and *DEF*, will be in the shape of right-angled triangles.

The diagrams below show some of the dimensions.





Diagrams not drawn to scale

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(a) Calculate the length of *AB*. [5]

(b) Metal edging strips are needed along the edges *AB* and *DE*.
The metal edging strips come in 45 cm lengths and can be cut to any length.

What is the minimum number of edging strips needed to cover the two edges *AB* and *DE*? [2]

END OF PAPER

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Question number	Additional page, if required. Write the question number(s) in the left-hand margin.	Examiner only

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