Surname	Centre Number	Candidate Number
Other Names		0

GCSE LINKED PAIR PILOT

4362/02

W16-4362-02

APPLICATIONS OF MATHEMATICS

UNIT 2: Financial, Business and Other Applications

HIGHER TIER

A.M. WEDNESDAY, 20 January 2016

2 hours

For Examiner's use only		
Question	**Maximum Mark**	**Mark Awarded**
1.	**7**	
2.	**8**	
3.*(a)*	**7**	
3.*(b)*	**8**	
3.*(c)(d)*	**7**	
4.	**6**	
5.	**7**	
6.*(a)*	**7**	
6.*(b)*	**6**	
7.	**11**	
8.	**10**	
9.	**11**	
10.	**5**	
Total	**100**	

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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.

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.

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.

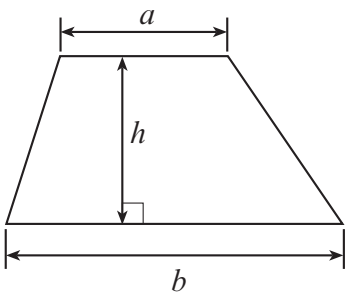
Scale drawing solutions will not be acceptable where you are asked to calculate.

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

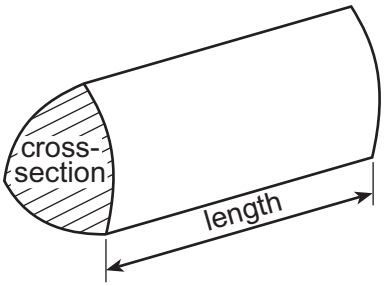
You are reminded that assessment will take into account the quality of written communication (including mathematical communication) used in your answer to question **3***(a)*.

Formula List

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

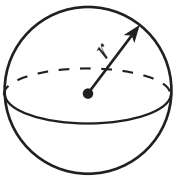


Volume of prism = area of cross-section × length



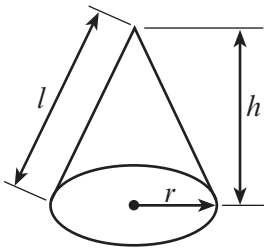
Volume of sphere = $\frac{4}{3}\pi r^3$

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



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

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

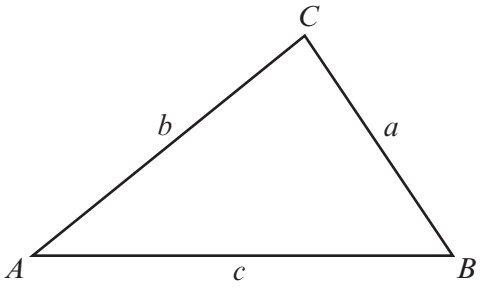


In any triangle ABC

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

$$x = \frac{-b \pm \sqrt{(b^2 - 4ac)}}{2a}$$

Examiner only

1. *(a)* Increase £760 by 26%. [2]

(b) A piece of wire is measured to be 26 cm correct to the nearest cm.
Write down the greatest and the least possible lengths of this piece of wire. [2]

Greatest length: ..... cm

Least length: ..... cm

(c) A bike was originally worth £460.
Each year, the value of the bike depreciates by 16% of its value at the start of the year.
What would be the value of the bike at the end of two years? [3]

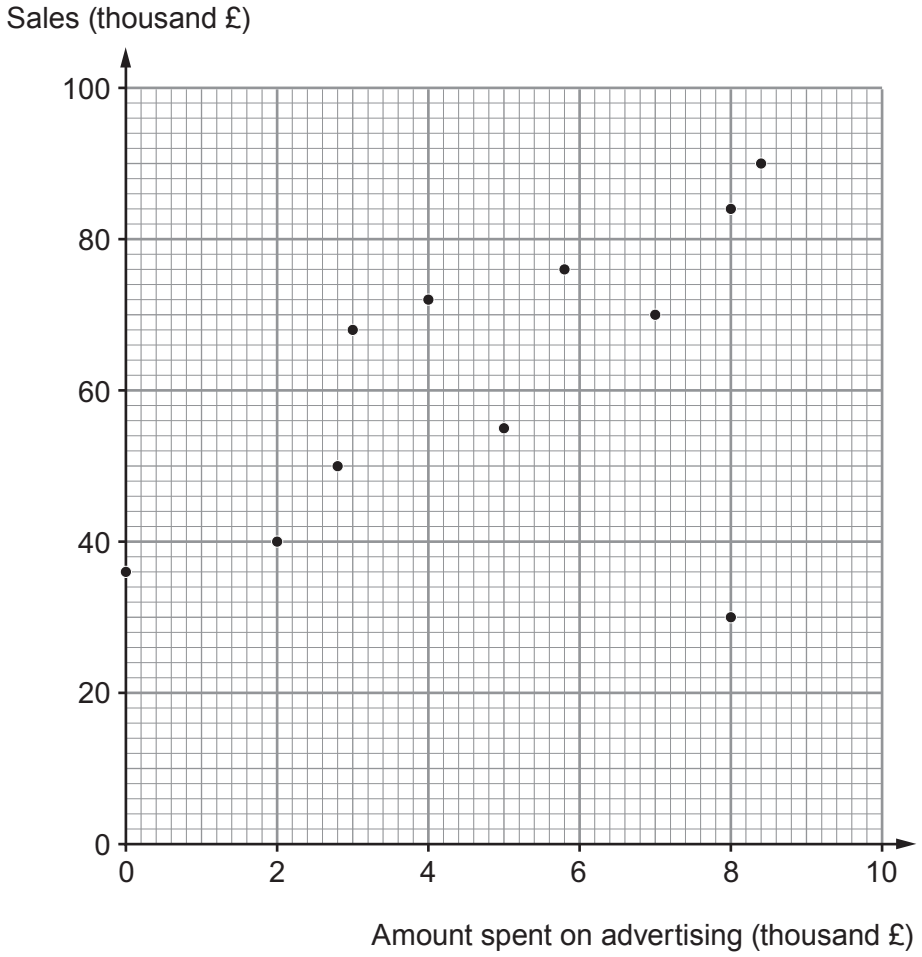
7

Turn over.

Examiner only

2. Many shampoo companies spend money on advertising.
Rita has asked 11 companies to tell her the **amount spent on advertising (thousand £)** and the **sales (thousand £)** for their shampoo during the previous month.

She has displayed her findings in a scatter diagram, shown below.



(a) One company did not spend on advertising.
What is the sales figure for this company? [1]

.....

(b) One company was very disappointed with their sales figure, given the amount that they spent on advertising.
Which company do you think this might be?
Indicate your answer on the scatter diagram and write down the amount they spent on advertising and their sales figure. [2]

Amount spent on advertising = ...

Sales figure = ...

Examiner only

(c) Ignoring the point you indicated in *(b)*, draw a line of best fit for the other points on the scatter diagram. [1]

(d) For a typical company selling shampoo, complete the following sentence.

For every £1 spent on advertising, the company expects an additional

£..... in sales of shampoo.

You **must** show your calculation. [2]

Calculation for this answer:

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(e) Rita is investigating if it is worth spending money on advertising shampoo.

(i) What conclusion could she draw so far from her investigation? [1]

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(ii) What should Rita do to improve her investigation? [1]

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Examiner only

3. *Island Boots* sells pairs of boots online and through mail order.

The boots are packaged in a box in the shape of a cuboid.
The dimensions of the box are 35 cm by 25 cm by 20 cm.
To stop the boots moving inside the box, *Island Boots* decides to insert a thin triangular piece of card.
This piece of card is shown by *ABC* in the diagram.

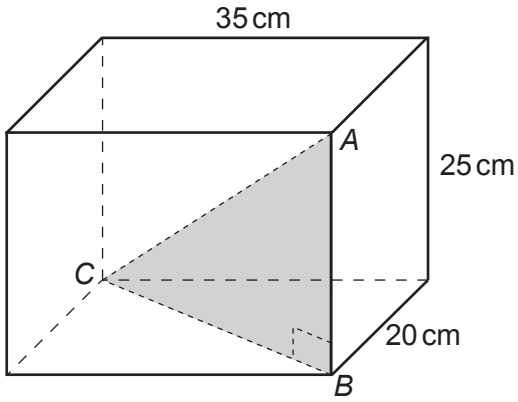

Diagram not drawn to scale

(a) You will be assessed on the quality of your written communication in this part of the question.

Calculate the length of **each side** of the triangle *ABC*.
You must show all your working. [7]

Examiner only

(b) *Island Boots* keeps a spreadsheet to help track the sales of different sized boots.

A partially complete section of the spreadsheet is shown below.

	A	B	C	D	E	F	G
1			Sales				
2	Boot style	Price £	Size 5	Size 6	Size 7	Size 8	Total sales (£)
3	*Arabel*	25.00	2	3	6	4	375
4	*Carba*	42.00	0	0	8	6	...
5	*Kata*	32.50	1	...	5	6	650
6	*Yara*	18.50	...	...	6	2	407
7							Overall total sales (£)
8							.....

(i) Complete the cells **G4** and **D5**. [2]

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(ii) The same number of size 5 *Yara* boots are sold as size 6 *Yara* boots. Complete cells **C6** and **D6**. [3]

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(iii) Write down a formula that could be used to calculate the value in **G3**. [2]

G3 = ...

(iv) Cell **G8** is to be used to total all the sales of the 4 different styles of boots. Write down a formula for **G8**. [1]

G8 = ...

8

Turn over.

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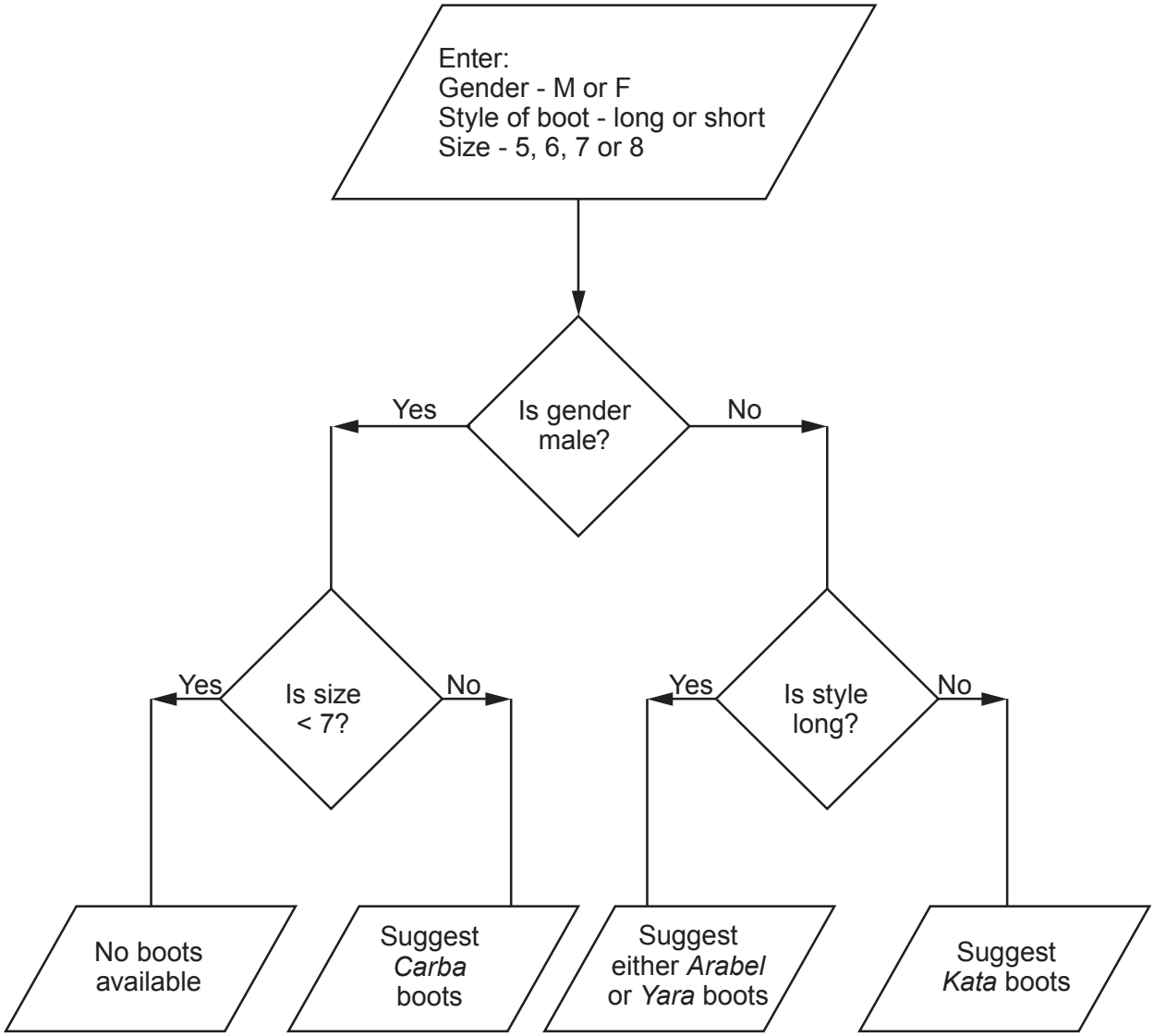
(c) The manager has written a flowchart to help tele-sales staff give suggestions to customers on the most suitable boots to buy.



(i) Suggest suitable boots for the following customers.

Rhodri, a man who takes a size 8 in boots. [1]

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Clara, a young woman looking for some short boots in a size 6. [1]

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(ii) *Island Boots* does not sell boots suitable for some particular groups of customers. Fully describe one of these groups of customers. [1]

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Examiner only

(d) Yesterday, the manager recorded the number of pairs of boots that needed to be sent to different customers in Europe and America.
The stem-and-leaf diagram shows the information.

Europe		America
	2	0 2 3
2 0	1	1 1 2 2 2
6 2 2 2 1 1 1 1 1	0	2 2 3 4 5

Key: 2 | 1 | 3 represents 23 pairs of boots
2 | 1 | represents 12 pairs of boots

(i) Complete the following table. [3]

	Median	Range	Mode
Europe			
America			

(ii) The manager of *Island Boots* says:

"Looking at the average sales, I think the boots sent to America are going to shops for selling to customers, but the boots sent to Europe are for customers buying for themselves."

Do you think the manager is definitely correct?
You must give a reason for your answer. [1]

Examiner only

4. Laces are made using a mix of 40% nylon and 60% polyester.
A pair of laces, of length 60 cm, weighs 8 g and costs 80p.

Another pair of the same style of laces is of length 96 cm.

(a) How much should a 96 cm pair of laces cost? [3]

(b) How many grams of **nylon** are there in a 96 cm pair of laces? [3]

6

Examiner only

5. Ceri has £20 000 to invest towards her retirement.
She plans to retire in 13 years' time.

There are a number of investment accounts available, as shown in the table below.
These accounts have fixed interest rates and any money must be invested for the complete time period stated.

Investment account in	AER	Minimum investment (£)	Maximum investment (£)	Fixed term for the investment (years)
Herenow Bank	2·2%	10 000	50 000	12
Denford Building Society	2·7%	15 000	30 000	10
Dreadly Bank	3·7%	25 000	40 000	10

In which bank or building society should Ceri invest her £20 000 to make the most of her investment?
You must justify your answer by showing all calculations. [7]

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Turn over.

Examiner only

6. *(a)* The energy used to cycle can be measured as the number of calories burned.
The following table helps to work out the energy used in cycling depending on how much a person weighs.

Person weighing	130 pounds	155 pounds	180 pounds
	Cycling for 1 hour, the number of calories burned		
Mountain biking	502	598	695
Leisure cycling	236	281	327
Fixed training bike	413	493	572

The values in the table can be used to find the approximate amount of energy used by persons of different weights, and also for different time intervals.

> Remember:
> 1 kg is approximately 2·2 pounds

(i) Calculate approximately how many calories a person weighing 170 pounds will burn when mountain biking for 1 hour.
You **must** show all your calculations. [3]

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(ii) Calculate approximately how many calories a person weighing **75 kg** will burn when leisure cycling during an afternoon ride of $4\frac{1}{2}$ hours.
You **must** show all your calculations. [4]

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Examiner only

(b) Kate is training for a long distance cycle ride.

She splits every training session into two parts.

In all training sessions Kate cycles the first part at an average speed of x km/h.
She cycles the second part at an average speed of y km/h.

The table shows the details of Kate's training sessions.

Training session	Time for first part	Time for second part	Total distance
1	20 minutes	$\frac{1}{4}$ hour	12 km
2	$\frac{1}{2}$ hour	45 minutes	30 km

Form and solve equations, in terms of x and y, to calculate the average speeds for the first and second parts of Kate's training sessions.
Give your answer in km/h. [6]

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Average speed of first part: ..... km/h

Average speed of second part: ..... km/h

Turn over.

Examiner only

7. *(a)* 

A pilot of an aeroplane has a fuel display on the flight deck.

This display shows the number of metric tonnes of fuel needed for a flight.

For example, 5·4 on the fuel display means a flight will require 5400 kg of fuel, which is equivalent to 4320 litres.

Complete each of the following.

Fuel display	Fuel in kg	Equivalent in litres
3·2		

[4]

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Fuel display	Fuel in kg	Equivalent in litres
		5120

[2]

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Examiner only

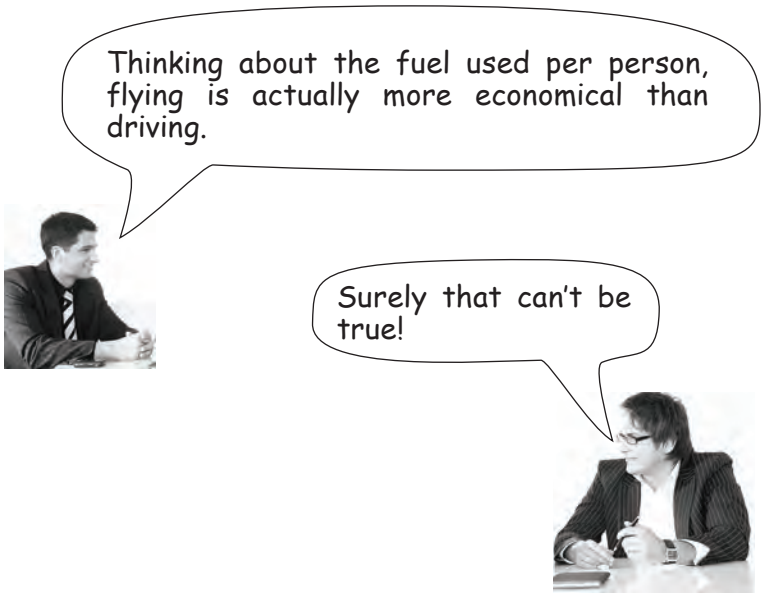
(b) In this part of the question you may assume the following for international flights.

> An aeroplane uses approximately 5 gallons of fuel per mile.
>
> Typically, an aeroplane carries about 550 passengers.

Matt travels by aeroplane, to a meeting in New York.

Matt usually drives to work and back each day on his own, a total distance of 200 miles. The typical fuel consumption of his car for this journey is 25 miles per gallon.

Matt's friend Carlo says:



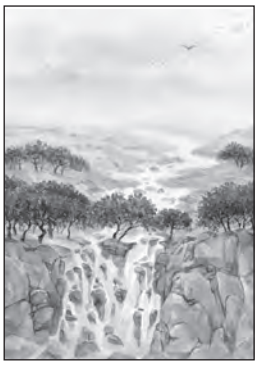
(i) Is Carlo correct?
You must show all your working. [4]

(ii) Would there be occasions when Carlo may be incorrect?
You must give a reason for your answer. [1]

Examiner only

8. Tomos is arranging an exhibition of statues and paintings.



Each statue is valued at £80 and each painting is valued at £120.

Tomos has been given the following instructions for arranging the exhibition.

- There must be at least 5 paintings on display.
- The number of paintings must be less than twice the number of statues on display.
- The value of the statues and paintings must be less than £2400.

Let x represent the number of statues on display.
Let y represent the number of paintings on display.

(a) Write down three inequalities that satisfy these instructions. [4]

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(b) Use the graph paper opposite to find the region that is satisfied by all three inequalities. [4]

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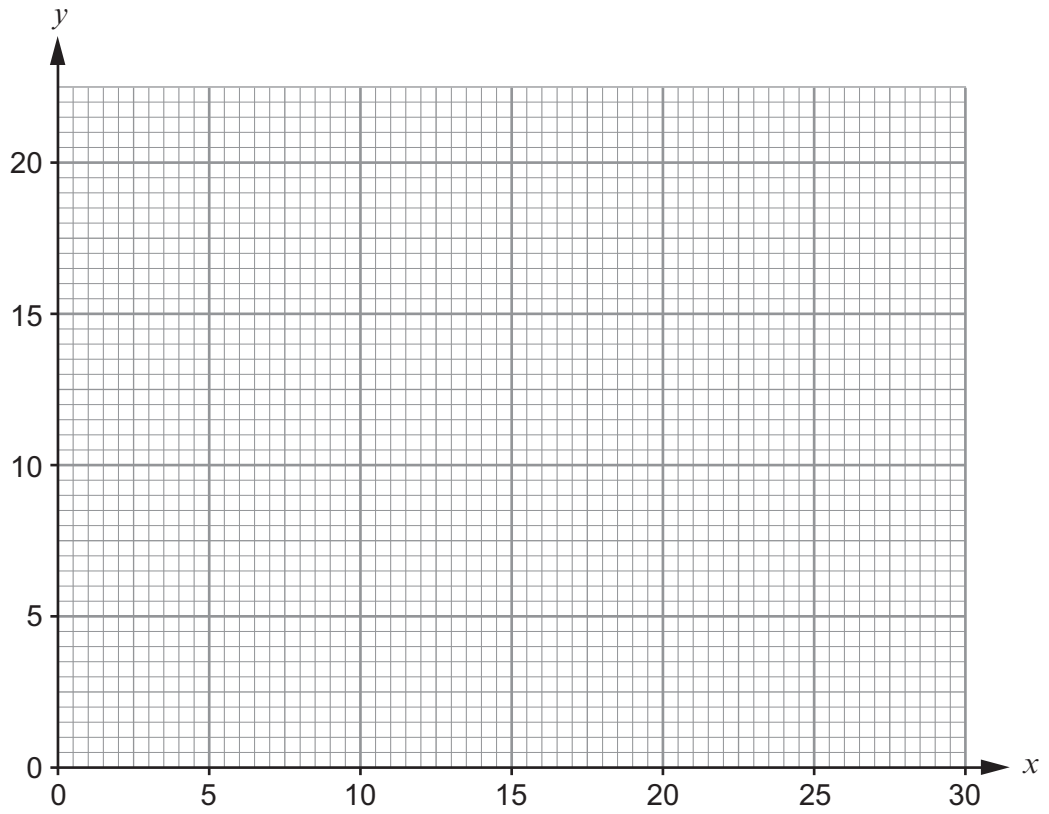
Examiner only



(c) Tomos displays the maximum possible number of paintings, keeping to the instructions. Find the number of statues and paintings he displays and their total value. [2]

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Number of statues = ...

Number of paintings = ...

Total value £ .....

10

Turn over.

Examiner only

9. Tilly grows tomatoes in greenhouses to sell at a market.

She has found that the number of ripe tomatoes, n, collected each morning is related to the number of hours of continuous sunshine on the previous day, d.
This relationship can be modelled by the following formula.

$$n = 3^d$$

(a) How many ripe tomatoes would Tilly collect on Wednesday morning if there had been 4 hours of continuous sunshine on Tuesday? [2]

(b) Tilly sells her tomatoes for £1.50 per kg.
Each of Tilly's tomatoes weighs approximately 50 g.

On Friday morning Tilly collected all the ripe tomatoes from her greenhouses to sell at the market.
She was left with 10·8 kg of her tomatoes unsold at the end of the day on Friday.

She took £51.90 from the sales of her tomatoes.

How many hours of continuous sunshine were there on Thursday?
Show all your working. [9]

Examiner only

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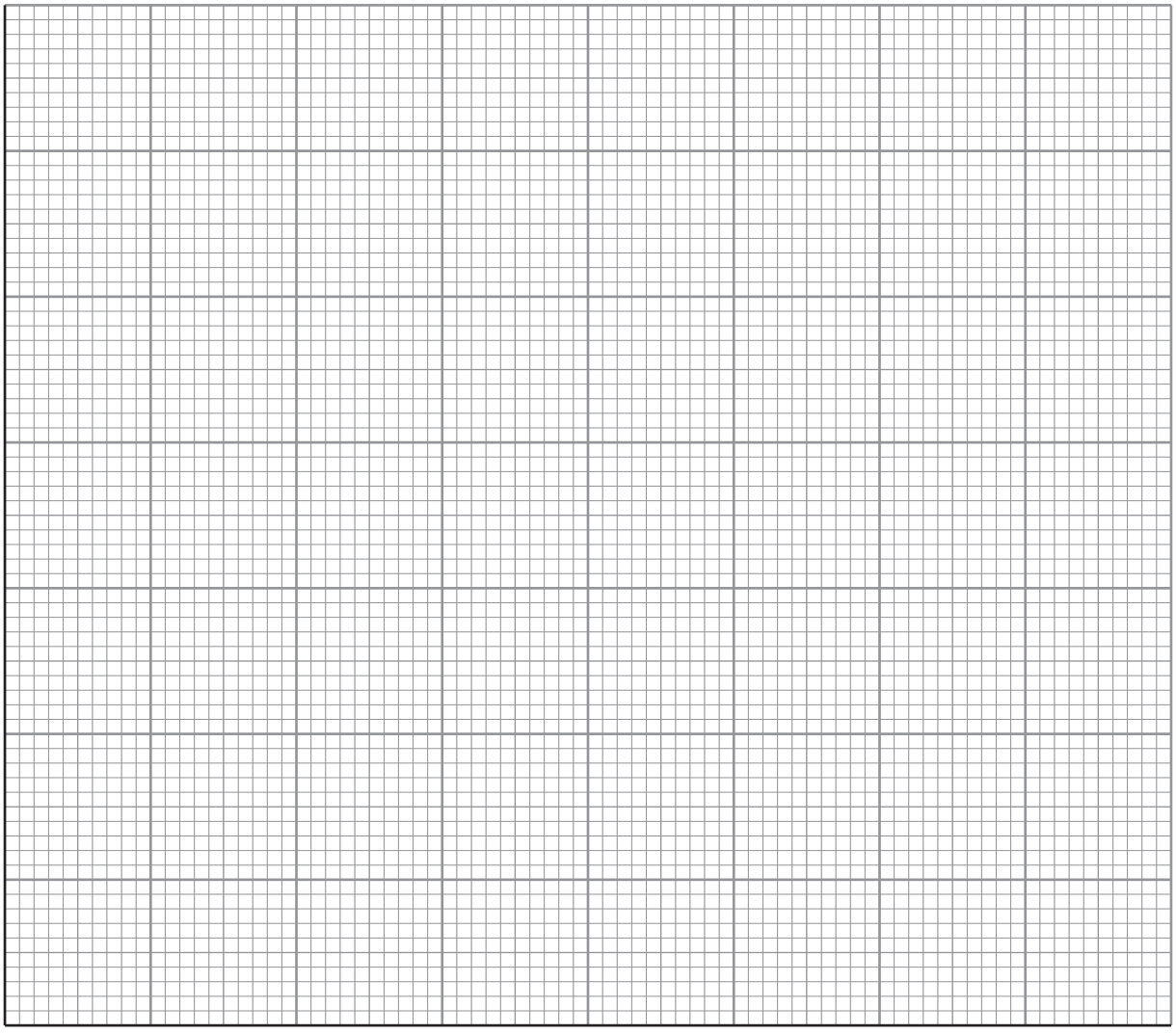
You may wish to use this graph paper in answering this question.



11

Turn over.

Examiner only

10.

Diagram not drawn to scale

The inside of a teacup is in the shape of a hemisphere with an inside diameter of 8·4 cm.
The teacup is completely filled with sugar.
The sugar from the teacup is tipped into a cylindrical jar.
The sugar fills the jar to a height of 5·2 cm.
Calculate the diameter of the jar correct to the nearest $\frac{1}{10}$ of a centimetre. [5]

Diameter of the jar = ... cm

5

END OF PAPER