X101/11/01

NATIONAL QUALIFICATIONS 2012

MONDAY, 21 MAY 9.00 AM – 9.45 AM

MATHEMATICS INTERMEDIATE 2

Units 1, 2 and Applications of Mathematics

Paper 1

(Non-calculator)

Read carefully

1 **You may NOT use a calculator.**

2 Full credit will be given only where the solution contains appropriate working.

3 Square-ruled paper is provided. If you make use of this, you should write your name on it clearly and put it inside your answer booklet.

FORMULAE LIST

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

Cosine rule: $a^2 = b^2 + c^2 - 2bc \cos A$ or $\cos A = \frac{b^2 + c^2 - a^2}{2bc}$

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

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

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

Volume of a cylinder: Volume $= \pi r^2 h$

Standard deviation: $s = \sqrt{\frac{\sum (x - \bar{x})^2}{n-1}} = \sqrt{\frac{\sum x^2 - (\sum x)^2 / n}{n-1}}$, where n is the sample size.

ALL questions should be attempted. *Marks*

1. The National Debt of the United Kingdom was recently calculated as

£1 157 818 887 139.

Round this amount to four significant figures. **1**

2. A teacher recorded the marks, out of ten, of a group of pupils for a spelling test.

Mark	Frequency
5	2
6	5
7	6
8	11
9	9
10	2

(*a*) Copy the frequency table and add a cumulative frequency column. **1**

(*b*) For this data, find:

(i) the median; **1**

(ii) the lower quartile; **1**

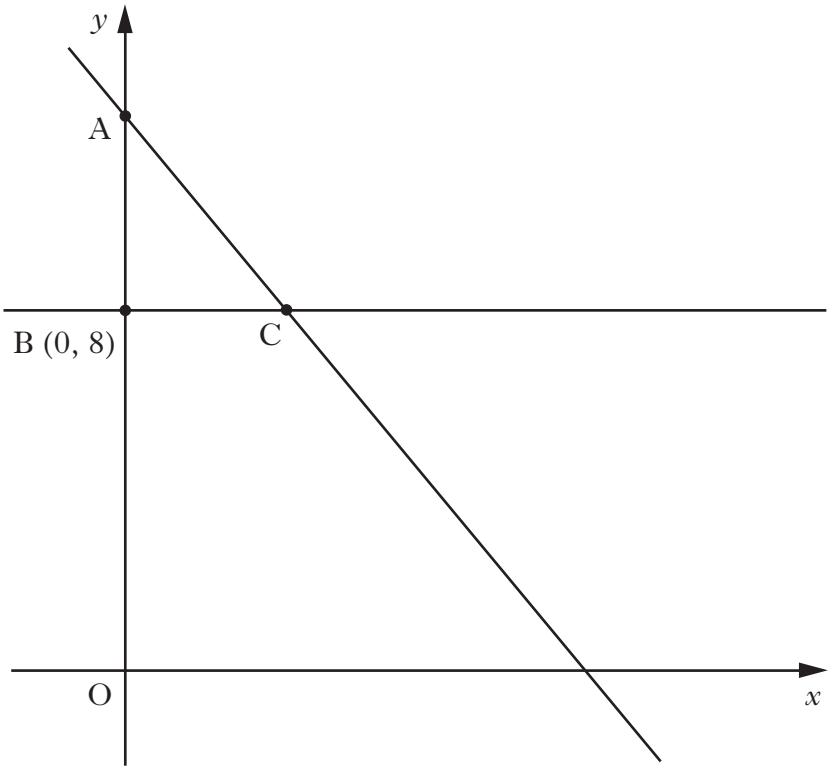
(iii) the upper quartile. **1**

(*c*) Draw a boxplot to illustrate this data. **2**

[Turn over

Marks

3. The straight line with equation $4x + 3y = 36$ cuts the y-axis at A.



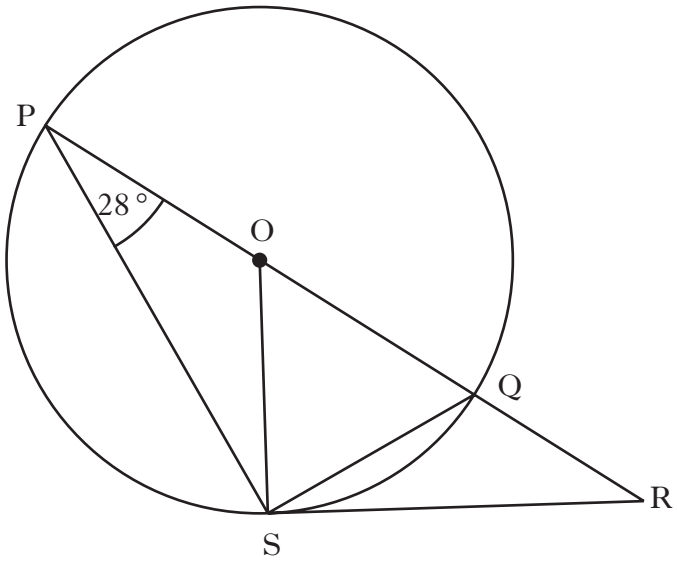
(*a*) Find the coordinates of A. **1**

This line meets the line through B (0, 8), parallel to the x-axis, at C as shown above.

(*b*) Find the coordinates of C. **2**

Marks

4.



In the above diagram,

- O is the centre of the circle
- PQ is a diameter of the circle
- PQR is a straight line
- RS is a tangent to the circle at S
- angle OPS is 28 °.

Calculate the size of angle QRS. **3**

5. One weekend, the attendances at five Premier League football matches were recorded.

8 900	12 700	59 200	10 300	9 700

The median attendance is 10 300.

(*a*) Calculate the mean attendance. **1**

(*b*) Which of the two "averages" – the mean or the median – is more representative of the data?

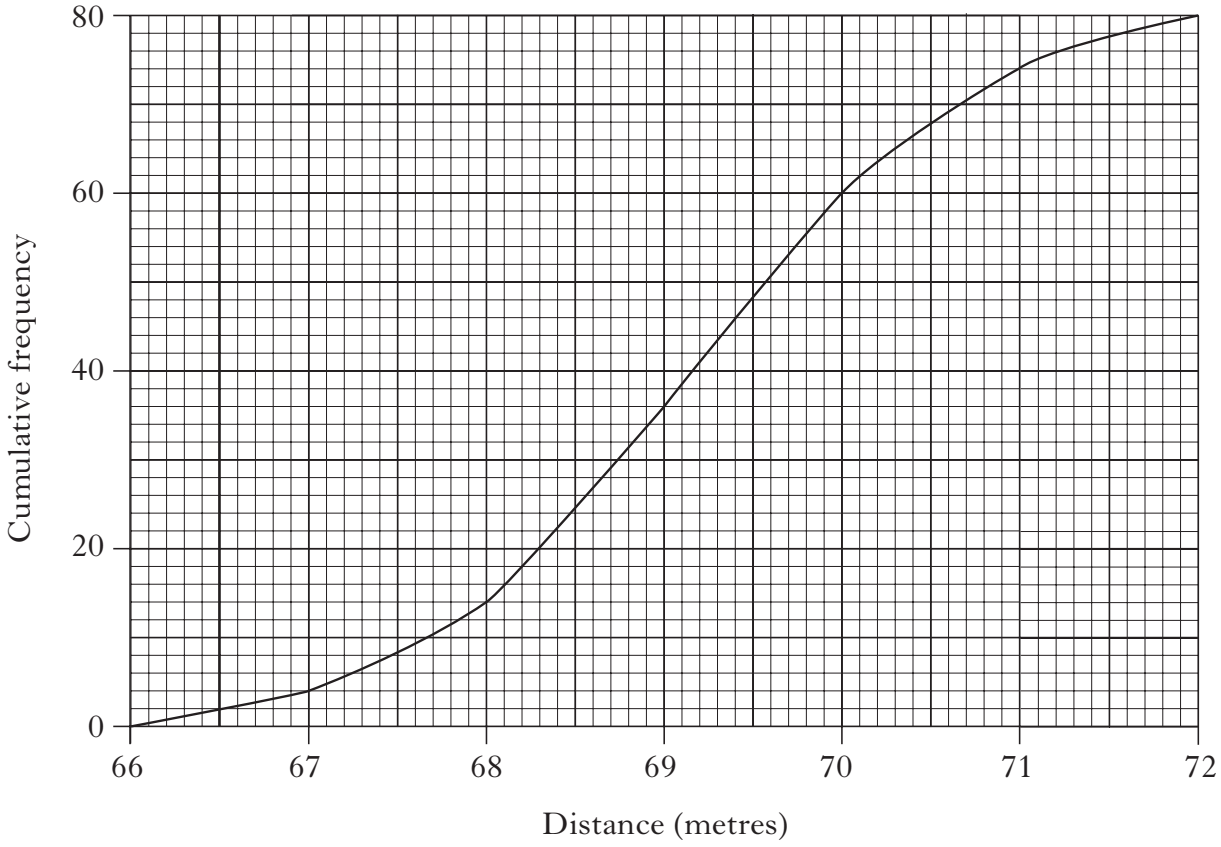
You must explain your answer. **1**

[Turn over

Marks

6. During an athletics meeting, the distances of 80 attempts in the discus competition are recorded.

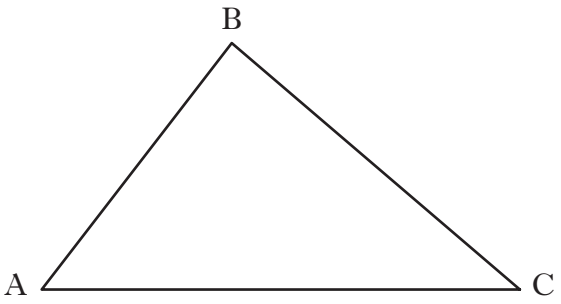
The cumulative frequency curve derived from the distances is shown below.



Use the curve to find the interquartile range of the distances. **3**

Marks

7.



The area of triangle ABC is 20 square centimetres.

AC = 16 centimetres and $\sin C = \frac{1}{4}$.

Calculate the length of BC. **2**

8. (*a*) Factorise

$$a^2 + 2ab + b^2.$$ **1**

(*b*) Hence, or otherwise, find the value of

$$94^2 + 2 \times 94 \times 6 + 6^2.$$ **2**

[Turn over

Marks

9. Maureen has her electricity supplied by the Use Less Power Company. She has designed a spreadsheet to check her bills.

	A	B	C	D	E	F	G	H	I
1	**Use Less Power Company**					**Cost per unit = 16p**			
2									
3									
4		**Previous Reading**	**Present Reading**	**Units Used**	**Cost of Units**	**Standing Charge**	**Sub-total**	**VAT at 5%**	**Total cost**
5									
6	**Jan–Mar**	75 812	76 915	1103	£176·48	£14·99	£191·47	£9·57	£201·04
7	**Apr–Jun**	76 915	77 408	493	£78·88	£14·99	£93·87	£4·69	£98·56
8	**Jul–Sep**	77 408	77 632	224	£35·84	£14·99	£50·83		
9	**Oct–Dec**	77 632	78 519	887					

She receives a bill each quarter. Electricity costs 16p per unit and there is a standing charge of £14·99 per quarter.

(*a*) Write down the **formula** to enter in cell E8 the cost of the units for the period from July to September. **1**

(*b*) Write down the **formula** to enter in cell H8 the cost of the VAT at 5% for the period from July to September. **1**

(*c*) What value will appear in cell I8? **2**

Marks

10. A copy of Logan Pollock's payslip is shown below for one week in February.

Name L. Pollock	**Employee No.** 027	**Tax Code** 64L	**Week Ending** 14/02/2012
Basic Pay £296·00	**Overtime Pay** £55·50	**Bonus** —	**Gross Pay** £351·50
National Insurance £20·04	**Income Tax** £45·40	**Pension** £21·09	**Deductions** £86·53
			Net Pay £264 ·97

Logan worked 40 hours for his basic pay.

If overtime was paid at the rate of "time and a half", calculate how many hours of overtime he worked during that week. **3**

[*END OF QUESTION PAPER*]

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X101/11/02

NATIONAL QUALIFICATIONS 2012

MONDAY, 21 MAY
10.05 AM – 11.35 AM

MATHEMATICS
INTERMEDIATE 2
Units 1, 2 and Applications of Mathematics
Paper 2

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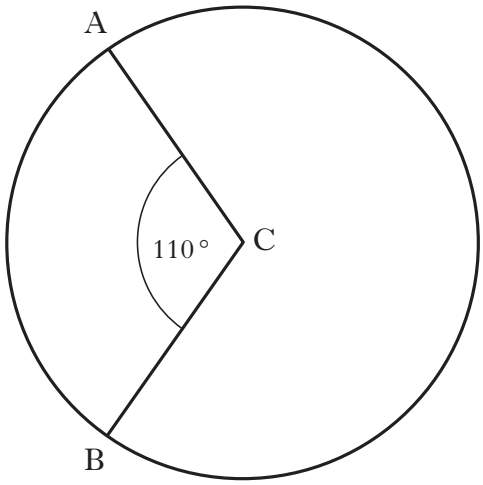
ALL questions should be attempted. *Marks*

1. The diagram below shows a circle, centre C.



The circumference of the circle is 40·8 centimetres.

Calculate the length of the minor arc AB. **2**

2. Multiply out the brackets and collect like terms.

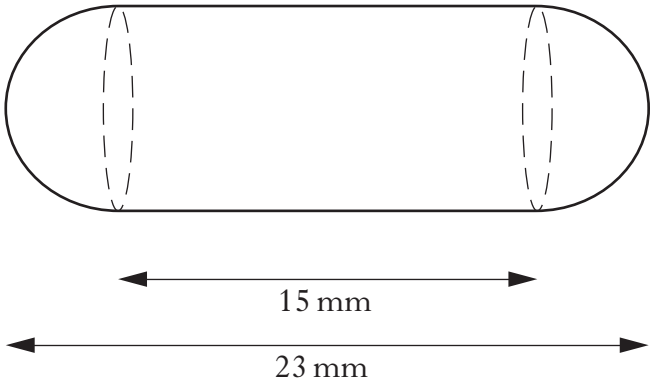
$(3x - 5)(x^2 + 2x - 6)$ **3**

[Turn over

Marks

3. A health food shop produces cod liver oil capsules for its customers.

Each capsule is in the shape of a cylinder with hemispherical ends as shown in the diagram below.

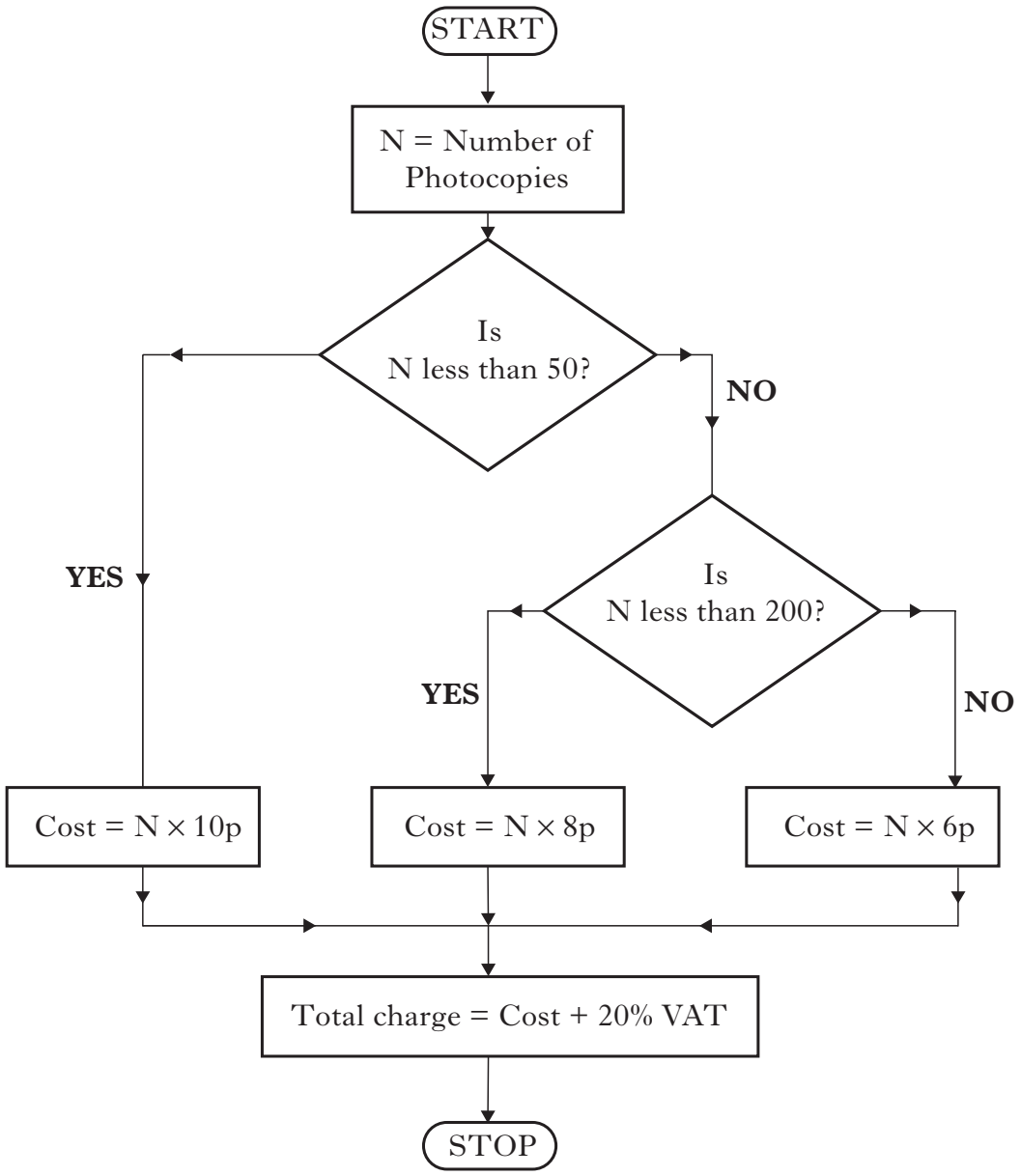


The total length of the capsule is 23 millimetres and the length of the cylinder is 15 millimetres.

Calculate the volume of one cod liver oil capsule. **4**

Marks

4. Stationery Systems offers a photocopying service to its customers. The flowchart below shows how charges are calculated for any number of copies.



Use the flowchart to calculate the total charge for Kamran who makes 360 photocopies. **4**

[Turn over

Marks

5. A ten-pin bowling team recorded the following six scores in a match.

134 102 127 98 104 131

(*a*) For this sample calculate:

(i) the mean;

(ii) the standard deviation.

Show clearly all your working. **4**

In their second match their six scores have a mean of 116 and a standard deviation of 12·2.

(*b*) Consider the 5 statements written below.

1 The total of the scores is the same in both matches.

2 The total of the scores is greater in the first match.

3 The total of the scores is greater in the second match.

4 In the first match the scores are more spread out.

5 In the second match the scores are more spread out.

Which of these statements is/are true? **2**

6. Three groups are booking a holiday. The first group consists of 6 adults and 2 children. The total cost of their holiday is £3148.

Let x pounds be the cost for an adult and y pounds be the cost for a child.

(*a*) Write down an equation in x and y which satisfies the above information. **1**

The second group books the same holiday for 5 adults and 3 children. The total cost of their holiday is £3022.

(*b*) Write down a second equation in x and y which satisfies this information. **1**

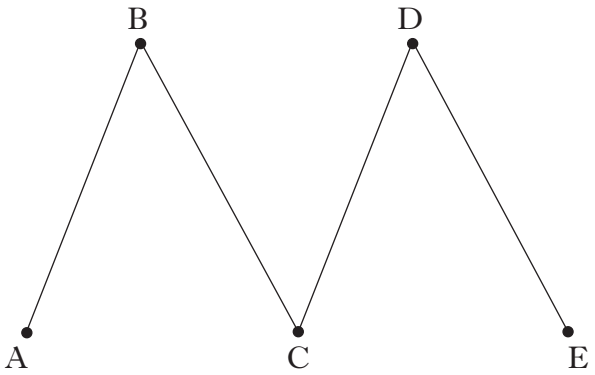
(*c*) The third group books the same holiday for 2 adults and 4 children. The travel agent calculates that the total cost is £2056.

Has this group been overcharged?

Justify your answer. **4**

Marks

7. A network diagram is shown below.



Copy the diagram and add one arc so that all the nodes are even. **1**

8. The Bank of Salamander offers loans to its customers.

The table shown below can be used to calculate loan repayments.

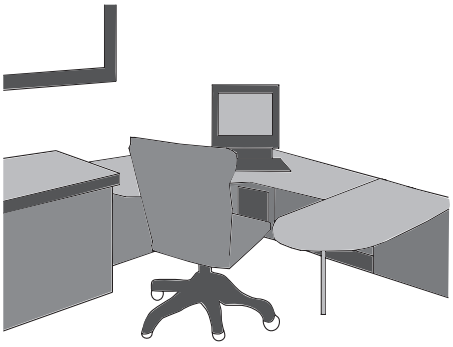
		60 months	**48 months**	**24 months**
		Monthly repayment (£)	Monthly repayment (£)	Monthly repayment (£)
With payment protection	£20 000	467·85	555·43	998·23
	£15 000	351·89	417·57	749·67
	£7500	177·94	210·79	376·84
Without payment protection	£20 000	388·65	471·72	888·47
	£15 000	292·49	354·79	667·35
	£7500	148·29	179·40	335·68

Amy requires to borrow £15 000 to buy a car.

How much will the loan cost her if she repays it over 24 months, **without payment protection**? **3**

[Turn over

9. The Room Index is used to calculate the amount of light needed in a workroom.



The formula for the Room Index, R, is

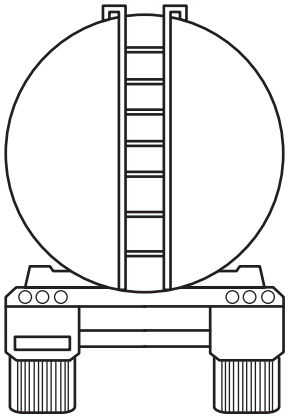
$$R = \frac{LW}{H(L+W)}$$

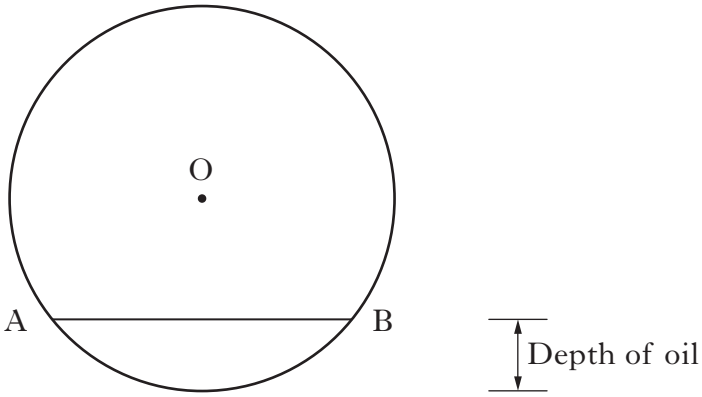
where L metres is the length of the room,
W metres is the width of the room
and H metres is the height of the light above the work surface.

Calculate the Room Index for a workroom 4·4 metres long and 3·2 metres wide with the light 1·4 metres above the work surface. **3**

10. A tanker delivers oil to garages.

The tank has a circular cross-section as shown in the diagram below.





The radius of the circle, centre O, is 1·9 metres.

The width of the surface of the oil, represented by AB in the diagram, is 2·2 metres.

Calculate the depth of the oil in the tanker. **4**

Marks

11. A dental practice keeps a record of the number of patients visiting the surgery over a period of time.

The information is shown below.

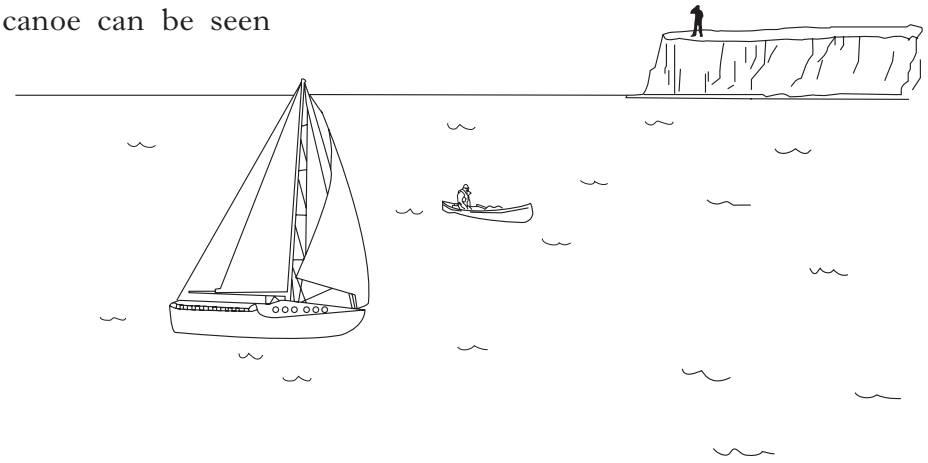
Number of patients	*Number of days*
6 – 10	4
11 – 15	8
16 – 20	10
21 – 25	18
26 – 30	7
31 – 35	3

Taking the number of patients to be at the mid-point of each interval, calculate the mean number of patients visiting the surgery per day. **5**

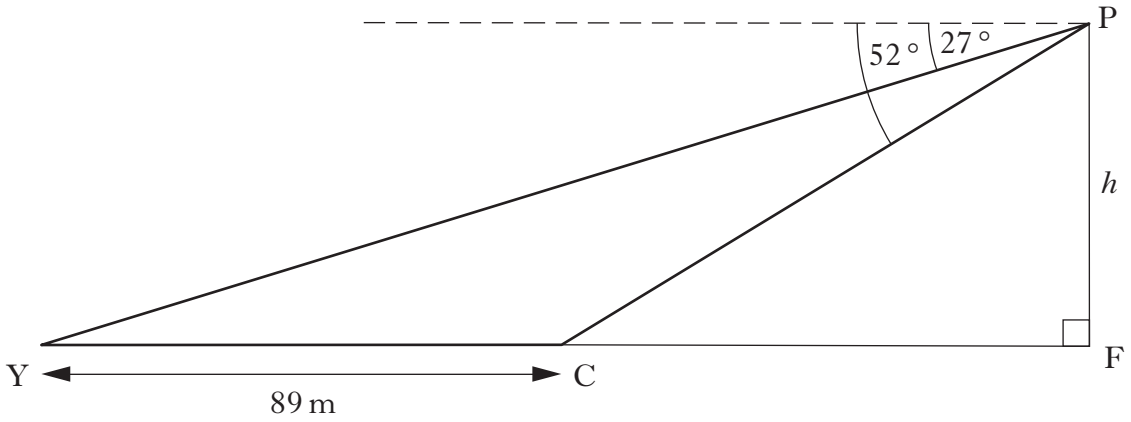
[Turn over

Marks

12. A yacht and a canoe can be seen from a clifftop.



In the diagram below, Y and C represent the positions of the yacht and the canoe.



From a point P on the clifftop:

- the angle of depression of the yacht is 27 °;
- the angle of depression of the canoe is 52 °.

The distance between the yacht and the canoe is 89 metres.

Calculate the height, h, metres, of the cliff. **5**

Marks

13. Due to the threat of global warming, scientists recommended in 2010 that the emissions of greenhouse gases should be reduced by 50% by the year 2050.

The government decided to reduce the emissions of greenhouse gases by 15% **every ten years**, starting in the year 2010.

Will the scientists' recommendations have been achieved by 2050?

You must give a reason for your answer. **4**

[*END OF QUESTION PAPER*]

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