

[CO56/SQP201]

NATIONAL
QUALIFICATIONS

Time: 45 minutes

Specimen Question paper
(based on the 2000 Question Paper)

MATHEMATICS
INTERMEDIATE 2
Units 1, 2 and
Applications of Mathematics
Paper 1
(Non-calculator)

Read carefully

- 1 You may **NOT** use a calculator.
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- 3 Square-ruled paper is provided.

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: $\text{Area} = \frac{1}{2}ab \sin C$

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

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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.

1. A group of students scored the following marks in a test.

9 5 6 8 6 9 7 8 6 5

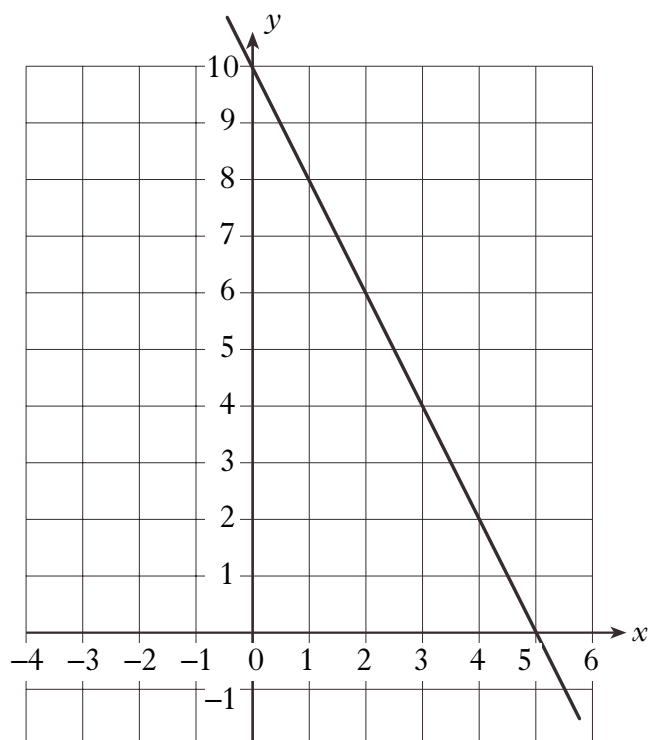
(a) Construct a frequency table from the above data and add a cumulative frequency column.

2

(b) What is the probability that a student chosen at random from this group scored less than 8?

1

2.



Find the equation of the straight line.

3

[Turn over

3. Stephen plans to go to a concert. The ticket costs £49.00. He works 2 hours overtime on Friday night at time and a half, and $2\frac{1}{2}$ hours overtime on Saturday morning at double time.
If his basic pay is £6.80 per hour, will his overtime pay cover the cost of the ticket?
You must give a reason for your answer.

4

4. Factorise

$$9a^2 - 25b^2.$$

2

5. The distance, s metres, travelled by a moving object is given by the formula

$$s = \frac{(u + v)t}{2}$$

where u metres per second is the initial velocity,
 v metres per second is the final velocity
and t seconds is the time taken.

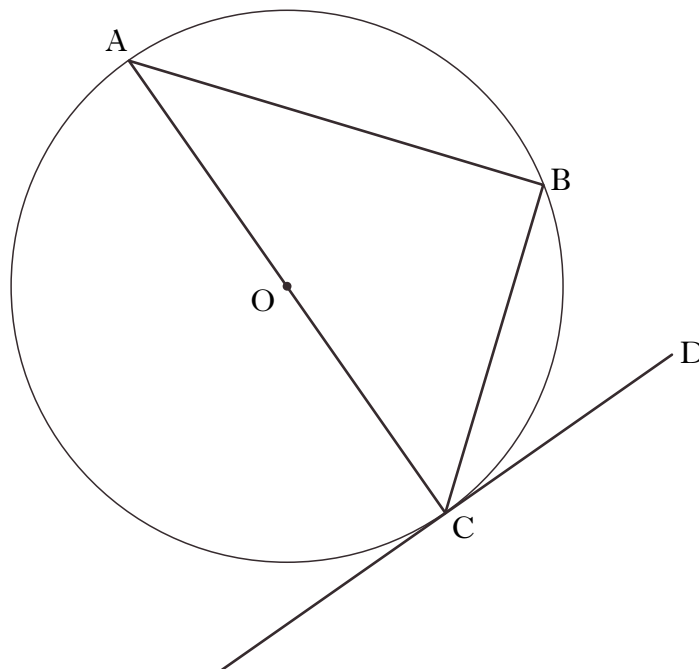
- (a) Calculate s when $u = 3$, $v = 7$ and $t = 4$.

3

- (b) Calculate t when $s = 35$, $u = 5$ and $v = 9$.

3

6.



- A, B and C are points on the circumference of a circle, centre O.
- CD is a tangent to the circle.
- Angle BCD = 25° .

Calculate the size of angle BAC.

Show all working.

3

[Turn over for Question 7 on Page six

7. A manufacturer of matches claims that there are “on average 60 matches per box”.

A sample of eleven boxes contains the following numbers of matches per box.

58, 62, 60, 65, 59, 60, 59, 62, 61, 61, 64

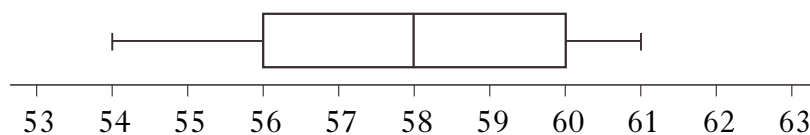
- (a) From the above data, find the median, the lower quartile and the upper quartile. 2

- (b) Comment on the claim made above. 1

- (c) Construct a boxplot for the data. 2

- (d) A different sample of matchboxes was taken.

The boxplot, shown below, was drawn for the new data.



Does this new data support the manufacturer’s claim?

Give a reason for your answer.

1

[END OF QUESTION PAPER]

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Applications of
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1. A hotel inspector recorded the volume of wine, in millilitres, in a sample of six glasses.

120 126 125 131 130 124

Use an appropriate formula to calculate the standard deviation.

Show clearly all your working.

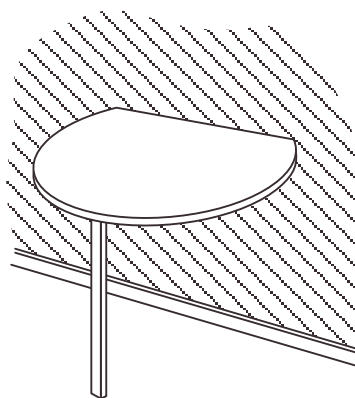
4

2. Multiply out the brackets and collect like terms.

$$(3x + 2)(x - 1) + 4x$$

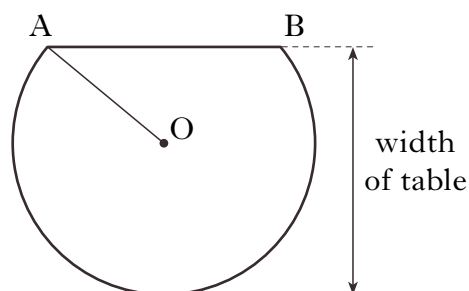
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3. The diagram shows a fold-away table whose top is in the shape of part of a circle.



- The centre of the circle is O.
- AB is a chord of the circle.
- AB is 70 centimetres.
- The radius, OA, is 40 centimetres.

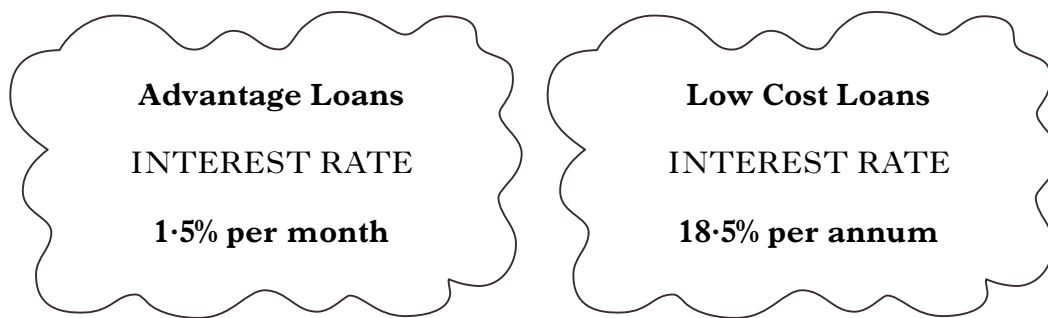
Find the width of the table.



4

[Turn over

4. Michael wishes to borrow £1000 for 3 months. He can choose from **Advantage Loans** or **Low Cost Loans**.



Which company costs less?

Give a reason for your answer.

4

5. The cost of hiring a car depends on the number of days the car is hired and the number of litres of petrol used.

(a) David hired a car for 3 days and used 50 litres of petrol. The total cost was £88.50.

Let x pounds be the cost per day of hiring a car, and y pounds be the cost of one litre of petrol.

Write down an equation in x and y which satisfies the above condition.

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(b) Anne hired the same model of car for 4 days and used 60 litres of petrol. The total cost was £113.00.

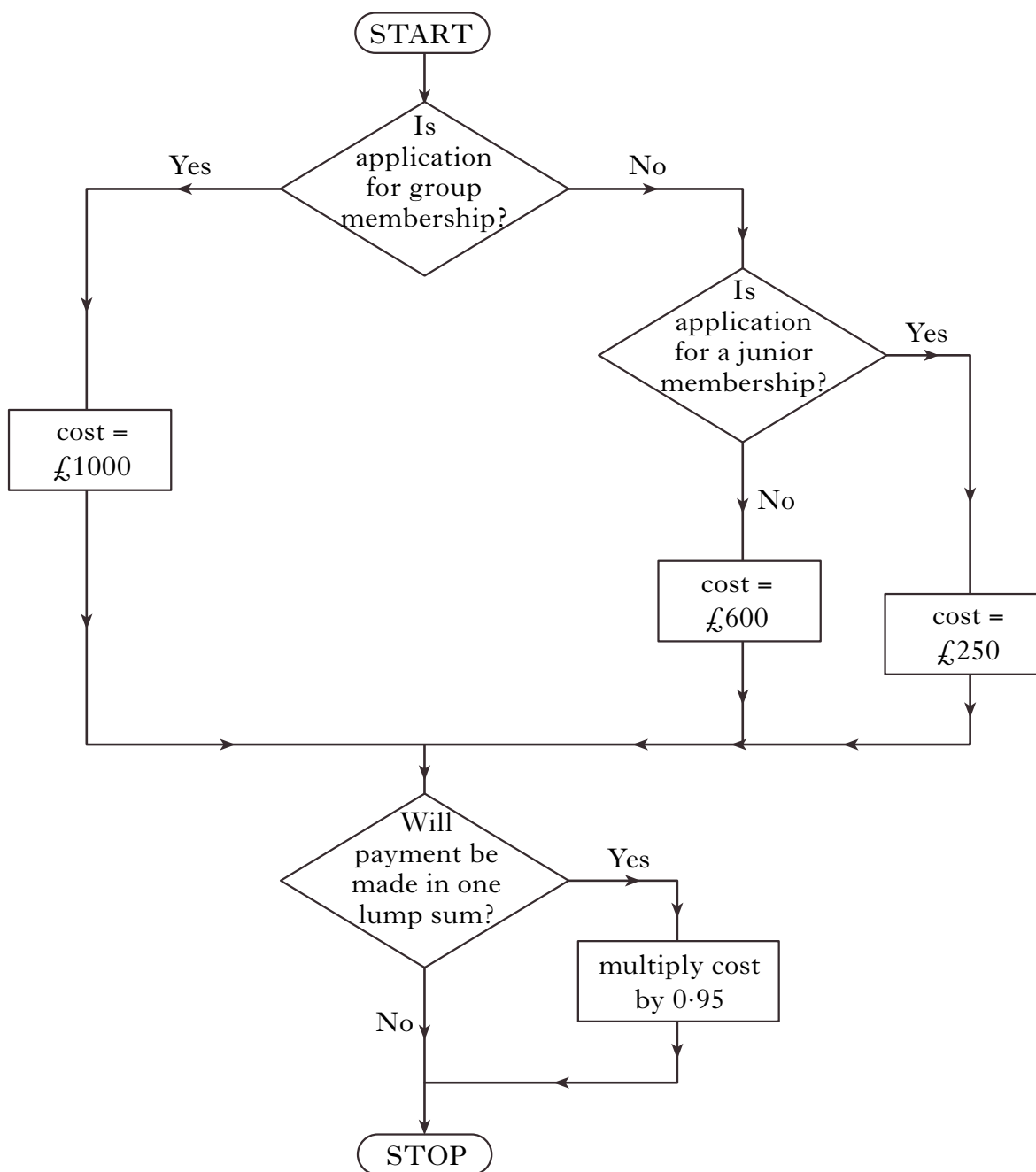
Write down a second equation in x and y which satisfies this condition.

1

(c) Find the cost per day of hiring the car and the cost of one litre of petrol.

4

6. The flowchart below shows how to calculate the cost of joining a sports club.

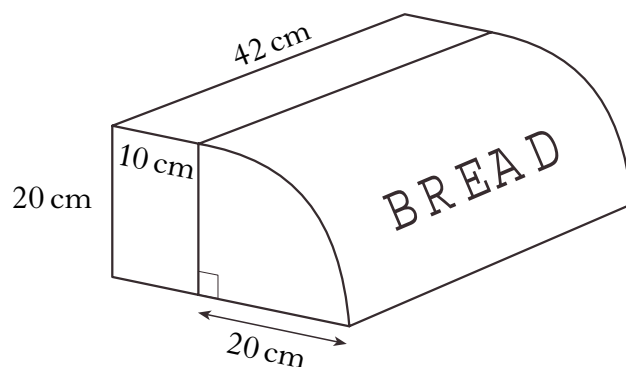


Use the flowchart to calculate the cost for an adult who wants to make the payment in one lump sum.

4

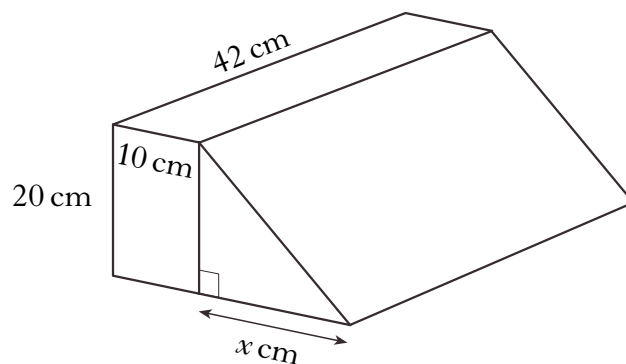
[Turn over

7. A bread bin is in the shape of a prism as shown below.



The cross-section of the bread bin consists of a rectangle 20 centimetres by 10 centimetres and a quarter circle.

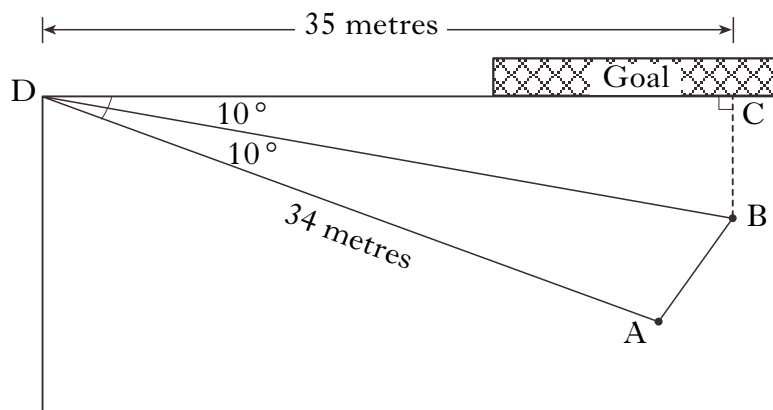
- (a) Calculate the volume of the bread bin.
Give your answer in cubic centimetres, correct to 3 significant figures. 4
- (b) The design is changed so that the volume remains the same. The cross-section is now a rectangle 20 centimetres by 10 centimetres and a right-angled triangle as shown in the diagram below.



Find x .

3

8.



The diagram shows part of a football pitch with players at A, B, C and D.

BC is perpendicular to CD.

CD = 35 metres, angle CDB = 10° , angle BDA = 10° , AD = 34 metres.

Find the distance from A to B.

5

[Turn over

9. Lorna Simpson sells double glazing. She has a basic salary of £12 500 per year. In addition to her basic salary she earns 10% commission on all her sales. Last year she sold £50 000 worth of double glazing products.

(a) Calculate her gross annual salary for last year.

2

(b) The table below shows the rates of tax applicable for last year.

<i>Rates of Tax</i>	<i>Taxable Income £</i>
Lower rate 20%	1 to 4300
Basic rate 23%	4301 to 27 100
Higher rate 40%	over 27 100

Lorna's total tax allowance is £4195.

Calculate her annual tax bill for last year.

5

10. A survey was carried out to find the waiting time for telephone calls to be answered at a call centre. The results are shown below.

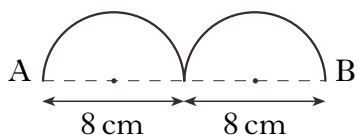
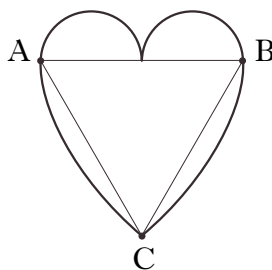
<i>Time in seconds</i>	<i>Number of calls</i>
20 – 34	9
35 – 49	10
50 – 64	14
65 – 79	19
80 – 94	22
95 – 109	35
110 – 124	21
125 – 139	20

Calculate the mean waiting time in seconds.

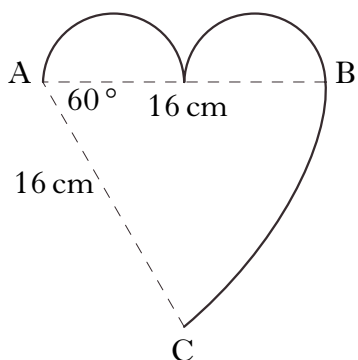
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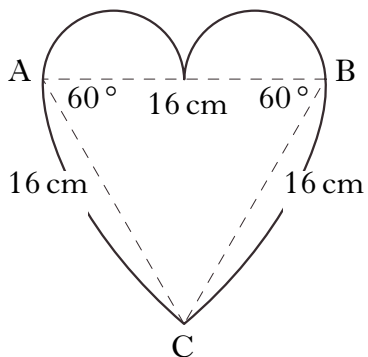
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Find the perimeter of the template.

5

[END OF QUESTION PAPER]

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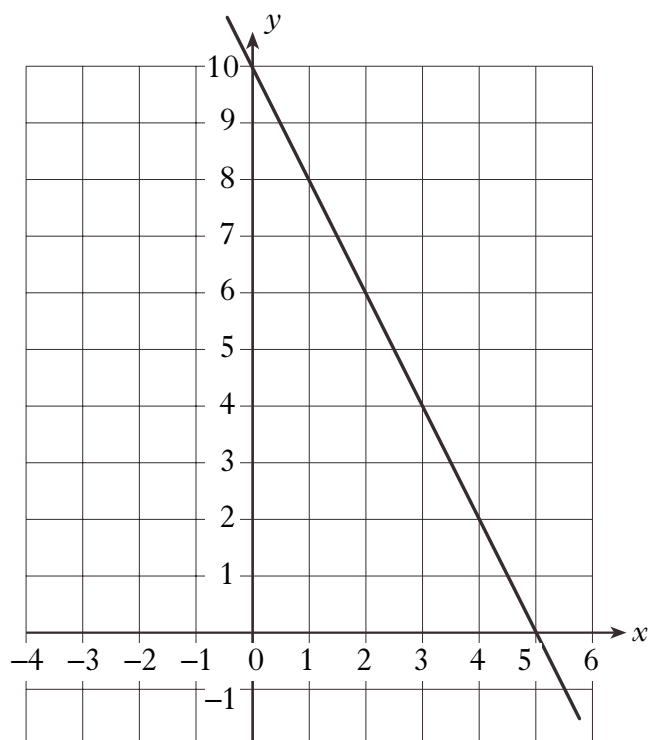
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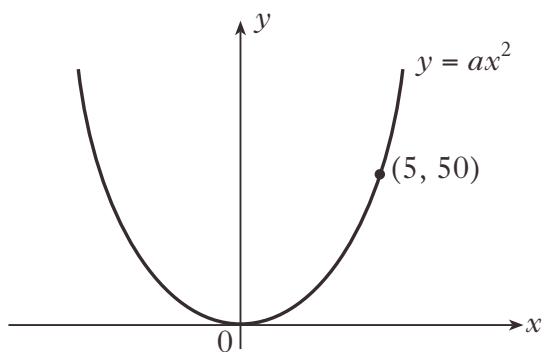


Find the equation of the straight line.

3

[Turn over

3. The diagram below shows the graph of $y = ax^2$.



Find the value of a .

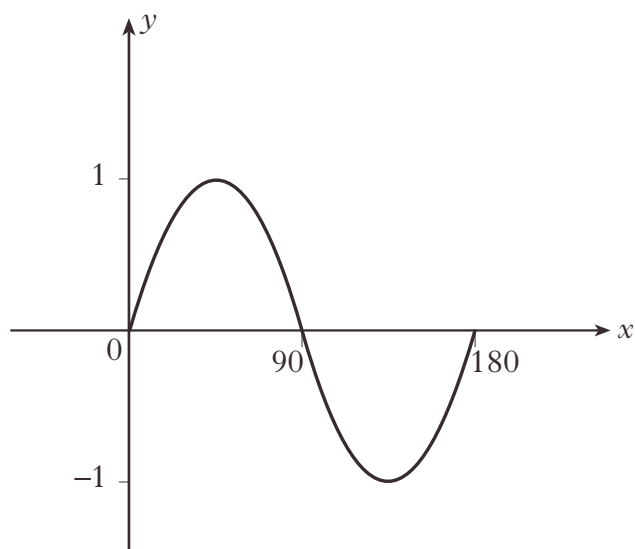
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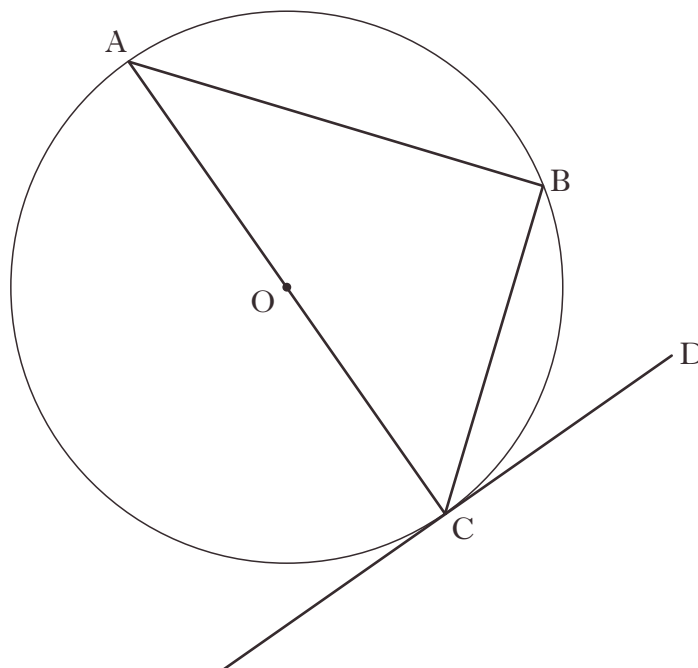
The graph of $y = \sin bx^\circ$ is shown in the diagram.

State the value of b .

1

6. (a) Express $\frac{a^{\frac{1}{2}} \times a^{\frac{5}{2}}}{a^2}$ in its simplest form. 2
- (b) Express $\frac{2}{\sqrt{3}}$ as a fraction with a rational denominator. 2
- (c) Express $\frac{2}{x} + \frac{4}{x+3}$, $x \neq 0$, $x \neq -3$, as a single fraction in its simplest form. 3

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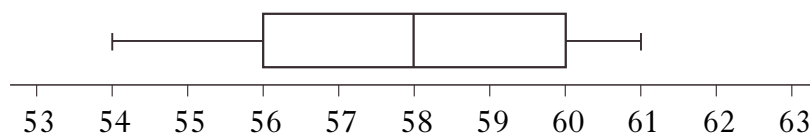
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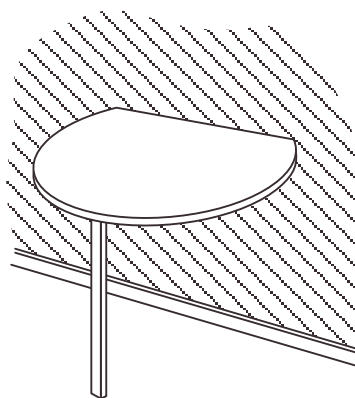
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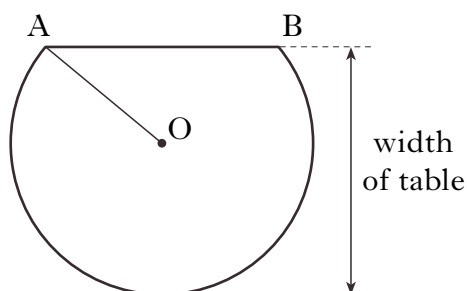
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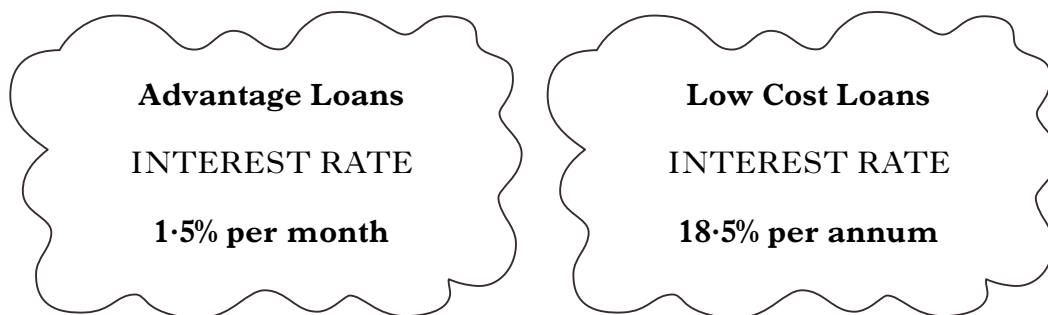
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Which company costs less?

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Write down an equation in x and y which satisfies the above condition.

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(b) Anne hired the same model of car for 4 days and used 60 litres of petrol. The total cost was £113.00.

Write down a second equation in x and y which satisfies this condition.

1

(c) Find the cost per day of hiring the car and the cost of one litre of petrol.

4

6. (a) Change the subject of the formula $r = \frac{st}{q}$ to s .

2

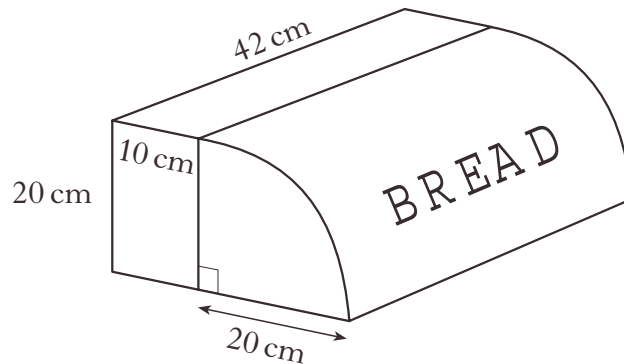
(b) Use an appropriate formula to solve the quadratic equation

$$3x^2 - 2x - 6 = 0.$$

Give your answer correct to 1 decimal place.

4

7. A bread bin is in the shape of a prism as shown below.



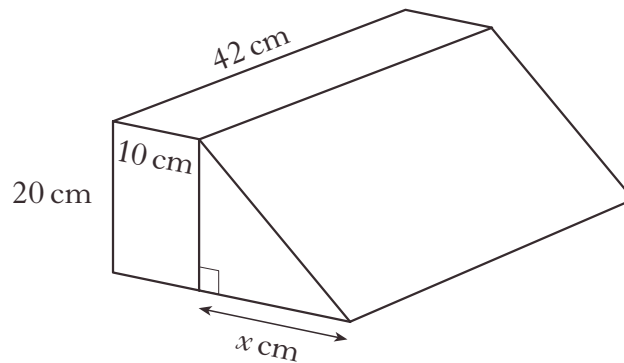
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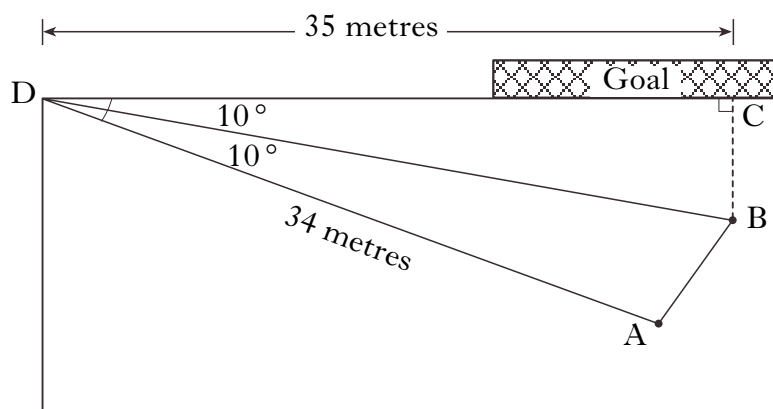


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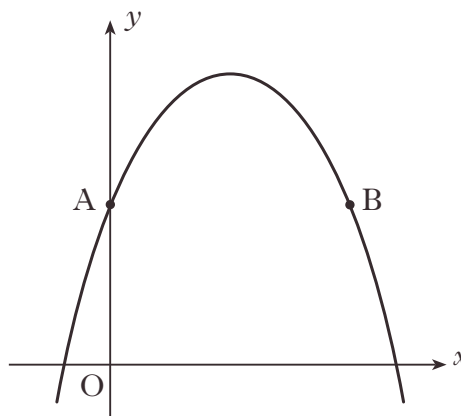
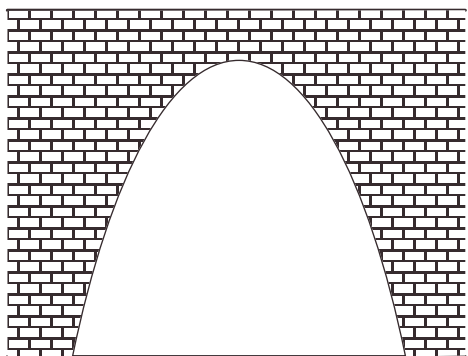
BC is perpendicular to CD.

CD = 35 metres, angle $CDB = 10^\circ$, angle $BDA = 10^\circ$, AD = 34 metres.

Find the distance from A to B.

5

9.



The arch of a railway bridge is represented by a parabola. The equation of the parabola is

$$y = 20 - (x - 3)^2.$$

- (a) State the coordinates of the maximum turning point of the parabola. 2
- (b) State the equation of the axis of symmetry. 1
- (c) Points A and B have the same y -coordinate.
A is the point (0, 11). State the coordinates of B. 2

10. (a) Solve the equation

$$4 \sin x^\circ - 1 = 0, \quad 0 \leq x < 360. \quad \text{3}$$

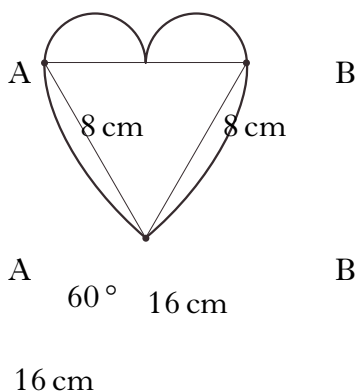
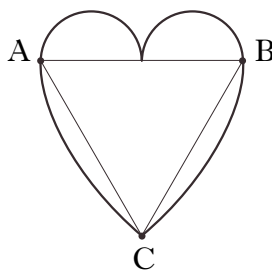
- (b) Show that

$$\frac{1 - \cos^2 A}{\cos^2 A} = \tan^2 A. \quad \text{2}$$

[Turn over for Question 11 on Page eight]

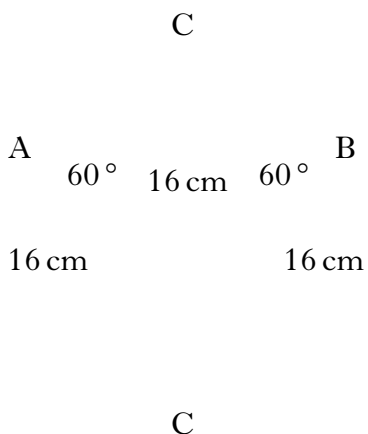
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