Candidate Name	Centre Number	Candidate Number

WELSH JOINT EDUCATION COMMITTEE

General Certificate of Secondary Education

CYD-BWYLLGOR ADDYSG CYMRU

Tystysgrif Gyffredinol Addysg Uwchradd

185/05

MATHEMATICS

PILOT EXAMINATION

HIGHER TIER PAPER 2

A.M. MONDAY, 12 June 2006

(2 Hours)

For Examiner's use only		
Question	**Maximum Mark**	**Mark Awarded**
1	**2**	
2	**3**	
3	**6**	
4	**11**	
5	**3**	
6	**2**	
7	**7**	
8	**3**	
9	**4**	
10	**5**	
11	**4**	
12	**9**	
13	**4**	
14	**4**	
15	**6**	
16	**3**	
17	**3**	
18	**3**	
19	**3**	
20	**3**	
21	**2**	
22	**4**	
23	**6**	
TOTAL MARK		

ADDITIONAL MATERIALS

A calculator will be required for this paper.

INSTRUCTIONS TO CANDIDATES

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, especially when a calculator is used.

Unless stated, diagrams are not drawn to scale.

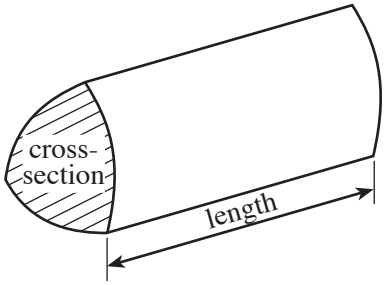
Scale drawing solutions will not be acceptable where you are asked to calculate.

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

No certificate will be awarded to a candidate detected in any unfair practice during the examination.

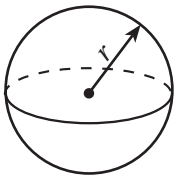
Formula List

Volume of prism = area of cross-section × length



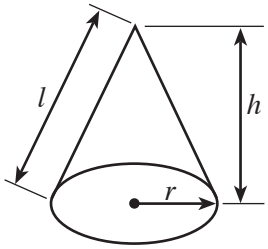
Volume of sphere = $\frac{4}{3}\pi r^3$

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



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

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

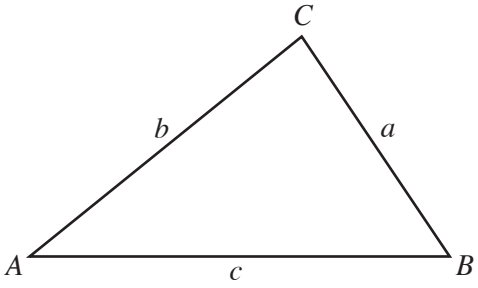


In any triangle ABC

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

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

Standard Deviation

Standard deviation for a set of numbers

$x_1, x_2, \ldots, x_n$, having a mean of $\bar{x}$ is given by

$$s = \sqrt{\frac{\sum (x - \bar{x})^2}{n}} \quad \textbf{or} \quad s = \sqrt{\frac{\sum x^2}{n} - \left\{\frac{\sum x}{n}\right\}^2}$$

1. Gordon uses $\frac{3}{4}$ of a jar of peanut butter on a single slice of toast. How many jars of peanut butter would he use for 20 slices of toast?

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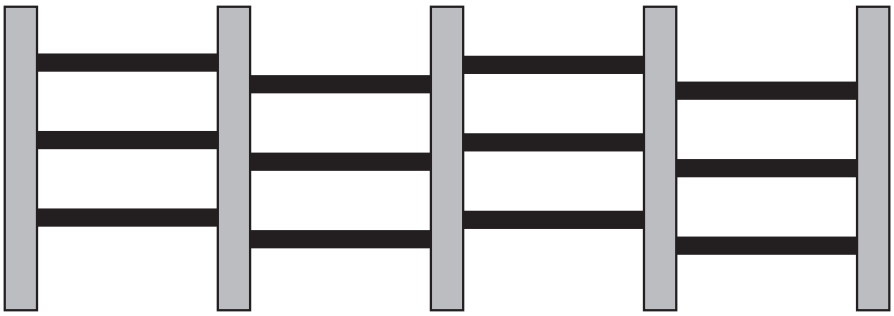
[2]

2. Fences are made using vertical posts and 3 horizontal rails between each pair of vertical posts. The fence shown below has 5 vertical posts with 3 horizontal rails between each pair of vertical posts.

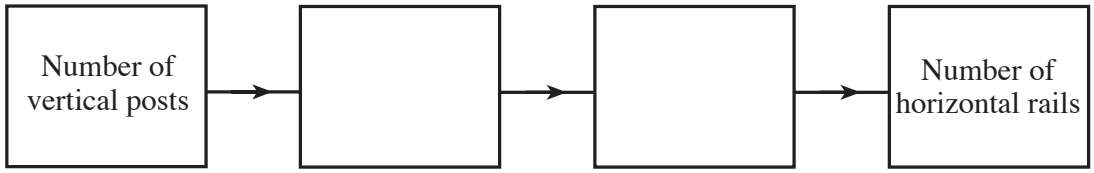


(a) Complete the following table which shows the relationship between the number of vertical posts and horizontal rails.

Number of vertical posts	Number of horizontal rails
2	3
3	6
4	9
5	12
6	
10	

[1]

(b) Use your table to enter the two missing stages in the number machine.



[2]

3. Frankie is offered a choice of two mobile telephone deals.

> ***Mega deal***
> A free phone and each month have up to
> 300 minutes of talk time at 4 pence per minute and 200 text messages at 1 pence each

OR

> ***Bonus deal***
> A free phone and each month have up to
> 200 minutes of talk time at 3 pence per minute and 250 text messages at 2 pence each

Frankie usually uses 150 minutes of talk time and sends 120 texts each month.

(a) Work out how much Frankie would pay a month using

(i) the Mega deal offer,

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(ii) the Bonus deal offer.

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[3]

(b) Frankie will also have to pay tax at a rate of 10% on the total monthly amount charged. Which is the cheapest deal for Frankie to choose and by how much?

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[3]

4. *(a)* Solve $8x + 4 = 7 - 4x$.

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[3]

(b) Solve $5(2x - 3) = 50$.

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[3]

(c) (i) Factorise $2x^2 - 6x$.

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(ii) Factorise $3a - 12$.

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[3]

(d) Write down the first three terms of a sequence where the nth term is $n^2 - 3$.

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[2]

5. Use the graph paper below to draw the graph of the straight line $y = 3x + 2$.

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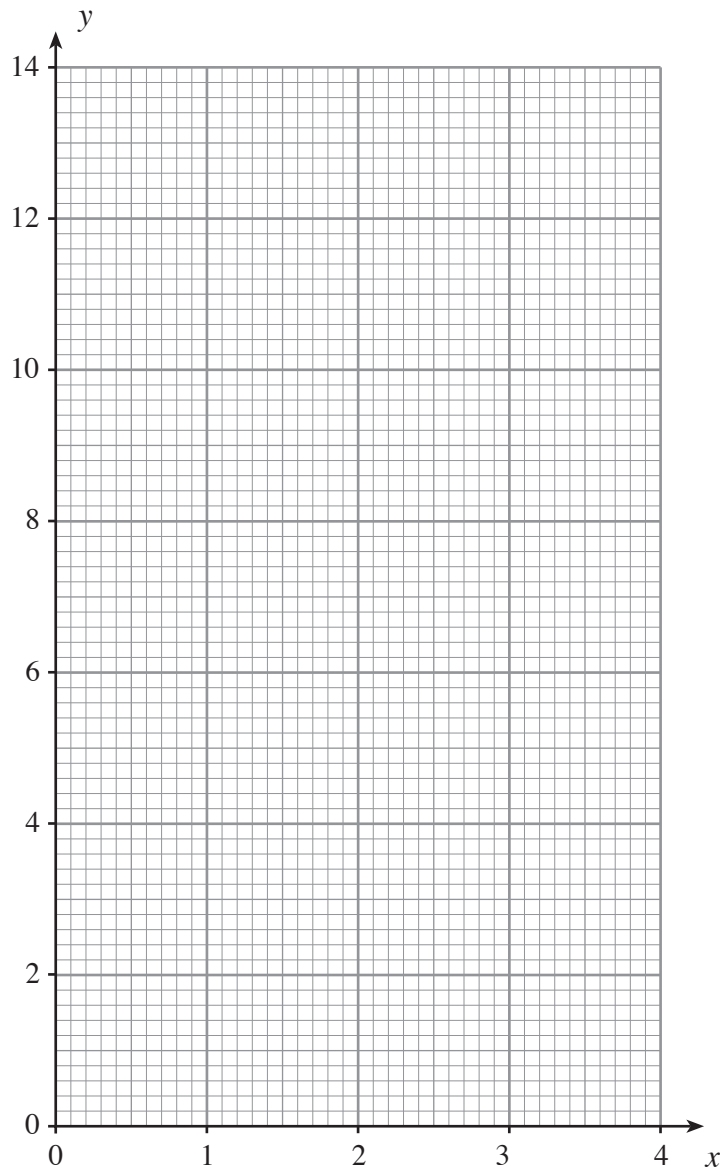
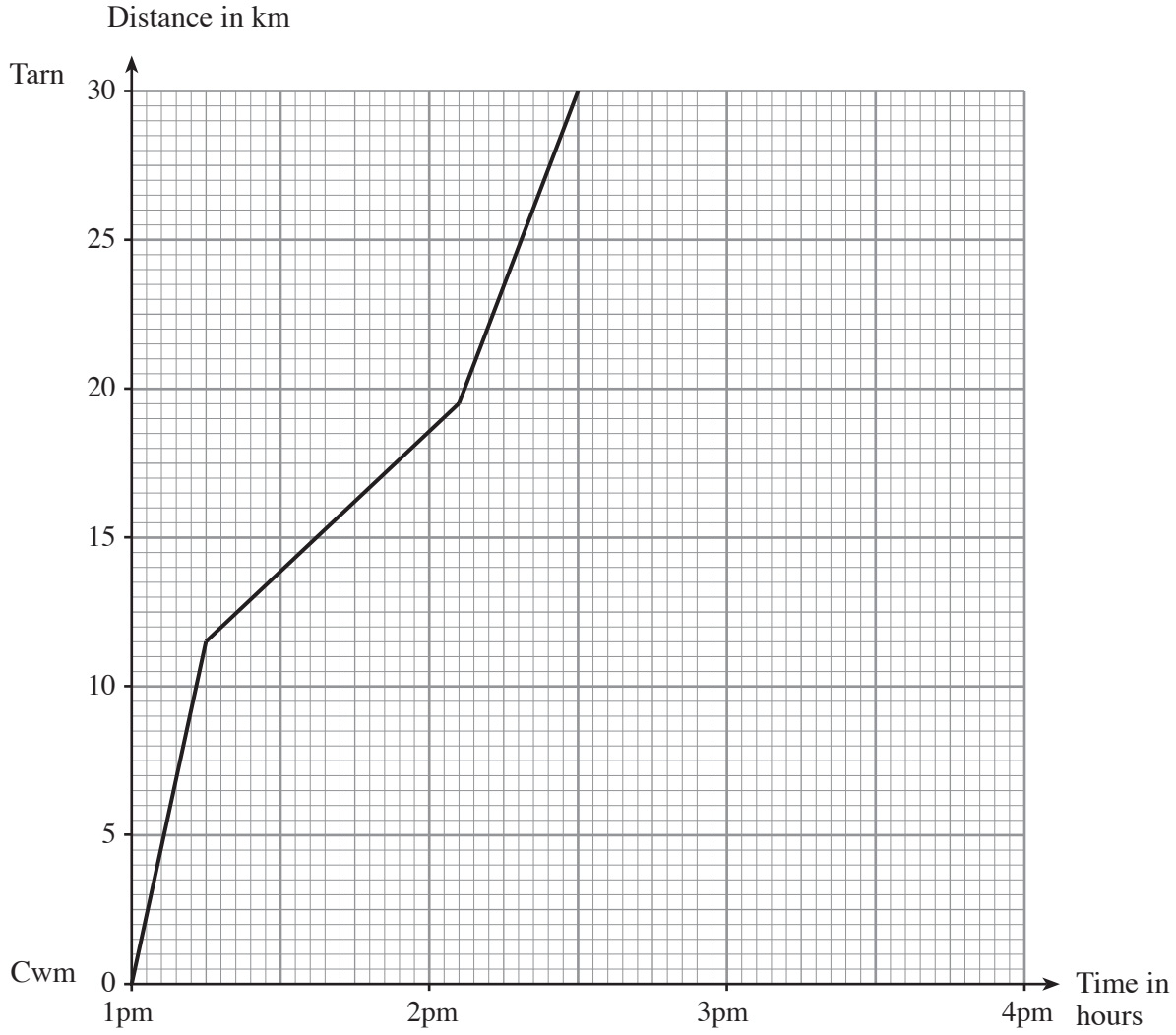
[3]



6. The distance – time graph shows a 30 km journey from Cwm to Tarn starting at 1 p.m.



Find the average speed for the 30 km journey.

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[2]

7. *(a)* Evaluate $\dfrac{2{\cdot}3 \times 4{\cdot}6}{5{\cdot}8 - 3{\cdot}6}$ correct to one decimal place.

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[2]

(b) Evaluate $\dfrac{1}{4} \div \dfrac{1}{3}$.

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[1]

(c) Find $\sqrt{5{\cdot}23^2 + 3{\cdot}21^2}$ giving your answer correct to 3 significant figures.

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[2]

(d) The length of a plank of wood is 950 mm, measured to the nearest 10 mm.
Write down the **least** and **greatest** possible values of the length of the plank.

Least value ..... mm Greatest value ..... mm [2]

8. Mal invests £5500 for 2 years at 6% per annum compound interest. What is the value of his investment after 2 years?

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[3]

9. The heights of 80 people were measured to the nearest centimetre. The table below shows a grouped frequency distribution of the heights.

Height (h centimetres)	Number of people
$151 \leqslant h \leqslant 157$	18
$158 \leqslant h \leqslant 164$	37
$165 \leqslant h \leqslant 171$	25

Find an estimate for the mean height of these people.

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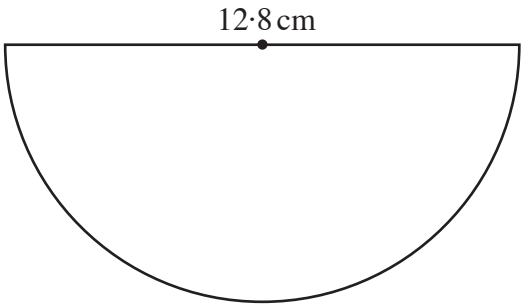
[4]

10. *(a)* Calculate the area of a semicircle with a diameter of 12·8 cm.



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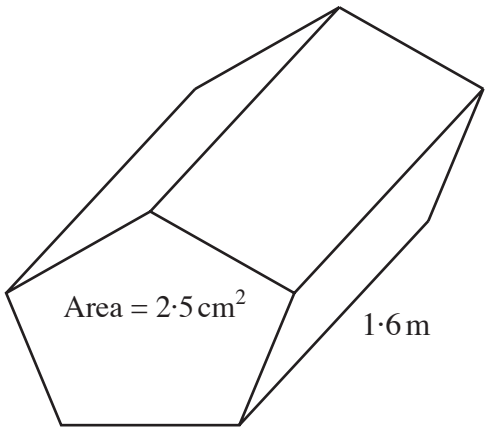
[2]

(b) Calculate the volume of a prism with an area of cross-section 2·5 cm^2 and length 1·6 m, giving your answer in cm^3.



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[3]

11. A solution to the equation

$$2x^3 + x - 8 = 0$$

lies between 1 and 2.
Use the method of trial and improvement to find this solution correct to 1 decimal place.

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[4]

12. *(a)* Factorise the expression $x^2 - 9x - 10$ and hence solve the equation $x^2 - 9x - 10 = 0$.

[3]

(b) Solve $\frac{24 - 2x}{5} = 6 - x$.

[3]

(c) Simplify $3x^6y^2 \times 4x^2y^5$.

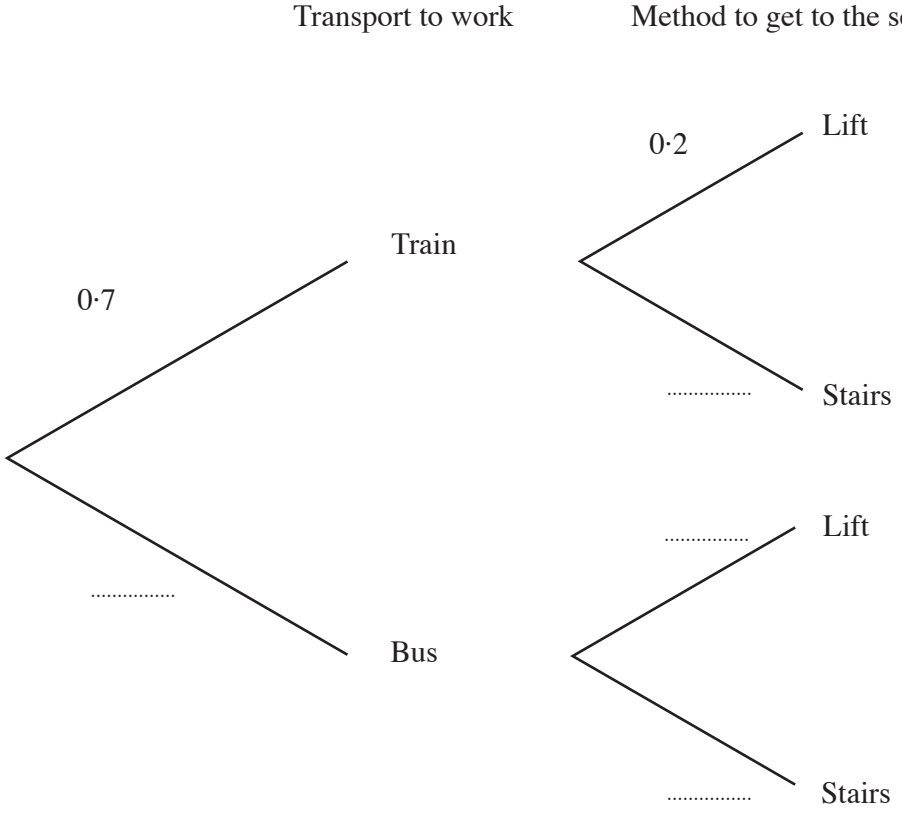
[2]

(d) Factorise $x^2 - 9$.

[1]

13. Jayne works in a second floor office, she can either take the train or bus to work. The probability that she takes the train to work is 0·7. When Jayne arrives at the office building where she works she can either use the stairs or the lift to the second floor. The probability that she uses the lift is 0·2.

(a) Complete the following tree diagram. [2]



(b) Calculate the probability that Jayne takes the train to work and uses the stairs to get to her office.

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[2]

14. *(a)* Write **each** of the following numbers in standard form.

(i) 6 million

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(ii) 0·0043

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[2]

(b) Find, in standard form, the value of $(8{\cdot}4 \times 10^3) \times (2 \times 10^5)$.

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[2]

15. *(a)* The triangle *EFG* is a right-angled triangle with $E\hat{F}G = 90°$. The length *EG* = 14·8 cm and $G\hat{E}F = 39°$.

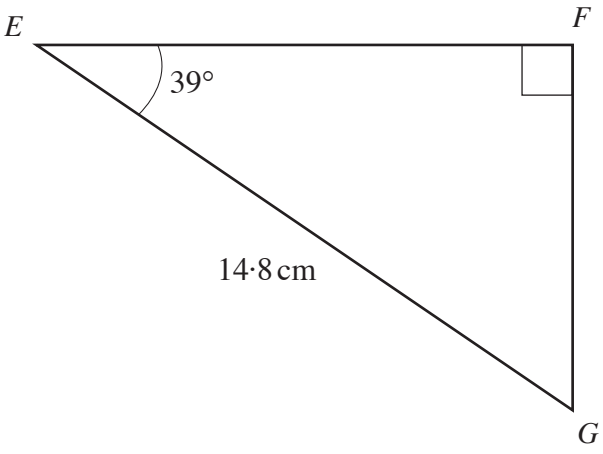

Diagram not drawn to scale.

Calculate the length of *EF*.

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[3]

(b) The triangle *RST* is a right-angled triangle with $\widehat{TRS} = 90°$. The length $RT = 12{\cdot}8$ cm and the length $RS = 18{\cdot}5$ cm.

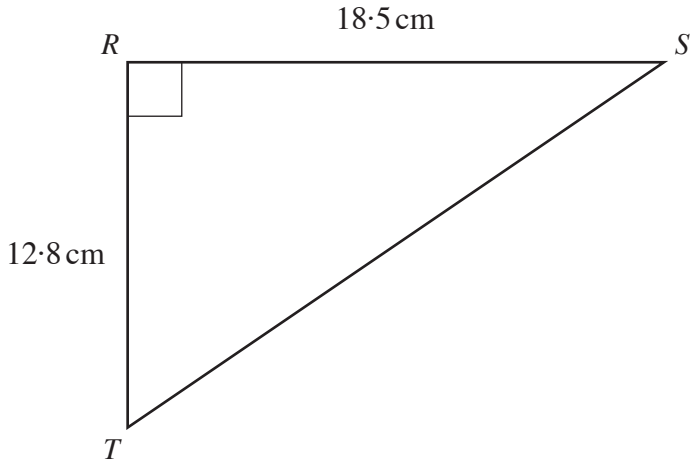

Diagram not drawn to scale.

Calculate the size of the angle $\widehat{RST}$.

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[3]

16. Use the formula method to solve the equation $3x^2 + 31x + 8 = 0$, giving solutions correct to two decimal places.

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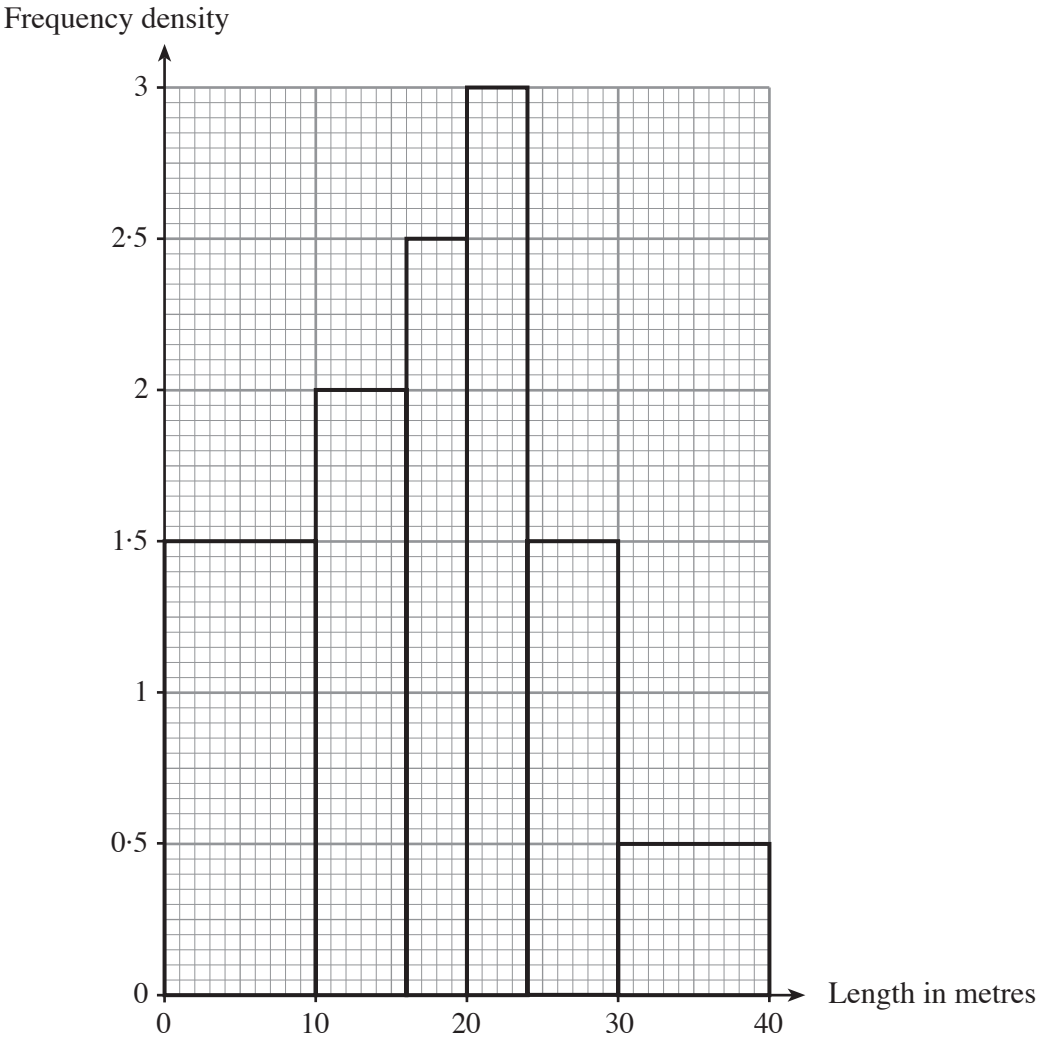
[3]

17. A survey was carried out to find the distribution of the lengths of boats in a marina. The histogram below illustrates the results of the survey.



Use the histogram to calculate the number of boats measured.

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[3]

18. Calculate the standard deviation of the following 10 numbers.

5·3, 6·1, 7·3, 4·5, 2·3, 4·4, 9·4, 3·4, 2·3, 7·2

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[3]

19. Three points *A*, *B* and *C* lie on the circumference of the circle centre *O*.
The tangent *RS* meets the circle at *A*.

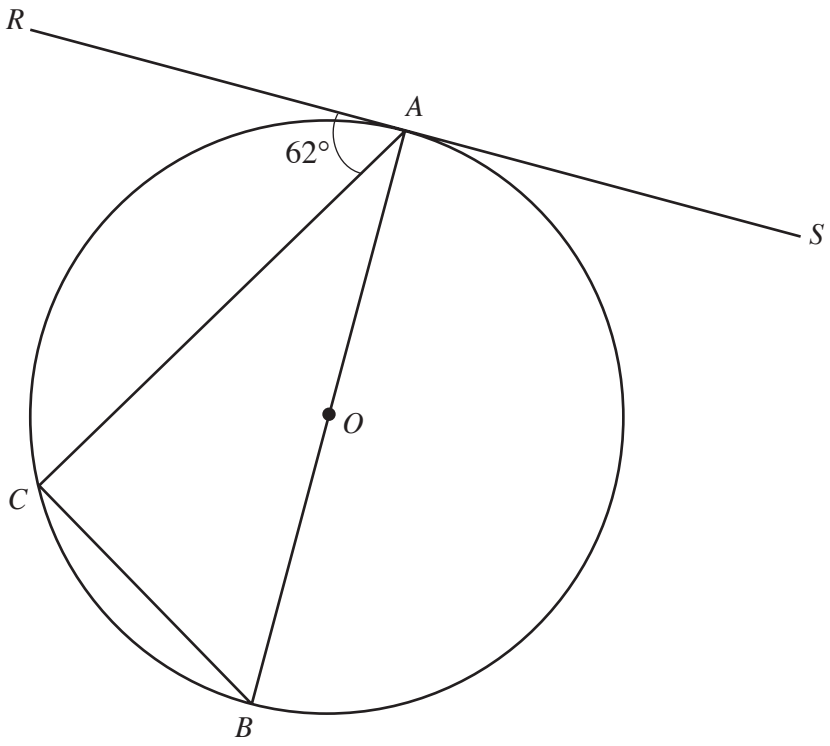

Diagram not drawn to scale.

Given that $R\hat{A}C = 62°$, find the following angles giving reasons for your answers.

(a) $A\hat{C}B$

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(b) $A\hat{B}C$

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[3]

20. The volume of a **hemisphere** is 34·2 cm^3. Calculate the radius of the **hemisphere**.

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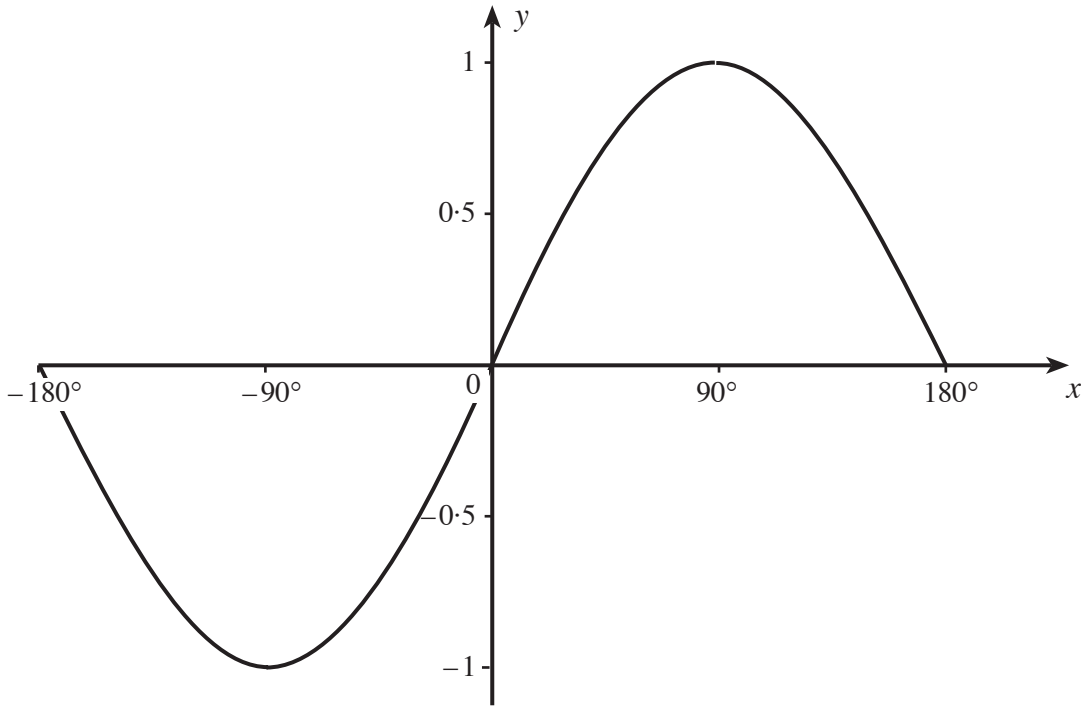
[3]

21. The diagram shows a sketch of the graph $y = \sin x$.



Using your calculator, find the values of x in the range $-180° \leqslant x \leqslant 180°$ which satisfy the equation $\sin x = 0{\cdot}2$.

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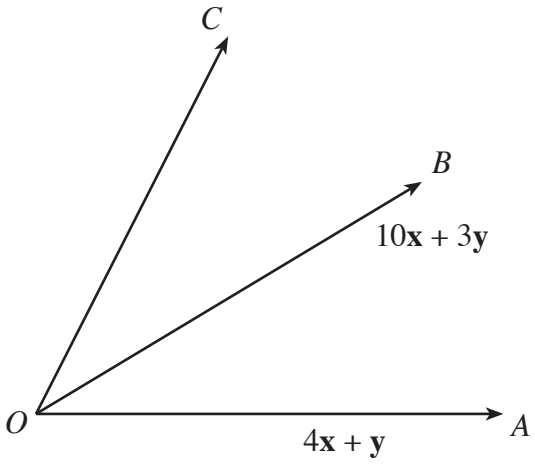
[2]

22. Vectors **OA**, **OB** and **OC** are shown in the diagram below.



You are given that **OA** = 4**x** + **y** and **OB** = 10**x** + 3**y**.

(a) Express **AB** in terms of **x** and **y** in its simplest form.

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[2]

(b) Given that **AC** = 1·5 **AB**, find **OC** in terms of **x** and **y**.

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[2]

23. The triangles ADB and BDC are such that $BC = 26{\cdot}2$ cm, $CD = 29{\cdot}3$ cm, $AB = 14{\cdot}4$ cm, $\widehat{ADB} = 50°$ and $\widehat{DCB} = 30°$.

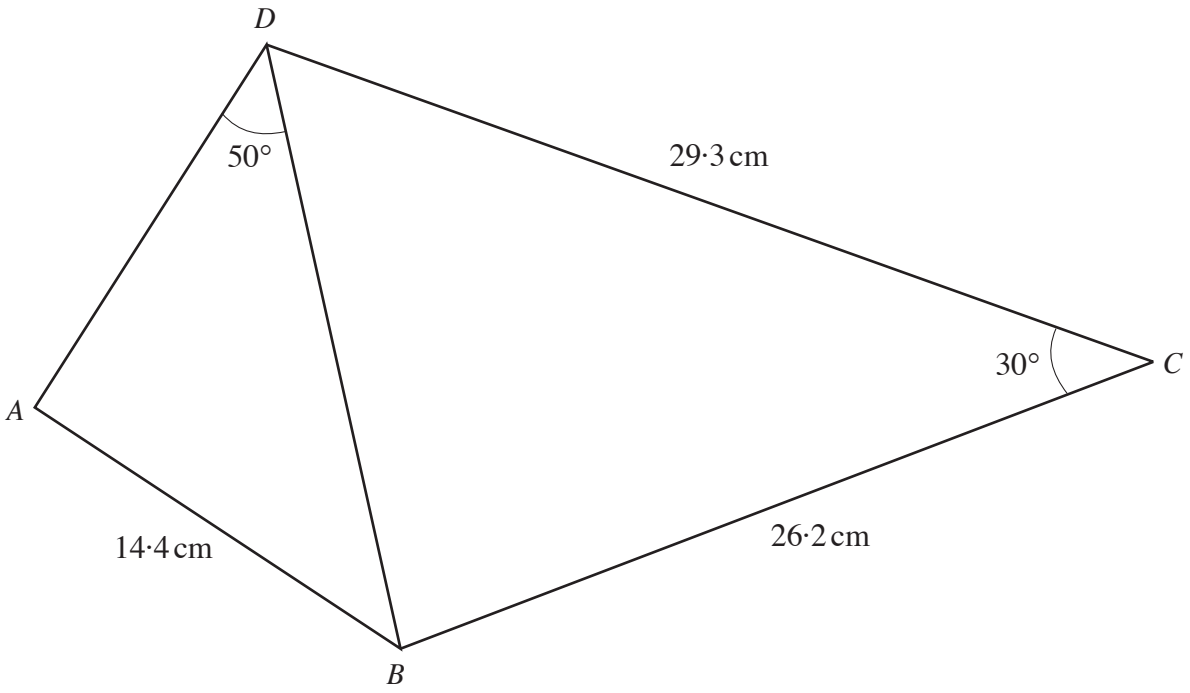

Diagram not drawn to scale.

Find the size of $\widehat{DAB}$.

[6]