

Candidate Name	Centre Number	Candidate Number

WELSH JOINT EDUCATION COMMITTEE
General Certificate of Secondary Education



CYD-BWYLLGOR ADDYSG CYMRU
Tystysgrif Gyffredinol Addysg Uwchradd

184/09

MATHEMATICS

HIGHER TIER PAPER 1

P.M. TUESDAY, 7 June 2005

(2 Hours)

**CALCULATORS ARE
NOT TO BE USED
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.

INFORMATION FOR CANDIDATES

You should give details of your method of solution.

Unless stated, diagrams are not drawn to scale.

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

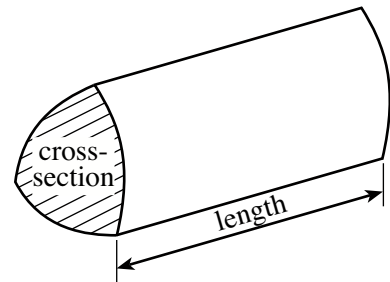
The number of marks is given in brackets at the end of each question or part-question.

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

For Examiner's use only		
Question	Maximum Mark	Mark Awarded
1	2	
2	4	
3	3	
4	4	
5	3	
6	4	
7	2	
8	7	
9	4	
10	4	
11	4	
12	3	
13	2	
14	4	
15	4	
16	5	
17	6	
18	5	
19	6	
20	6	
21	6	
22	2	
23	3	
24	7	
TOTAL MARK		

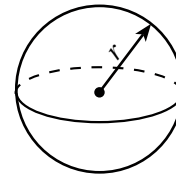
Formula List

Volume of prism = area of cross-section \times length



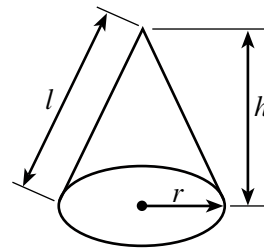
Volume of sphere = $\frac{4}{3} \pi r^3$

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



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

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

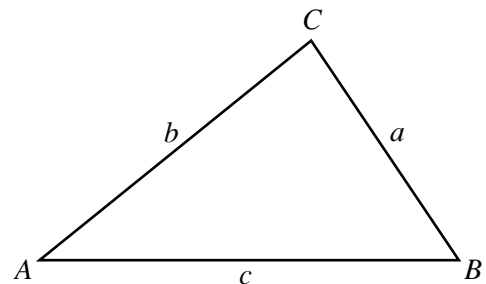


In any triangle ABC

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, \dots, x_n , having a mean of \bar{x} is given by

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

1. The lengths, in millimetres, of 300 engine bolts were measured. The table shows a grouped frequency distribution of the results.

Length (x mm)	$48 < x \leq 49$	$49 < x \leq 50$	$50 < x \leq 51$	$51 < x \leq 52$	$52 < x \leq 53$
Frequency	12	102	86	76	24

Write down the class interval in which the median of the data will be found.

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 [2]

2. Write down, in terms of n , the n th term of **each** of the following sequences.

(a) 14 19 24 29 34

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 [2]

(b) 2×1 4×3 6×5 8×7

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 [2]

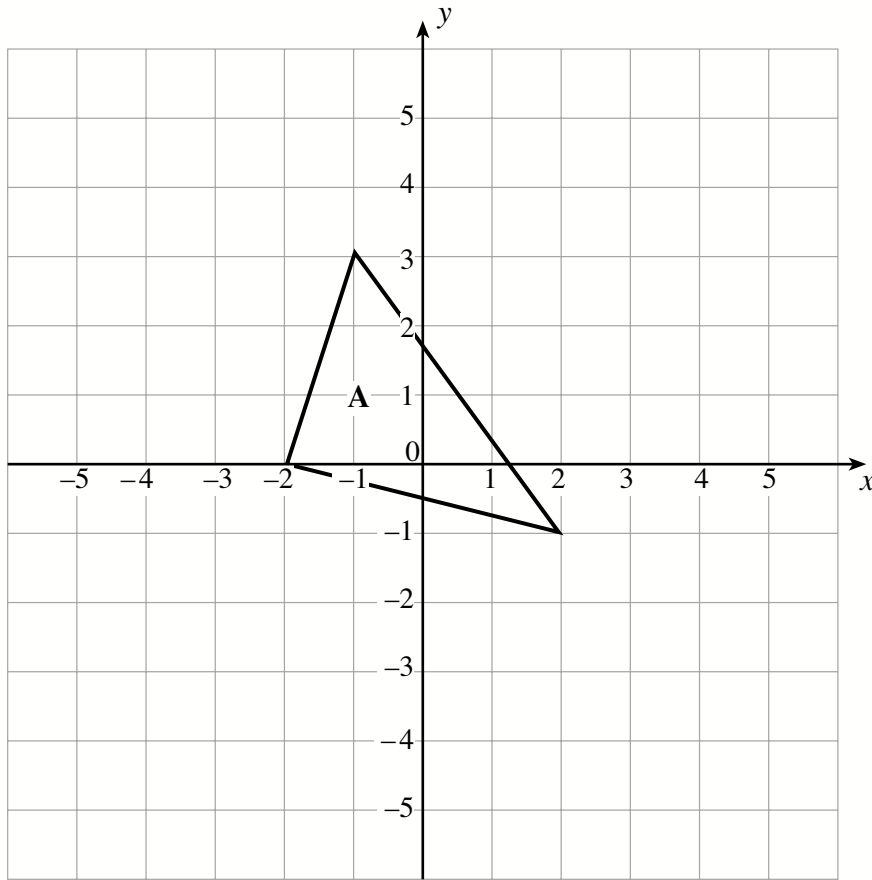
3. Solve the following equation.

$$12x + 19 = 2(8 + 5x)$$

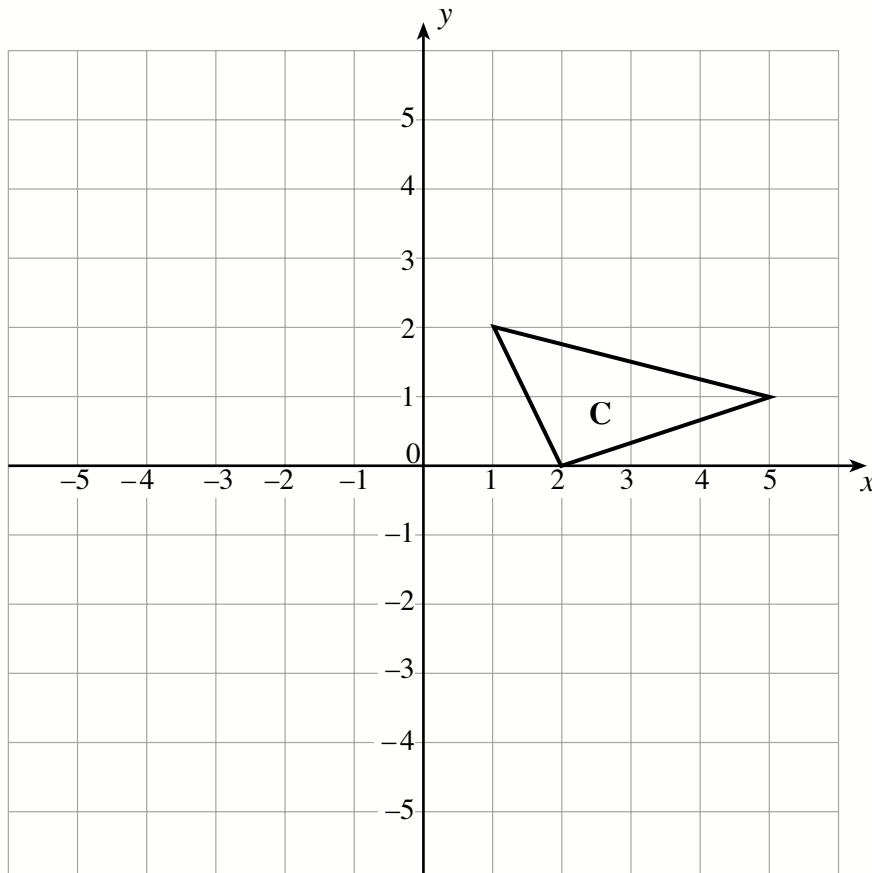
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 [3]

6. (a) Draw the image of the triangle A after reflection in the line $y = x$. Label the image B. [2]



- (b) Rotate the triangle C through 90° clockwise about the point $(-1, 2)$. Label the image D. [2]



7. Explain why the size of each of the exterior angles of a regular polygon cannot be 50° .

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[2]

8. A jug has a volume of 500 cm^3 , measured to the nearest 10 cm^3 .

(a) Write down the least and greatest possible values of the volume of the jug.

Least volume cm^3 Greatest volume cm^3

[2]

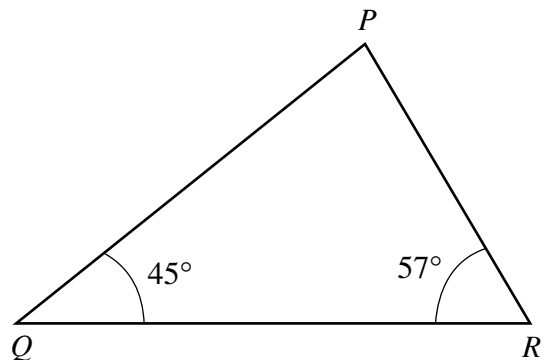
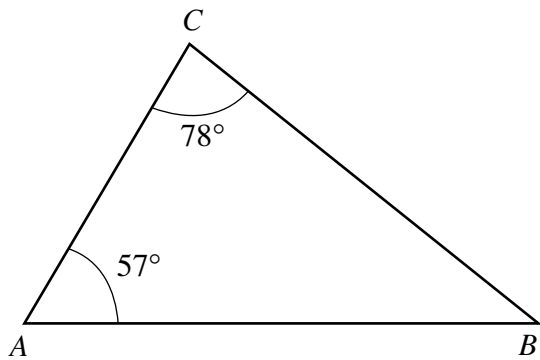
Water is poured from the jug into a tank of volume 15.5 litres measured to the nearest 0.1 litre.

(b) Explain, showing all your calculations, why it is always possible to pour water from 30 full jugs into the tank without overflowing.

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[5]

9. (a) Explain clearly why the following triangles are similar.



Diagrams not drawn to scale.

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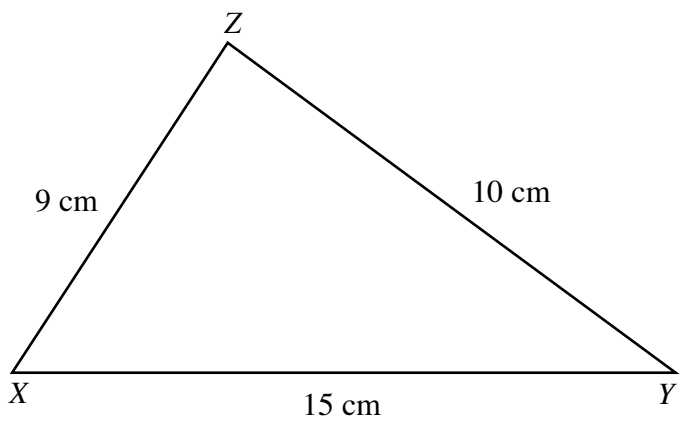
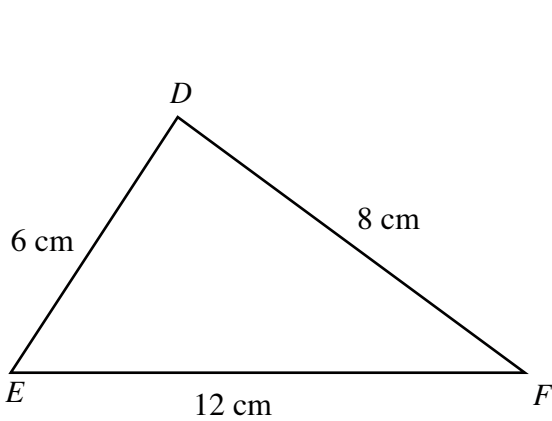
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[1]

(b) Explain clearly why the following triangles are **not** similar.



Diagrams not drawn to scale.

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[3]

10. Solve the following simultaneous equations by an algebraic (not graphical) method. Show all your working.

$$\begin{aligned}4x + 3y &= 1 \\6x + 4y &= 3\end{aligned}$$

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[4]

11. (a) Simplify the expression

$$3a^4b^3 \times 2a^3b.$$

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[2]

- (b) Factorise $x^2 + 2x - 35$.

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[2]

12. (a) Solve the inequality

$$7x - 3 < 14 + 4x.$$

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[2]

- (b) Write down the largest whole number that satisfies this inequality.

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[1]

15. (a)

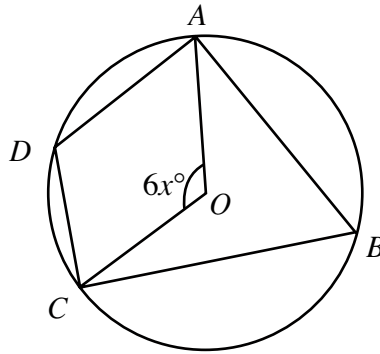


Diagram not drawn to scale.

The diagram shows four points A , B , C and D lying on the circumference of a circle centre O with $\widehat{AOC} = 6x^\circ$.

Find an expression for **each** of the following angles in terms of x .

(i) \widehat{ABC}

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[1]

(ii) \widehat{ADC}

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[1]

(b)

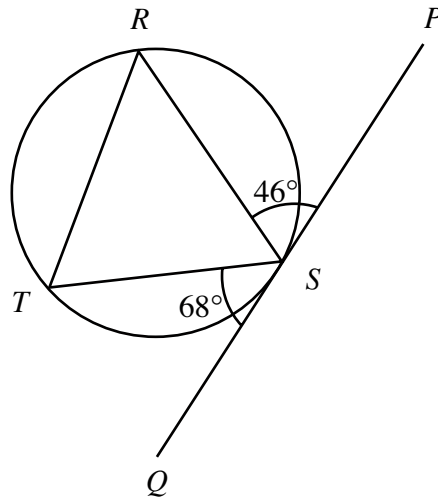


Diagram not drawn to scale.

Three points R , S and T lie on the circumference of the circle.
The tangent PQ touches the circle at S .

Find \widehat{TRS} , giving a reason for your answer.

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16. Make x the subject of the following formula.

$$y = \frac{3x + 4}{5x + 2}$$

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17. (a) Simplify **each** of the following.

(i) $3x^{\frac{3}{2}} \times 2x^{\frac{5}{2}}$

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(ii) $\frac{24x^{\frac{7}{2}}}{6x^{-\frac{3}{2}}}$

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[2]

(b) Express $25^{-\frac{1}{2}}$ as a fraction.

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[2]

18. Given that y is **inversely** proportional to x , and that $y = 3$ when $x = 10$,

(a) find an expression for y in terms of x ,

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[3]

(b) calculate y when $x = 1.5$,

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[1]

(c) calculate x when $y = 0.5$.

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19. (a) Factorise the expression $18x^2 + 27x + 4$ and hence solve the equation $18x^2 + 27x + 4 = 0$.

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(b) (i) Factorise $64x^2 - y^2$.

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(ii) Hence, simplify $\frac{64x^2 - y^2}{8x - y}$.

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[1]

20. One hundred raffle tickets are sold. The tickets sold are numbered from 1 to 100. The raffle tickets are placed in a drum for a draw. Two raffle tickets are selected, one ticket at a time and not replaced in the drum.

(a) Find the probability that one of the tickets drawn is odd and the other is even.

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(b) Find the probability that at least one of the tickets drawn is odd.

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21. (a) Express the following as a single fraction in its simplest form.

$$\frac{3}{x+2} + \frac{5}{x-3}$$

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- (b) Hence, or otherwise, solve the following equation.

$$\frac{3}{x+2} + \frac{5}{x-3} = 0$$

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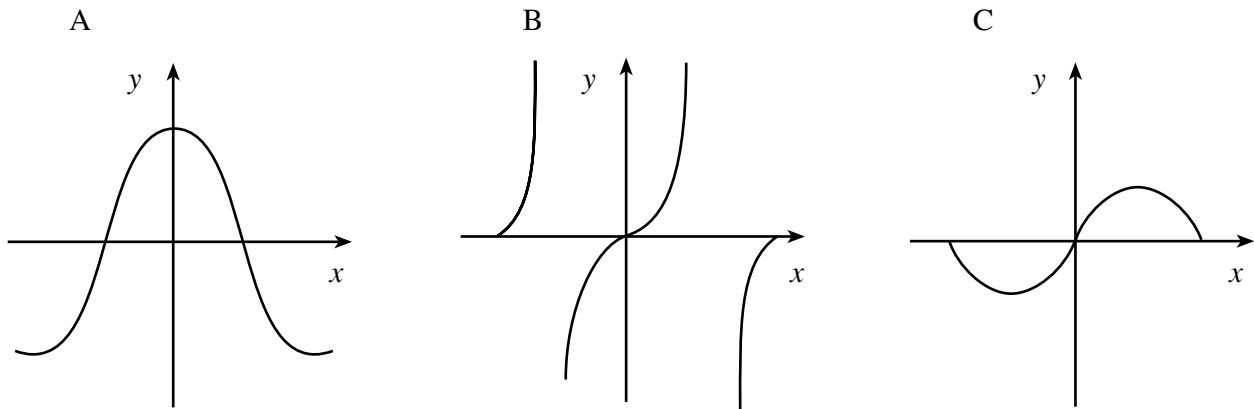
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[3]

22. Sketches of three graphs labelled A, B and C are shown below.



Complete the following table matching each function with the appropriate graph.

Function	Graph
$y = \cos x$	
$y = \sin x$	
$y = \tan x$	

[2]

23. Elections to choose members of a committee at a sports club take place every five years. When the committee was elected on 10th January 2003, the ages (in years) of its members had a mean of 41 and a standard deviation of 6.8.

(a) What was the mean and standard deviation of the ages of members of the committee on 10th January 2005?

Mean

Standard deviation

[2]

(b) The oldest member of the committee decides to leave and is not replaced. Describe the effect of this on the mean age of the committee.

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[1]

24. The diagram shows three vectors \mathbf{OA} , \mathbf{OB} and \mathbf{OC} .

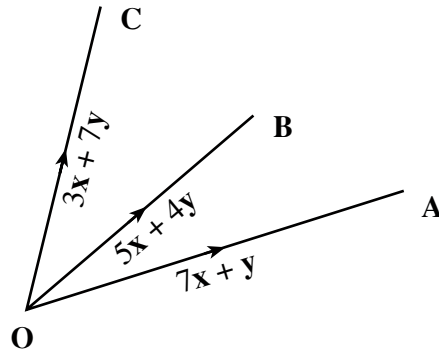


Diagram not drawn to scale.

Given that $\mathbf{OA} = 7x + y$, $\mathbf{OB} = 5x + 4y$ and $\mathbf{OC} = 3x + 7y$:

(a) Express each of the following in terms of x and y in their simplest form.

(i) \mathbf{AO}

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[1]

(ii) \mathbf{AB}

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[1]

(iii) \mathbf{AC}

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(b) State **two** geometrical relationships between AB and AC .

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[2]

(c) Given that $OD = 2OB$,

(i) find OD ,

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[1]

(ii) state what type of quadrilateral is $OADC$.

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