Candidate Name	Centre Number	Candidate Number

WELSH JOINT EDUCATION COMMITTEE

General Certificate of Secondary Education

CYD-BWYLLGOR ADDYSG CYMRU

Tystysgrif Gyffredinol Addysg Uwchradd

184/10

MATHEMATICS

HIGHER TIER PAPER 2

A.M. FRIDAY, 11 November 2005

(2 Hours)

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

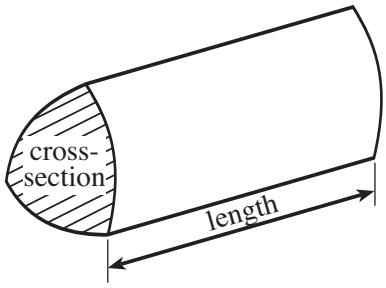
Scale drawing solutions will not be acceptable where you are asked to calculate.

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.

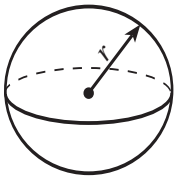
Formula List

Volume of prism = area of cross-section × length



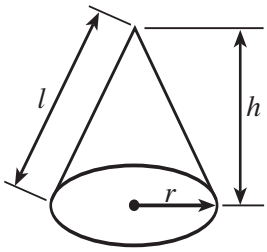
Volume of sphere = $\frac{4}{3}\pi r^3$

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



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

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

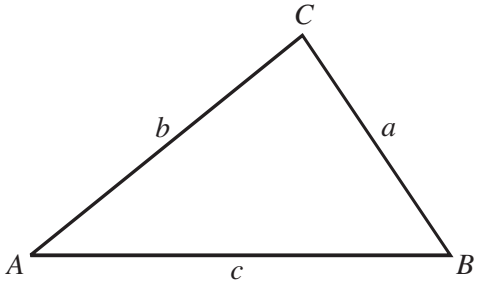


In any triangle ABC

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. *(a)* Write down, in terms of n, the nth term of **each** of the following sequences.

(i) 4, 8, 12, 16, 20, ...

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[1]

(ii) 2, 7, 12, 17, 22, ...

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[2]

(b) The nth term of another sequence of numbers is $3n^2 - 5$.
Write down the first three terms of this sequence.

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[2]

2. Calculate the length of the diagonal *PR* of a rectangular garden *PQRS* with sides 26·7 m and 18·5 m.

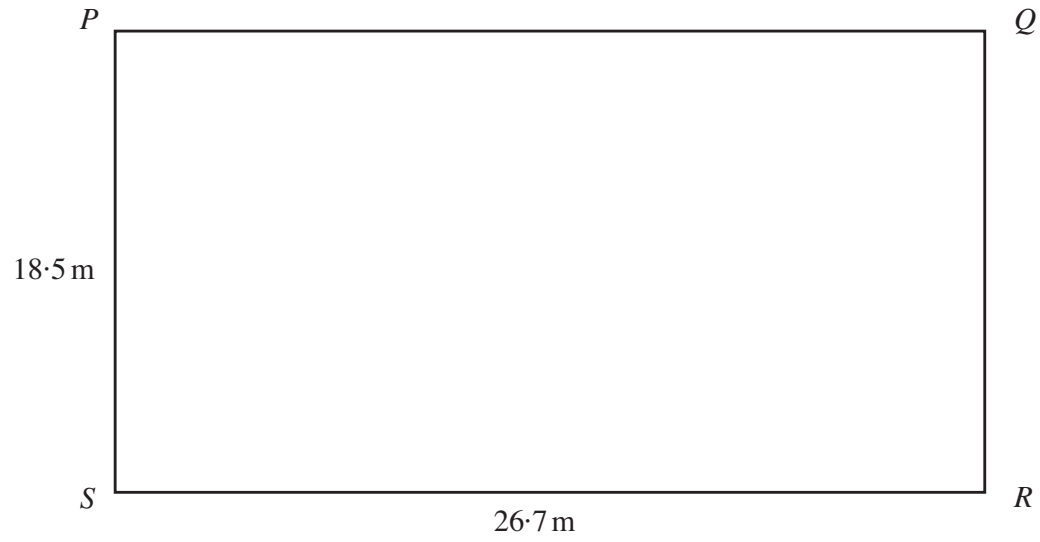

Diagram not drawn to scale.

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[3]

3. The times of 80 mobile phone calls were measured. The table shows a grouped frequency distribution of the results.

Time (t seconds)	Number of calls
$0 < t \leqslant 30$	1
$30 < t \leqslant 60$	7
$60 < t \leqslant 90$	15
$90 < t \leqslant 120$	27
$120 < t \leqslant 150$	18
$150 < t \leqslant 180$	12

Find an estimate for the mean time of the calls.

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[4]

4. Find the compound interest when £800 is invested for 3 years at 5% per annum.

[4]

5. A prism has a uniform cross-section of $54\,cm^2$ along its length of 22·7 cm and has a mass of 6·5 kg. Calculate the density of the metal from which the prism is made in g/cm^3.

[4]

6. A meal costs £54.05 inclusive of V.A.T. at $17\frac{1}{2}$ %. What was the cost of the meal before V.A.T. was added?

[3]

7. A solution to the equation

$$x^3 - 4x + 1 = 0$$

lies between 1·8 and 1·9.

Use the method of trial and improvement to find this solution correct to 2 decimal places.

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[4]

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

(i) 0·00076

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[1]

(ii) 415 000 000 000

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[1]

(b) Find, in standard form, the value of

$$(8{\cdot}1 \times 10^{12}) \times (5{\cdot}9 \times 10^{-4}).$$

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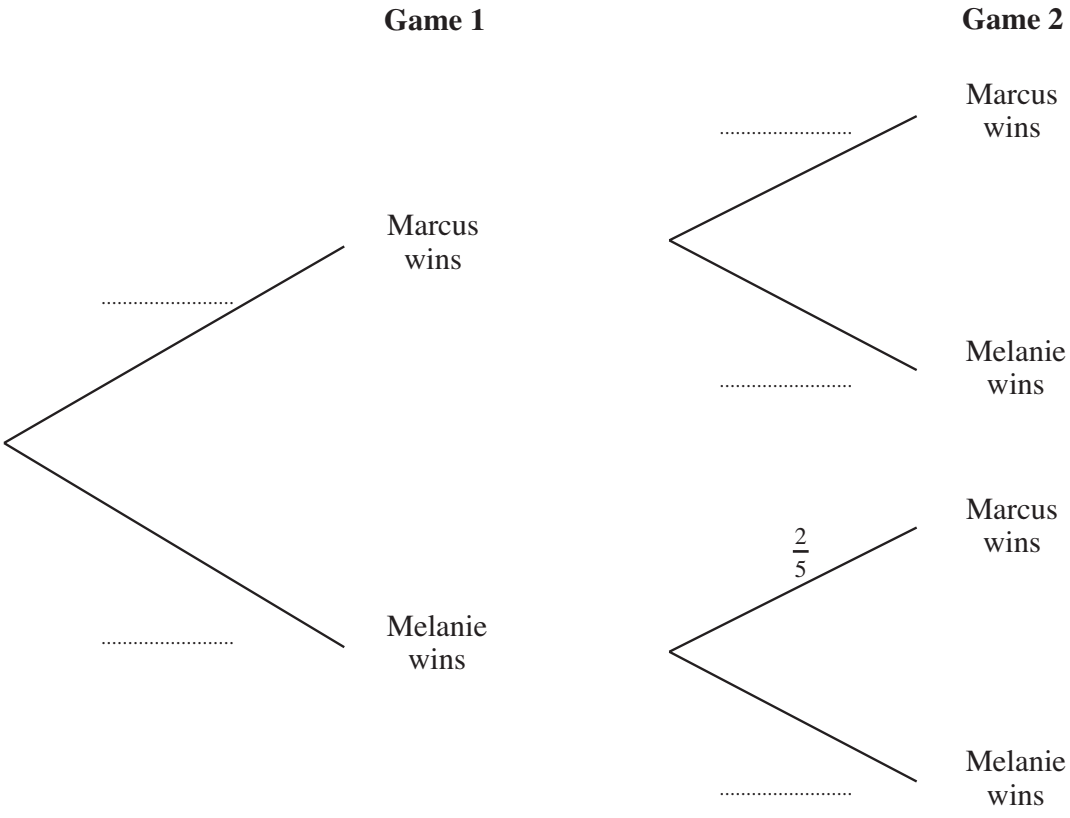
[2]

9. Whenever Marcus and Melanie play a game of tennis the probability that Marcus wins the game is $\frac{2}{5}$.

(a) Complete the following tree diagram to show the probabilities of what can happen when Marcus and Melanie play two games of tennis.



[2]

(b) Calculate the probability that Melanie wins both games.

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[2]

10. In the diagram *ABC* is a straight line and *BDE* is a straight line perpendicular to it. It is given that *AD* = 36 m, *BC* = 49 m, $D\hat{A}B = 43°$ and $E\hat{C}B = 54°$.

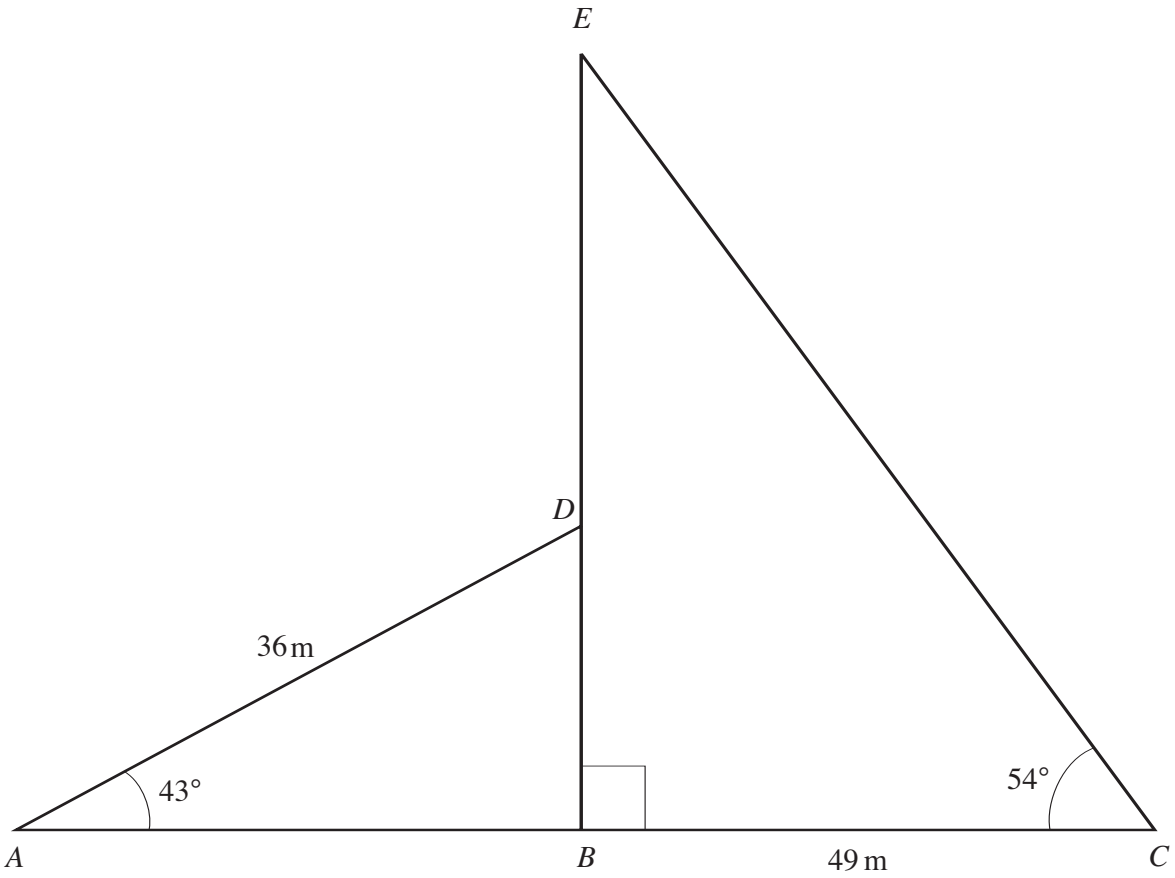

Diagram not drawn to scale.

Calculate the length of *DE*.

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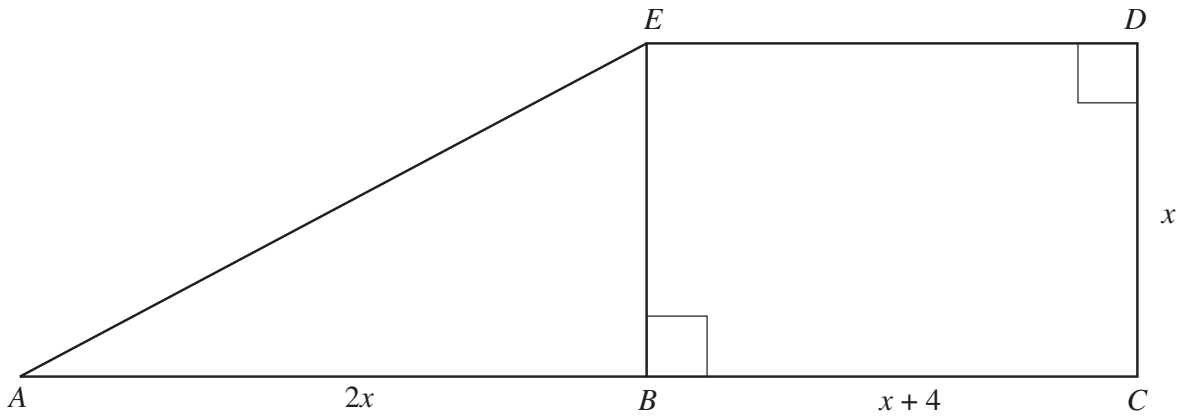
[6]

11. *(a)* In the diagram *ABC* is a straight line and *BCDE* is a rectangle. The side *DC* is of length x cm, *BC* is of length $(x + 4)$ cm and *AB* is of length $2x$ cm.



The diagram is not drawn to scale and the measurements are in centimetres.

The area of the whole shape *ABCDE* is 48 cm^2.
Giving full details of all your working, show clearly that x satisfies the equation

$$x^2 + 2x - 24 = 0.$$

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[2]

(b) Solve the equation to find the length of *DC*.

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[2]

12. Solve the following equation.

$$\frac{4x-1}{4} - \frac{2x-5}{8} = 3$$

[4]

13. Factorise the expression $12x^2 + 5x - 2$ and hence solve the equation $12x^2 + 5x - 2 = 0$.

[3]

14. Simplify **each** of the following.

(a) $(x + y)^0$

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[1]

(b) $\sqrt{x^{16}}$

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[1]

(c) $\dfrac{48 \times a^{\frac{9}{2}} \times a^{-\frac{7}{2}}}{12a^4}$

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[2]

15. Given that y is inversely proportional to x^2, and that $y = 4$ when $x = 5$,

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

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[3]

(b) calculate

(i) the value of y when $x = \frac{1}{2}$,

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[1]

(ii) a value of x when $y = 10\,000$.

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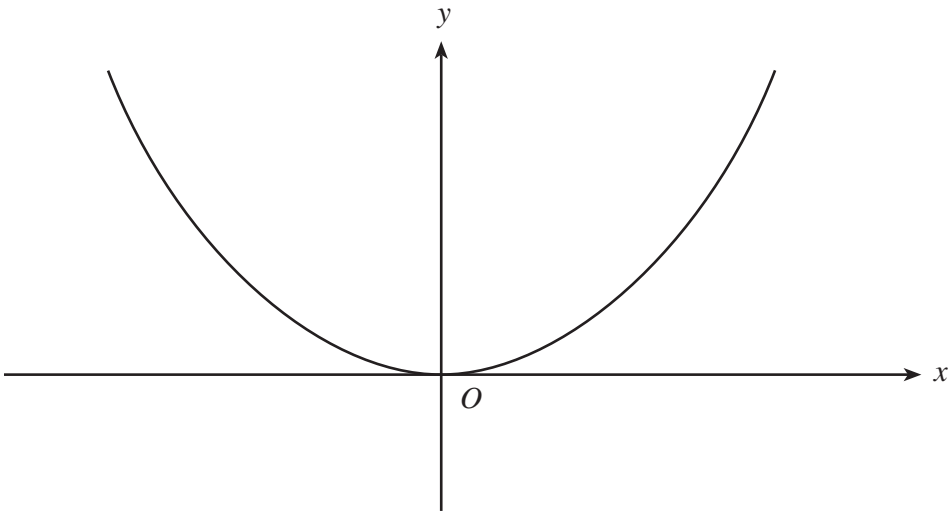
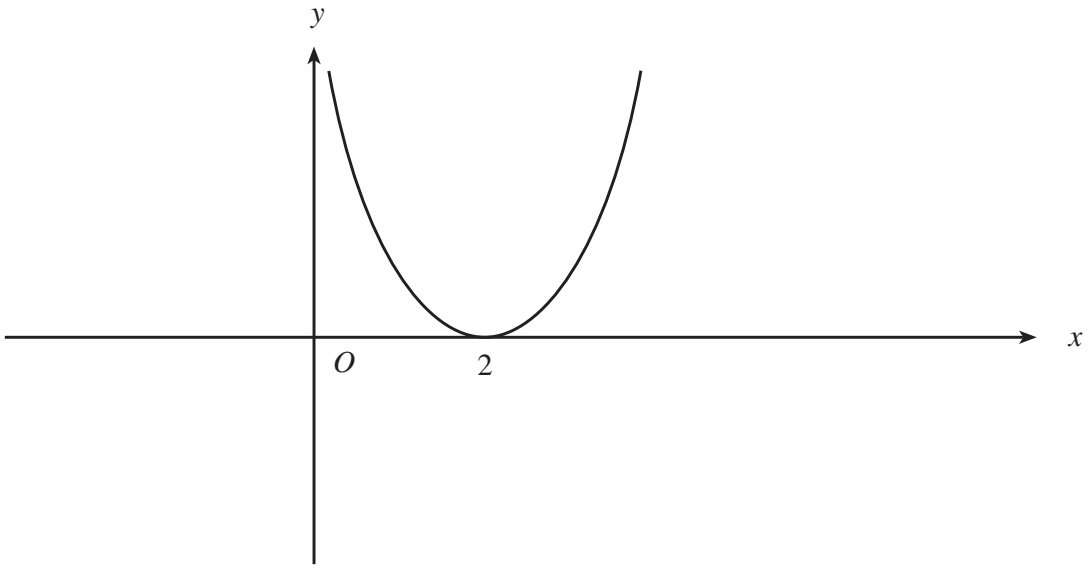
[2]

16. *(a)* The diagram shows a sketch of $y = x^2$.
On the same diagram, sketch the curve $y = 2x^2 + 1$.
Mark clearly the coordinates of the point where the curve crosses the y-axis.



[3]

(b) The diagram shows the sketch of $y = \mathrm{h}(x)$.
On the same diagram sketch the curve $y = \mathrm{h}(x - 4)$.
Mark clearly the coordinates of the point where the curve crosses the x-axis.



[2]

17. An international company employs people from around the world.
The number of people employed by the company in each country is given in the following table.

Country	Number of employees
Germany	2355
France	1340
Canada	6867
India	4342
Japan	9843

The company is organising a conference and decides to invite 40 employees to represent the views of the workforce.

Use a stratified sampling method to calculate how many people from each country should be invited to the conference.

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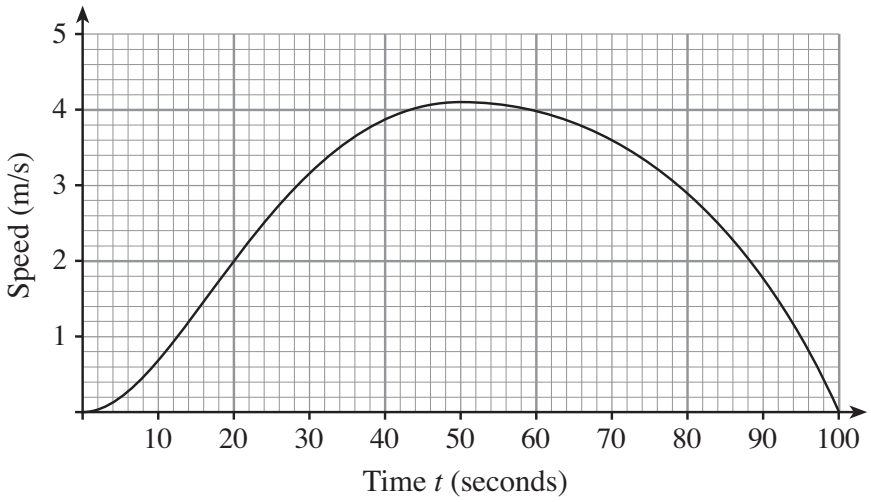
[4]

18. The graph below shows the speed of a train, in m/s, over a period of 100 seconds starting at time $t = 0$ seconds.



(a) Estimate the acceleration of the train at time $t = 40$ seconds.

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[3]

(b) The table below gives the speed of the train between $t = 70$ and $t = 100$.

Time t (seconds)	70	80	90	100
Speed (m/s)	3·6	2·9	1·8	0

Use the trapezium rule with the values taken from the table to estimate the distance, in metres, travelled by the train between $t = 70$ and $t = 100$ seconds.

[3]

19. For the first x seconds of a journey the average speed of a cyclist is 4 m/s. For the next $(5x + 2)$ seconds the average speed is x m/s. The total distance travelled is 128 metres.

(a) Show that x satisfies the equation $5x^2 + 6x - 128 = 0$.

[3]

(b) Use the formula method to solve the equation $5x^2 + 6x - 128 = 0$, giving solutions correct to one decimal place.

[3]

(c) Hence find the total time for the journey.

[1]

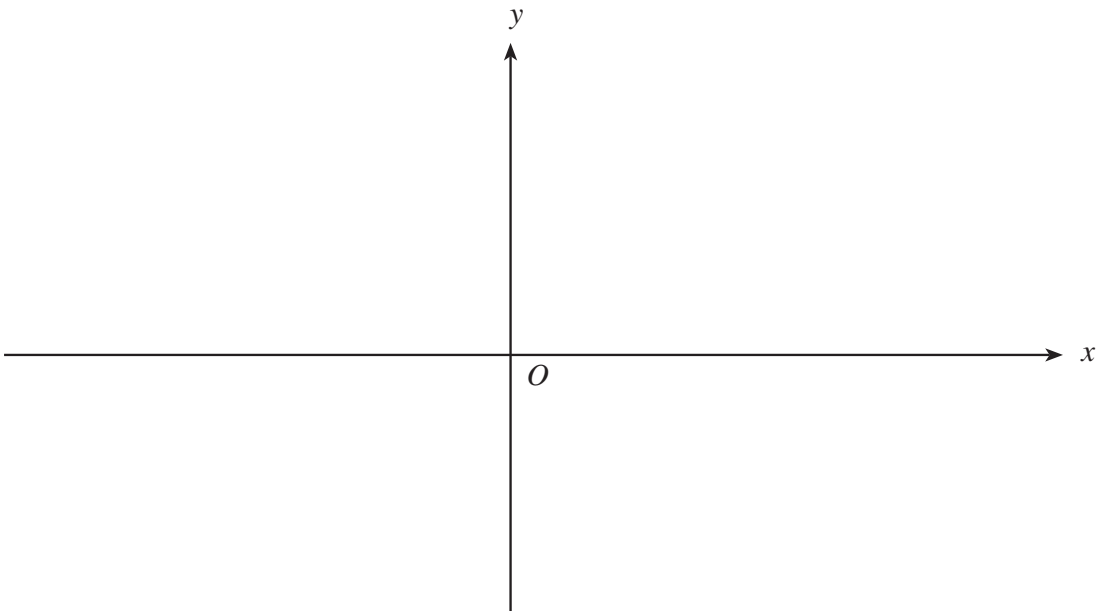
20. The volume of a hemisphere is 7π cm^3. Calculate the radius of the hemisphere.

[4]

21. Express $\sqrt{180}$ in the form $a\sqrt{b}$, where a is a whole number and b is a prime number.

[2]

22. *(a)* Using the axes below, **sketch** the graph of $y = \cos x$ for values of x from $-180°$ to $180°$. [2]



(b) Find all solutions of the following equation in the range $-180°$ to $180°$.

$$\cos x = -0{\cdot}829$$

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[2]

23. The diagram shows triangle *GHK*.

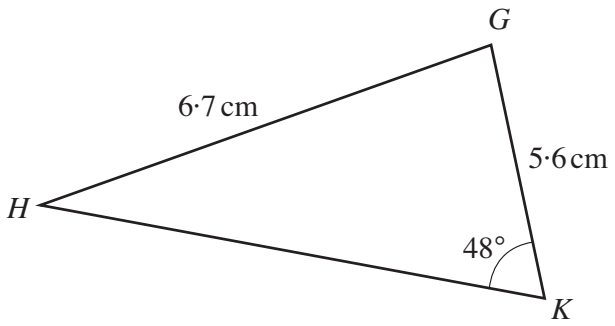

Diagram not drawn to scale.

Given that $GH = 6{\cdot}7\,\text{cm}$, $GK = 5{\cdot}6\,\text{cm}$ and $G\hat{K}H = 48°$, calculate the area of the triangle *GHK*.

[6]