Surname		Centre Number	Candidate Number
Other Names			0

WJEC CBAC

GCSE

4353/02

||||||| A14-4353-02

MATHEMATICS (UNITISED SCHEME)
UNIT 3: Calculator-Allowed Mathematics
HIGHER TIER

A.M. MONDAY, 10 November 2014

1 hour 45 minutes

For Examiner's use only		
Question	**Maximum Mark**	**Mark Awarded**
1.	2	
2.	3	
3.	4	
4.	5	
5.	2	
6.	4	
7.	6	
8.	8	
9.	5	
10.	3	
11.	4	
12.	4	
13.	3	
14.	3	
15.	5	
16.	5	
17.	3	
18.	4	
19.	7	
20.	4	
21.	6	
Total	90	

ADDITIONAL MATERIALS

A calculator will be required for this paper.

A ruler, a protractor and a pair of compasses may be required.

INSTRUCTIONS TO CANDIDATES

Use black ink or black ball-point pen.

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 when appropriate.

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.

You are reminded that assessment will take into account the quality of written communication (including mathematical communication) used in your answer to question **7**.

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Formula List

Area of trapezium $= \dfrac{1}{2}(a+b)h$
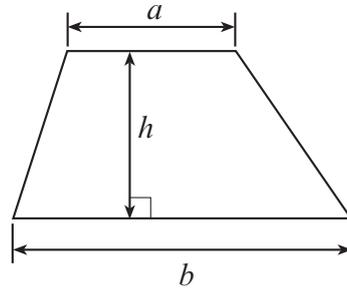
Volume of prism = area of cross-section × length
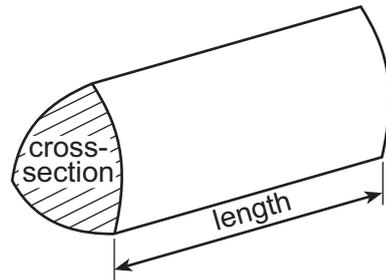
Volume of sphere $= \dfrac{4}{3}\pi r^3$

Surface area of sphere $= 4\pi r^2$
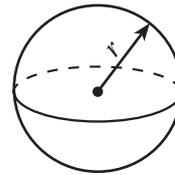
Volume of cone $= \dfrac{1}{3}\pi r^2 h$

Curved surface area of cone $= \pi r l$
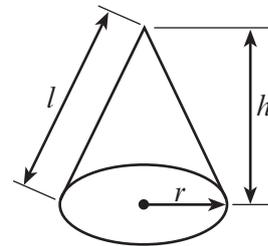
In any triangle ABC

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

    Cosine rule $a^2 = b^2 + c^2 - 2bc \cos A$

    Area of triangle $= \dfrac{1}{2}ab \sin C$
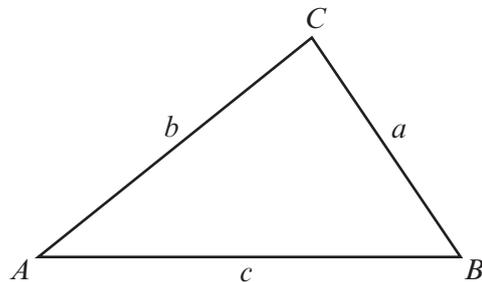
The Quadratic Equation

The solutions of $ax^2 + bx + c = 0$

where $a \neq 0$ are given by

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

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1. Given the formula $v = u + at$, find v when $u = -20$, $a = 9\cdot8$ and $t = 5$. [2]

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2. Ioan, Meinir and Gerallt share a sum of money.

Ioan receives $\frac{1}{5}$, Meinir receives $\frac{3}{10}$, and Gerallt receives $\frac{1}{2}$.

In what ratio do they share the money?
Give your ratio in its simplest form. [3]

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Ioan : Meinir : Gerallt

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3. A theme park collects a large amount of data for every day that it is open.
The following table shows the data collected for six randomly selected days in August 2014.

Day	1	2	3	4	5	6
Number of visitors (thousands)	4	6	14·6	10·4	9·8	13
Weight of litter collected (tonnes)	1·6	3	6·1	3·8	4·6	5

(a) On the graph opposite, draw a scatter diagram to show this information. [2]

(b) Draw a line of best fit on your scatter diagram. [1]

(c) Use your line of best fit to estimate the weight of litter that would be collected on a day when 12 000 people visited the park. [1]

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Weight of litter collected
(tonnes)

Number of visitors (thousands)

Turn over.
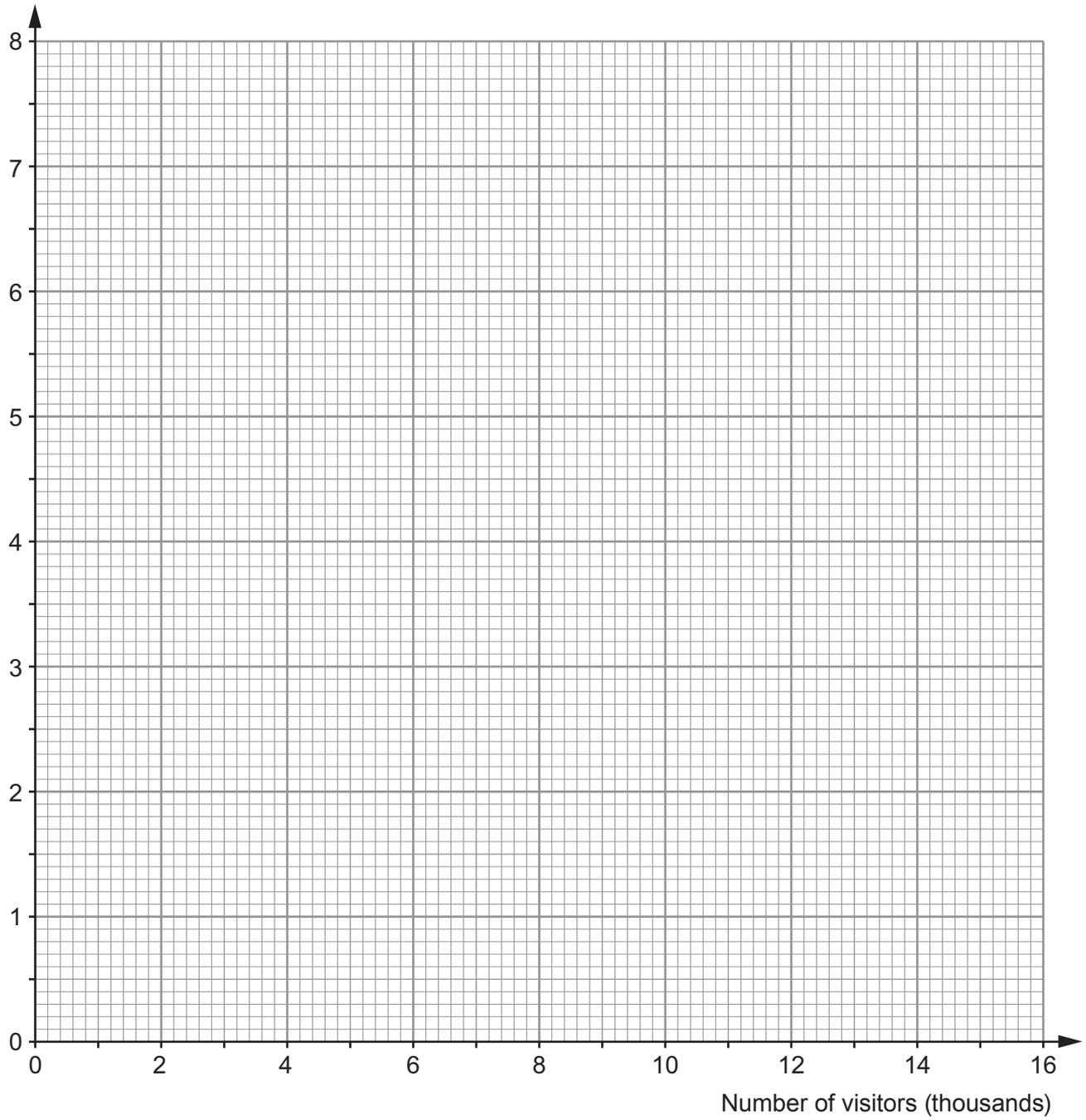
4. Danny lives 1500 m away from his school. He walks to school at the same constant speed every day starting at 08:00.
The travel graph below shows the start of his journey one day.

 (a) Complete the travel graph using the following information:

 • When he had travelled 1000 m he realised that he had left his dinner money in the house, so he turned around, arriving back at his home at 08:30.

 • He immediately set off from home running at a steady speed, so that he ran a distance of 500 m every 5 minutes, until he reached his school. [3]

Distance from Danny's house (metres)

Time of day
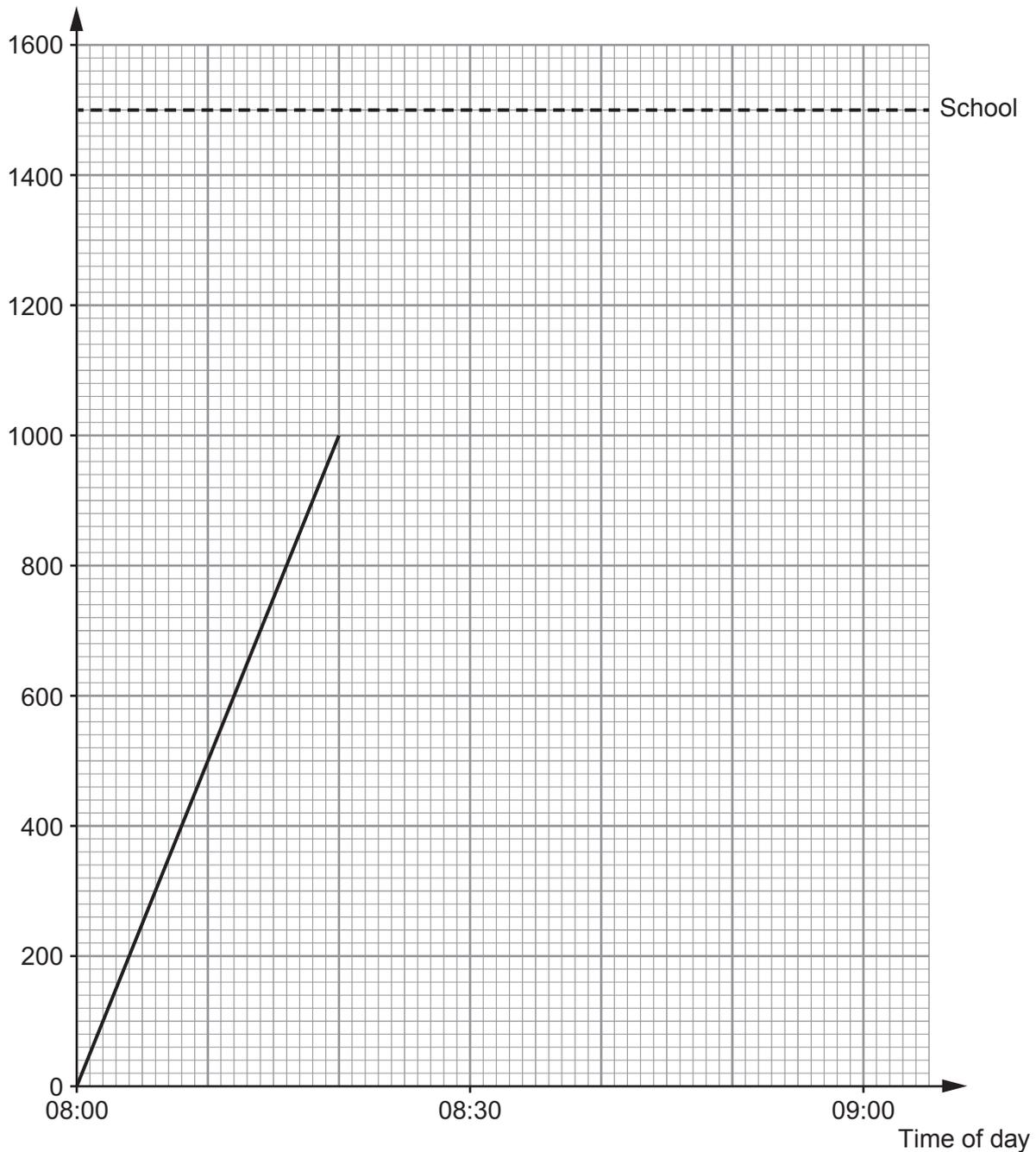
(b)   Danny arrived at school later than usual. How many minutes later than usual did Danny arrive at school?   [2]

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5.   Find the size of each interior angle of a regular pentagon.   [2]

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6. Using a ruler and a pair of compasses, construct an accurate diagram of the quadrilateral shown below.
You must show all your construction lines.
One line has already been drawn for you. [4]

Diagram not drawn to scale

10 cm

(4353-02)

7. *You will be assessed on the quality of your written communication in this question.*

A bathroom mirror is shown below. Two vertical and two horizontal overlapping wooden pieces are placed over the mirror as shown. The width of each of the wooden pieces is 2 cm.

Diagram not drawn to scale

Calculate the area of the mirror that is **not** covered by the wooden pieces.
Show all your working. [6]

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Turn over.

8. *(a)* Solve the equation $\dfrac{12}{y} = 5$. [1]

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(b) Solve the equation $4(2x - 5) = 3x - 5$. [3]

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(c) A solution to the equation $x^3 + 10x - 20 = 0$ lies between 1·5 and 1·6.
Use the method of trial and improvement to find this solution correct to 2 decimal places. [4]

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9. A gas company uses the following information to calculate Hywel's monthly payment.

- Hywel is expected to use 18 000 units of gas this year

- For the first 2000 units of gas used, he will be charged 6·883p per unit

- For the remaining units of gas used, he will be charged 2·987p per unit

- VAT of 5% is to be charged

Calculate Hywel's **monthly** payment, correct to the nearest penny.
Show all your working. [5]

Monthly payment = £ ....

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10. The diagram below shows a ladder resting against the top of a vertical wall.
The ladder is 4·9 m long and the wall is 4 m high.
How far is the bottom of the ladder from the base of the wall? [3]

Diagram not drawn to scale

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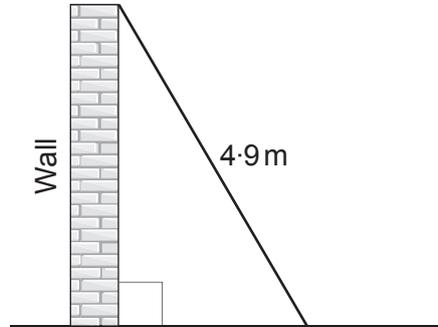
11. A golfer hits 40 golf balls with one of his clubs.
He records the distance each ball travels. The grouped frequency table shows his results.

Distance travelled, d, in yards	Frequency
$75 < d \leqslant 80$	4
$80 < d \leqslant 85$	13
$85 < d \leqslant 90$	17
$90 < d \leqslant 95$	6

Calculate an estimate for the mean distance travelled by these balls. [4]

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12. Triangle *ABC* is isosceles with perpendicular height 12 cm and $A\hat{C}B = 72°$.
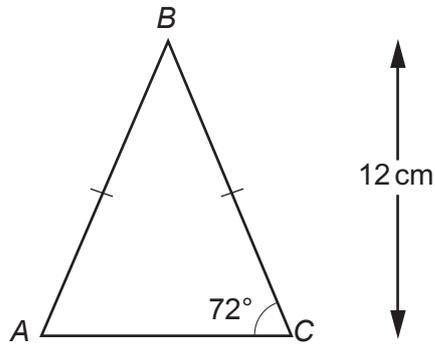
Diagram not drawn to scale

Calculate the length *AC*. [4]

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13. Our Sun is a star within a galaxy called the Milky Way.

Scientists estimate that there are about 300 billion stars in the Milky Way, and that there are about 500 billion galaxies in the Universe.
1 billion = 1000 million.
Assuming that each galaxy has the same number of stars as in the Milky Way, approximately how many stars are there in the Universe?
Give your answer in standard form. [3]

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14. *AOD* and *BOC* are two diameters of a circle, centre *O*. Two triangles are formed by joining *A* to *B* and *C* to *D*.
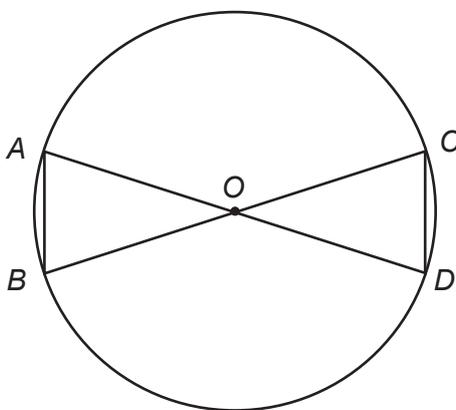
Diagram not drawn to scale

Prove that the triangles are congruent. [3]

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15. *(a)* Factorise the expression $9a^3b + 6a^2$. [2]

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(b) Factorise the expression $x^2 + 8x - 20$, and hence solve the equation $x^2 + 8x - 20 = 0$. [3]

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16. A solid metal cube has sides of length 7 cm.
The cube is melted down and recast into solid spheres of radius 1·5 cm.
Calculate the maximum number of spheres that can be formed. [5]

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17.

Diagram not drawn to scale

Calculate the length *PQ*. [3]

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Turn over.

18. The diagram shows an inverted hollow cone of height 12 cm and a volume of 3510 cm^3.
The cone contains 130 cm^3 of water.
Calculate the height of the water in the cone. [4]

Diagram not drawn to scale

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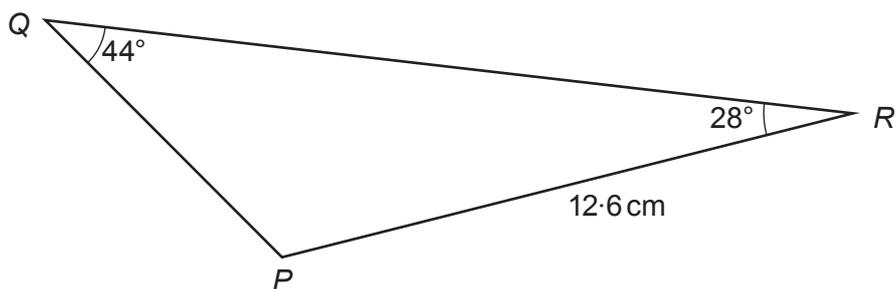
19. *(a)* Show that the equation $\dfrac{5}{x-2} + \dfrac{4}{x+1} = 2$ can be written as $2x^2 - 11x - 1 = 0$. [4]

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(b) Hence solve the equation $\dfrac{5}{x-2} + \dfrac{4}{x+1} = 2$.

Give your answers correct to 2 decimal places. [3]

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20. The heights of a group of adult males are recorded. The table below shows the results.

Height, x, in cm	Frequency	Frequency density
$160 < x \leqslant 165$	4	0·8
$165 < x \leqslant 170$	7	
$170 < x \leqslant 175$	13	
$175 < x \leqslant 180$	10	
$180 < x \leqslant 190$	....	0·6

(a) Use the table to complete the histogram on the opposite page. [3]

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Frequency density

Height, x, in cm

160   165   170   175   180   185   190
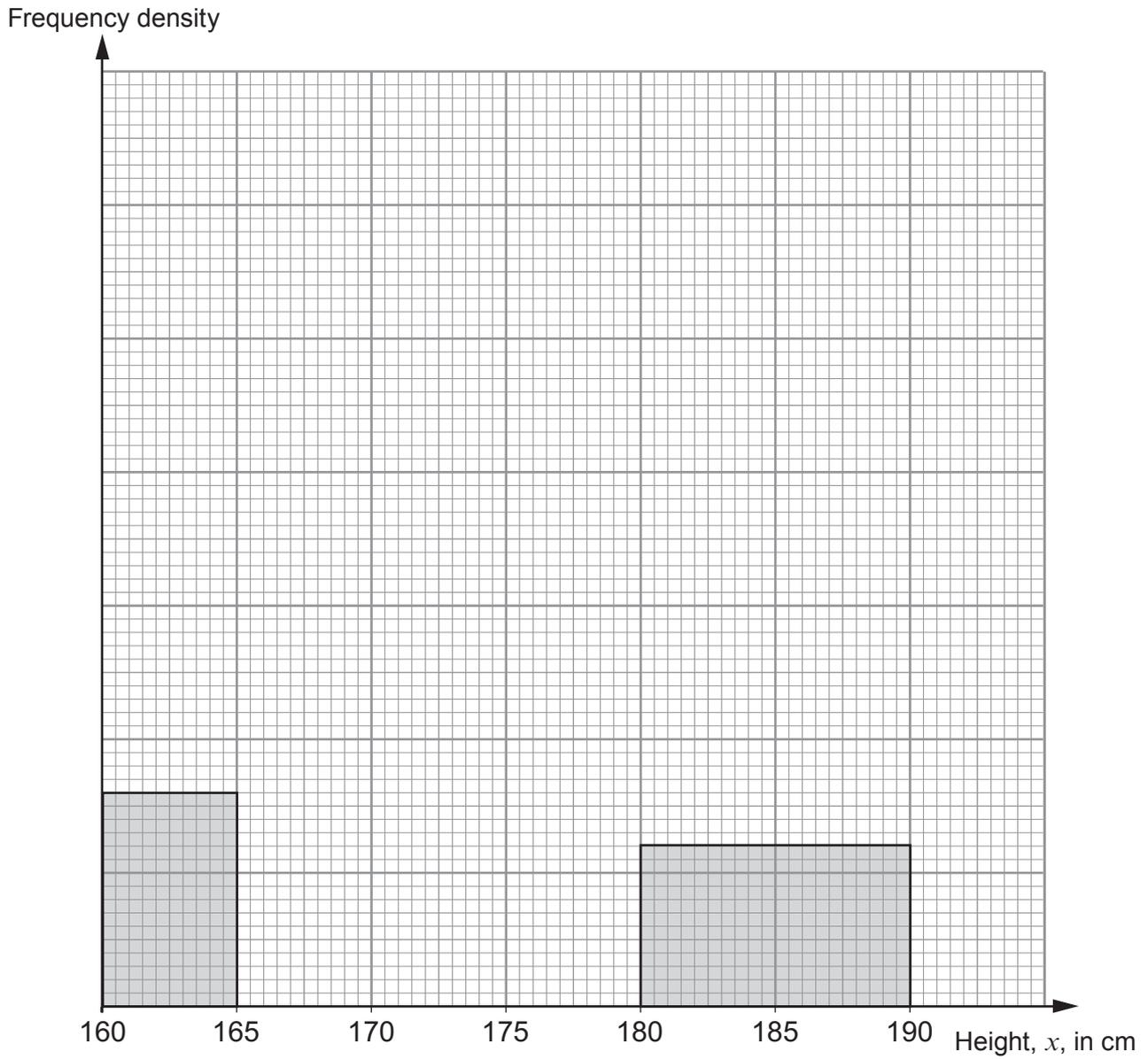
(b)   Find the number of adult males whose heights, in cm, are in the group $180 < x \leqslant 190$.

[1]

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Turn over.

21. The graph of $y = 2x^2 + 3$, for values of x between $x = 0$ and $x = 3$, is shown below.
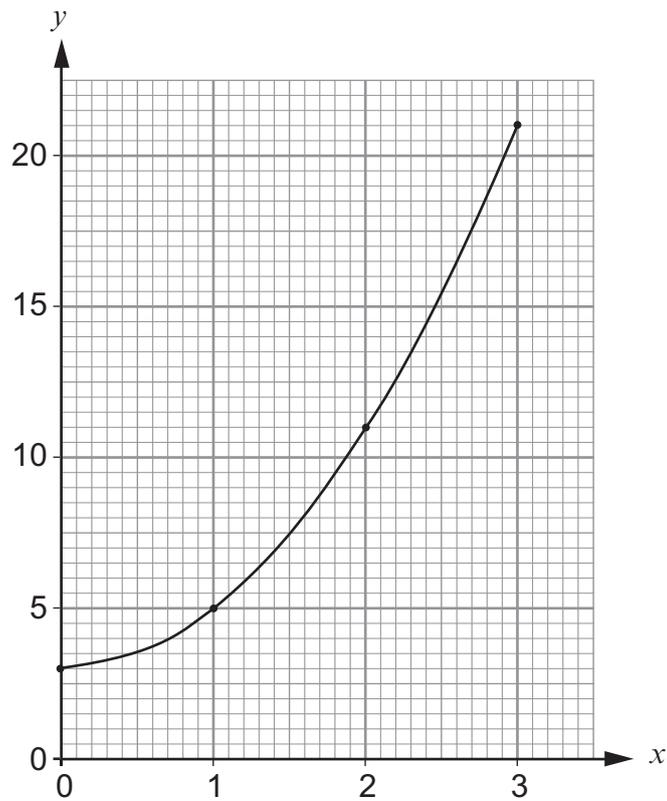
(a) Estimate the gradient of the curve when $x = 1$. [3]

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(b) Use the trapezium rule with ordinates $x = 0$, $x = 1$, $x = 2$ and $x = 3$ to estimate the area bounded by the curve $y = 2x^2 + 3$, the x-axis and the lines $x = 0$ and $x = 3$. [3]

END OF PAPER