| Centre Number | | | | | | Candidate Number | | | | |
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| Surname | | | | | | | | | | |
| Other Names | | | | | | | | | | |
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| For Examiner's Use | |
|---|---|
| Examiner's Initials | |
| Pages | Mark |
| 3 | |
| 4–5 | |
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| 18 | |
| TOTAL | |

General Certificate of Secondary Education
Higher Tier
January 2013

# Mathematics (Linear) 43651H

**Paper 1**

**Friday 11 January 2013 9.00 am to 10.30 am**

**H**

**For this paper you must have:**
- mathematical instruments.

You must **not** use a calculator.

**Time allowed**
- 1 hour 30 minutes

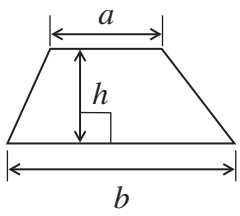
**Instructions**
- Use black ink or black ball-point pen. Draw diagrams in pencil.
- Fill in the boxes at the top of this page.
- Answer **all** questions.
- You must answer the questions in the spaces provided. Do not write outside the box around each page or on blank pages.
- Do all rough work in this book.

**Information**
- The marks for questions are shown in brackets.
- The maximum mark for this paper is 70.
- The quality of your written communication is specifically assessed in Questions 9 and 13. These questions are indicated with an asterisk (*).
- You may ask for more answer paper, tracing paper and graph paper. These must be tagged securely to this answer book.

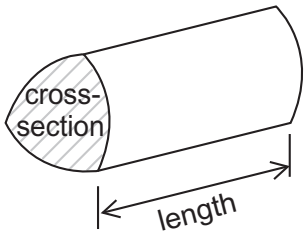
**Advice**
- In all calculations, show clearly how you work out your answer.

## Formulae Sheet: Higher Tier

**Area of trapezium** = $\frac{1}{2}(a+b)h$

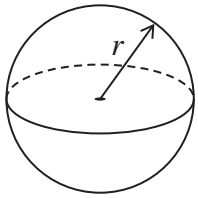



**Volume of prism** = area of cross-section × length



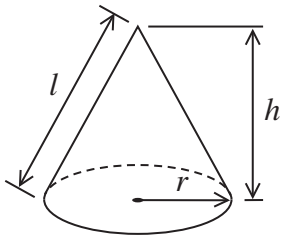

**Volume of sphere** = $\frac{4}{3}\pi r^3$

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




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

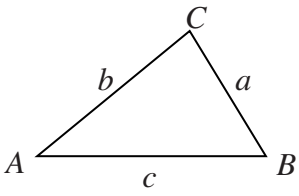
**Curved surface area of cone** = $\pi r l$




**In any triangle** $ABC$

**Area of triangle** = $\frac{1}{2}ab\sin C$

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




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

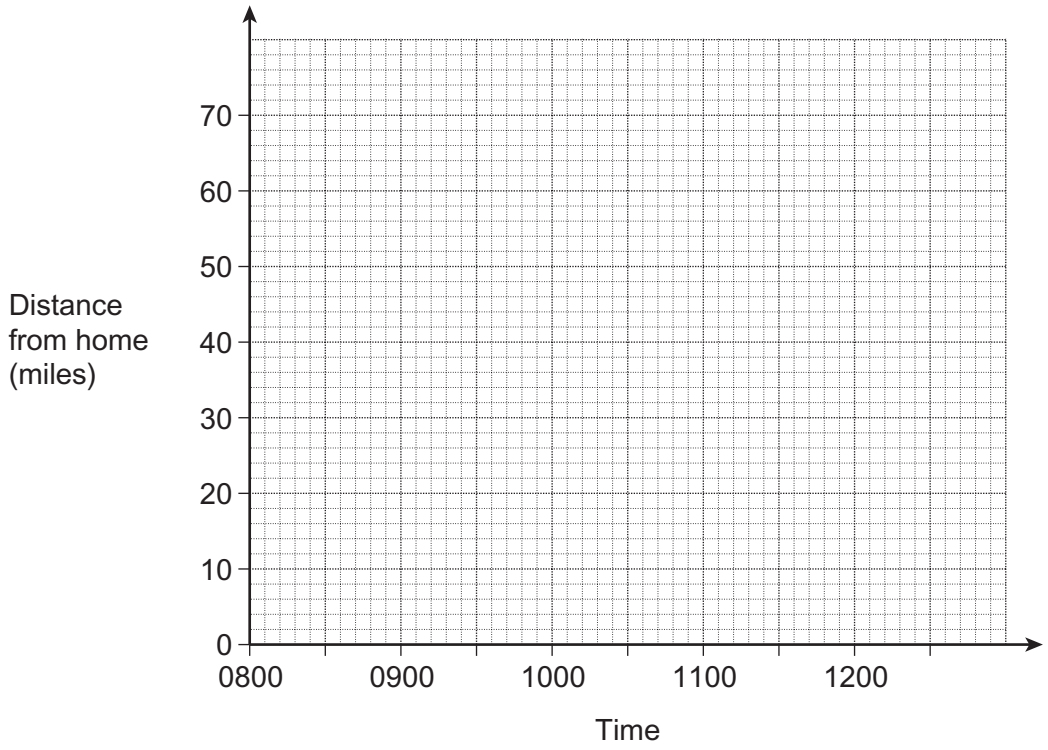
**The Quadratic Equation**

The solutions of $ax^2 + bx + c = 0$, where $a \neq 0$, are given by

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

Answer **all** questions in the spaces provided.

**1** Dan leaves home at 0800.
He drives 60 miles from home in the first 90 minutes.
He stops for 30 minutes.
He then drives home at an average speed of 50 mph.




**1 (a)** Draw a distance-time graph to show Dan's journey.

*(3 marks)*

**1 (b)** A TV programme starts at 1130.

Does Dan get home in time for the start?
Show how you decide.

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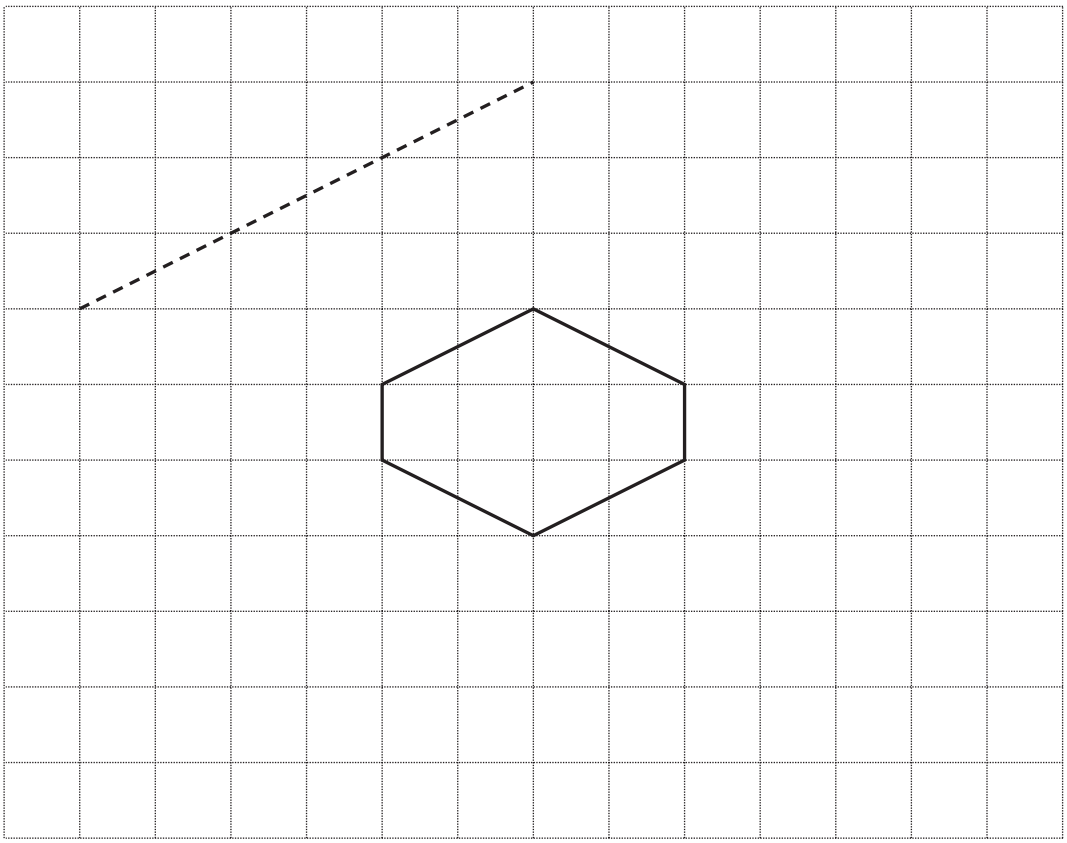
*(1 mark)*

4

**Turn over ▶**

**2** The dotted line is one side of an enlargement of the hexagon.



**2 (a)** Complete the enlarged hexagon.

*(2 marks)*

**2 (b)** What is the scale factor of the enlargement?

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Answer ..... *(1 mark)*

**3** Solve $5x - 9 = 3x + 11$

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$x$ = ..... *(3 marks)*

**4** A scooter is travelling at a constant speed of 75 kilometres per hour.

**4 (a)** The scooter travels at this speed for 20 minutes.

How many kilometres has the scooter travelled in this time?

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.....

Answer ..... km *(2 marks)*

**4 (b)** The speed limit is 50 **miles** per hour.

Is the scooter travelling faster or slower than the speed limit?

Faster ☐ Slower ☐

You **must** show your working.

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*(2 marks)*

**10**

**5 (a)** Complete this table.

| $3^0$ | $3^1$ | $3^2$ | $3^3$ | $3^4$ | $3^5$ | $3^6$ | $3^7$ |
|---|---|---|---|---|---|---|---|
| 1 | 3 | 9 | | | 243 | 729 | 2187 |

*(2 marks)*

**5 (b)** $729 \times 2187 = 1\,594\,323$

and $1\,594\,323 = 3^x$

Use the table to work out the value of $x$.

$x$ = ..... *(1 mark)*

**5 (c)** Use the table, or otherwise, to work out $\frac{2187}{9}$

Give your answer as a power of 3.

Answer ..... *(1 mark)*

**6** This grid follows two rules.

Rule 1 The sums of each row are equal.

Rule 2 The products of each column are equal.

| | | | | Sum of rows |
|---|---|---|---|---|
| | 5 | 32 | 80 | 117 |
| | 96 | 15 | 6 | 117 |
| Product of columns | 480 | 480 | 480 | |

The grid below follows the same two rules.

Work out the missing numbers.

| | | | | Sum of rows |
|---|---|---|---|---|
| | | | | |
| | | 5 | 6 | |
| Product of columns | 60 | | | |

*(3 marks)*

7

**Turn over ▶**

**7 (a)** The rule for continuing a sequence is

Double the previous term and add 5

The **third** term of this sequence is 27.

Work out the **first** term.

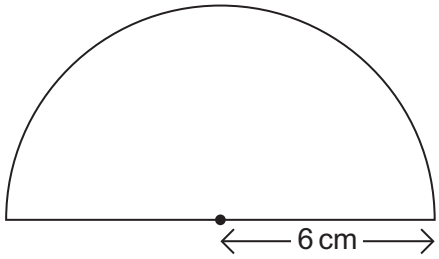
Answer .....  *(3 marks)*

**7 (b)** Work out the $n$th term of this sequence.

6  10  14  18  22  ....

Answer .....  *(2 marks)*

**8** Work out the area of a semi-circle of radius 6 cm.
Give your answer in terms of $\pi$.




Not drawn accurately

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Answer ..... $cm^2$ *(2 marks)*

**Turn over for the next question**

7

***9 (a)** Show the inequality $x > -2$ on the number line.


*(1 mark)*

**9 (b)** Solve the inequality $3x + 5 \leqslant 11$

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Answer ..... *(2 marks)*

**10** Five **whole** numbers are written in order.

4 7 $x$ $y$ 11

The mean and median of the five numbers are the same.

Work out the values of $x$ and $y$.

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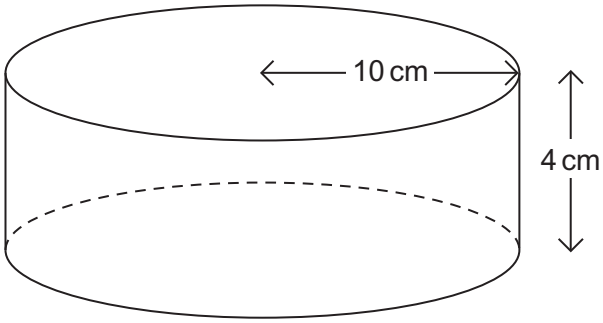
$x$ = ..... $y$ = ..... *(3 marks)*

**11** The radius, $r$, of the cylinder is 10 cm.
The height, $h$, is 4 cm.

The volume, $V$, of a cylinder is $V = \pi r^2 h$




Work out the volume of the cylinder.
Use $\pi = 3.1$

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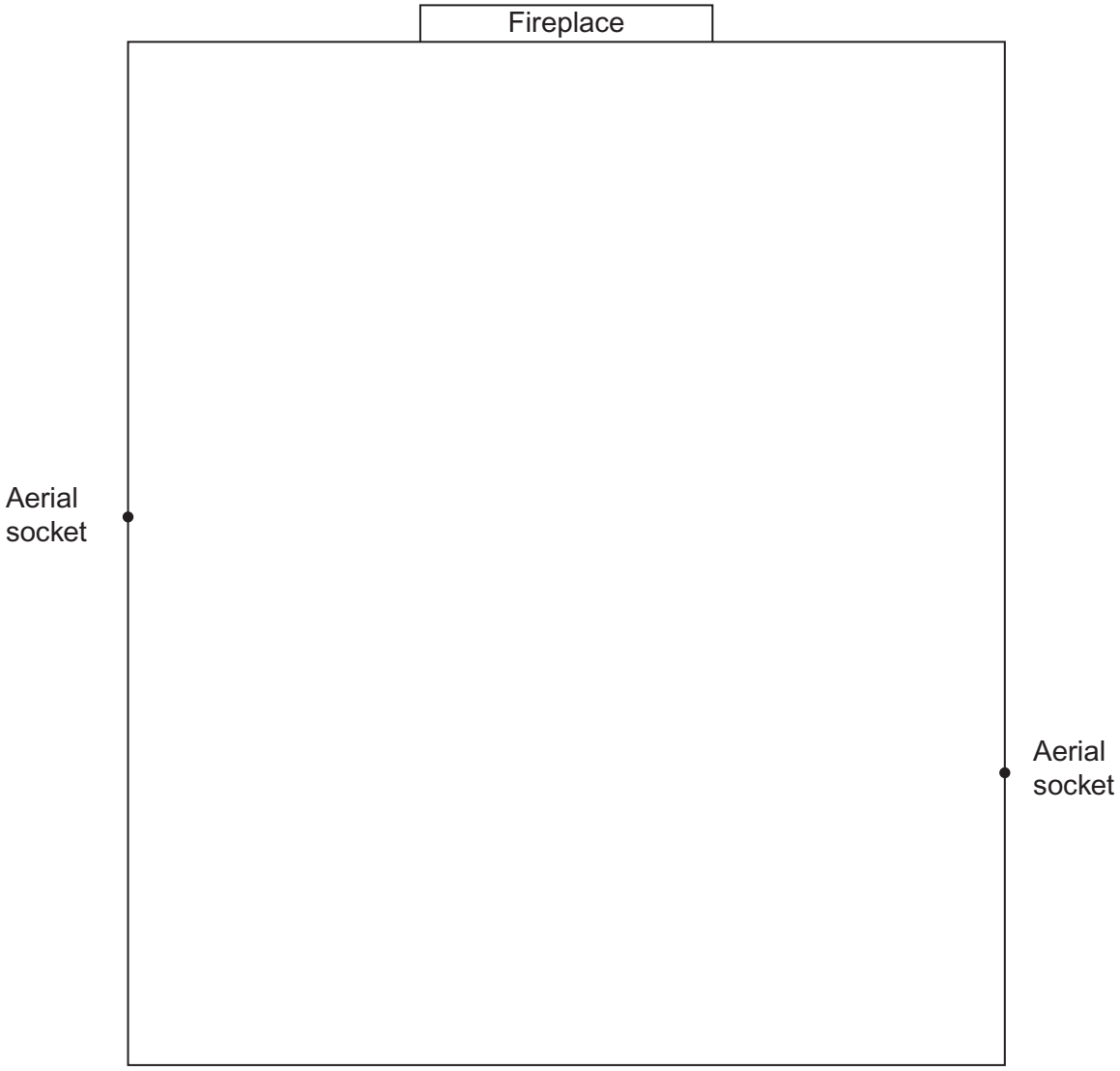
Answer ..... $cm^3$ *(3 marks)*

**Turn over for the next question**

9

**12** The diagram shows the plan of a room.

**Scale**: 4 cm represents 1 m




A new socket is to be fitted to one of the walls.

It must be

equidistant from the two aerial sockets

at least half a metre from the fireplace.

Use a ruler and compasses to show where the socket should be fitted.
Mark the position of the new socket with the letter S.

*(4 marks)*

***13** Show that $x(y + 6) - (xy + 4) \equiv 2(3x - 2)$

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*(3 marks)*

**14** Solve $\frac{2x + 3}{4} - \frac{3x - 3}{2} = 2$

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$x =$ ..... *(4 marks)*

11

**Turn over ▶**

**15 (a)** A school has 400 boys and 500 girls.

The probability that a boy is vegetarian is 0.1
The probability that a girl is vegetarian is 0.2

Estimate the total number of vegetarians in the school.

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Answer ..... *(3 marks)*

**15 (b)** There are ten prefects in the school.
Four of the prefects are vegetarian.

Two of the prefects are chosen at random to have lunch with a visitor.

Show that the probability that they are **both** vegetarian is $\frac{2}{15}$

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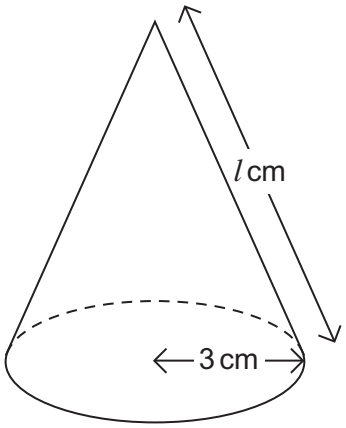
*(2 marks)*

**16** The cone below has radius 3 cm and slant height $l$ cm.




The **total** surface area, including the base, is $24\pi$ cm$^2$.

Work out the length $l$.

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Answer ..... cm *(3 marks)*

**Turn over for the next question**

8

**17 (a)** Show that $\sqrt{75}$ can be written as $5\sqrt{3}$

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*(1 mark)*

**17 (b)** Rationalise the denominator and simplify $\frac{6}{\sqrt{3}}$

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Answer ..... *(2 marks)*

**17 (c)** Work out the mean of the three numbers $\sqrt{75}$, $\sqrt{75}$ and $\frac{6}{\sqrt{3}}$

Give your answer in the form $b\sqrt{3}$ where $b$ is an integer.

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Answer ..... *(2 marks)*

**18** Simplify fully $\dfrac{9x^2 - 1}{3x^2 + 2x - 1} \div \dfrac{3x + 1}{x - 2}$

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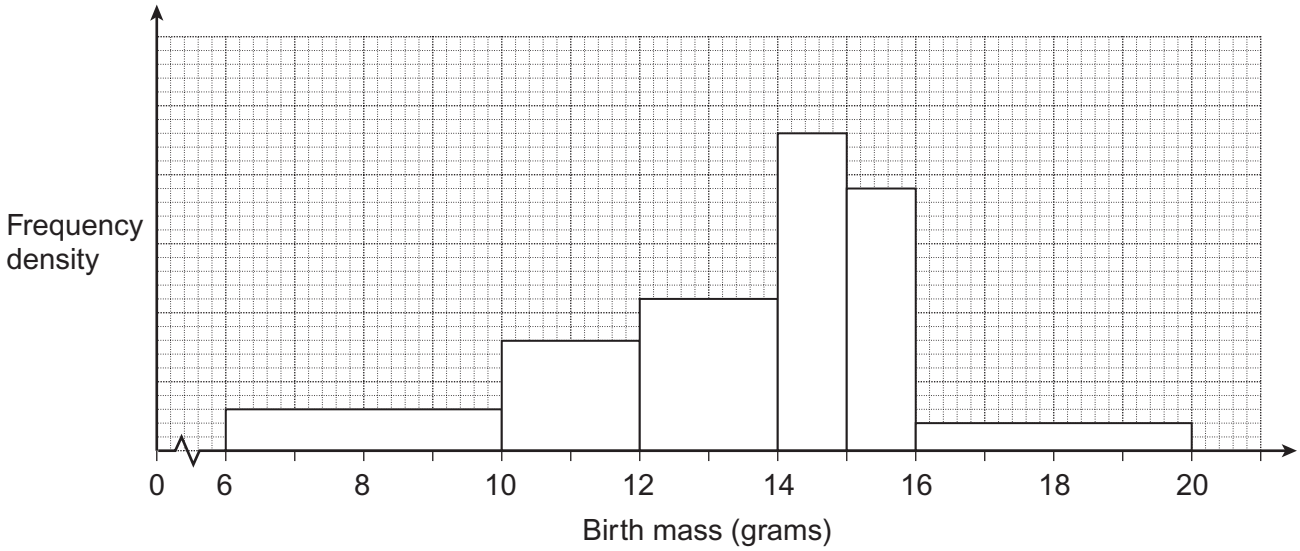
Answer ..... *(5 marks)*

**Turn over for the next question**

**10**

**19** The histogram represents the birth masses of 500 mice.




Work out the number of mice with birth masses below 10 grams.

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Answer ..... *(4 marks)*

**END OF QUESTIONS**

4

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