FOR OFFICIAL USE

N5

National
Qualifications
SPECIMEN ONLY

Mark

S847/75/01

Mathematics
Paper 1 (Non-calculator)

Date — Not applicable

Duration — 1 hour

S847750 1

Fill in these boxes and read what is printed below.

Full name of centre

Town

Forename(s)

Surname

Number of seat

Date of birth

Day Month Year

Scottish candidate number

Total marks — 40

Attempt ALL questions.

You must NOT use a calculator.

To earn full marks you must show your working in your answers.

State the units for your answer where appropriate.

Write your answers clearly in the spaces provided in this booklet. Additional space for answers is provided at the end of this booklet. If you use this space you must clearly identify the question number you are attempting.

Use **blue** or **black** ink.

Before leaving the examination room you must give this booklet to the Invigilator; if you do not, you may lose all the marks for this paper.

FORMULAE LIST

The roots of $ax^2 + bx + c = 0$ are $x = \dfrac{-b \pm \sqrt{(b^2 - 4ac)}}{2a}$

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

Cosine rule $a^2 = b^2 + c^2 - 2bc\cos A$ or $\cos A = \dfrac{b^2 + c^2 - a^2}{2bc}$

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

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

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

Volume of a pyramid $V = \frac{1}{3}Ah$

Standard deviation $s = \sqrt{\dfrac{\Sigma(x - \overline{x})^2}{n - 1}}$

or $s = \sqrt{\dfrac{\Sigma x^2 - \frac{(\Sigma x)^2}{n}}{n - 1}}$, where n is the sample size.

* S 8 4 7 7 5 0 1 0 2 *

MARKS DO NOT WRITE IN THIS MARGIN

Total marks — 40

Attempt ALL questions

1. Evaluate $2\frac{1}{3}+\frac{4}{5}$. **2**

2. Find the resultant vector $2\boldsymbol{u}-\boldsymbol{v}$ when $\boldsymbol{u}=\begin{pmatrix}-2\\3\\5\end{pmatrix}$ and $\boldsymbol{v}=\begin{pmatrix}0\\-4\\7\end{pmatrix}$.

Express your answer in component form. **2**

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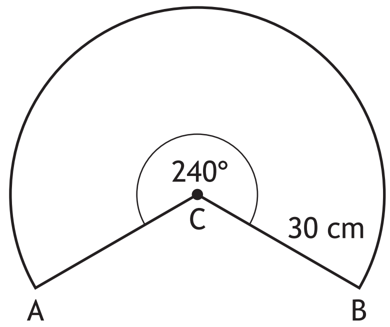
[Turn over

3. Solve, algebraically, the system of equations

$$4x + 5y = -3$$
$$6x - 2y = 5.$$

3

4. The diagram below shows a sector of a circle, centre C.

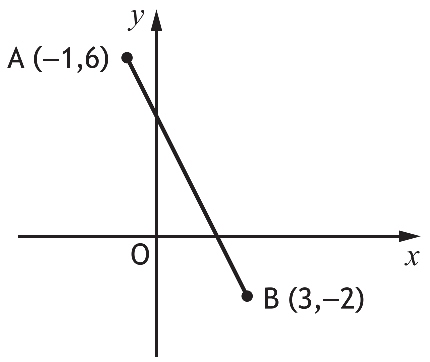


The radius of the circle is 30 centimetres.

Calculate the length of the major arc AB.

Take $\pi = 3.14$. **3**

5. The diagram below shows the straight line joining points A and B.



Find the equation of the line AB.

Give the equation in its simplest form. **3**

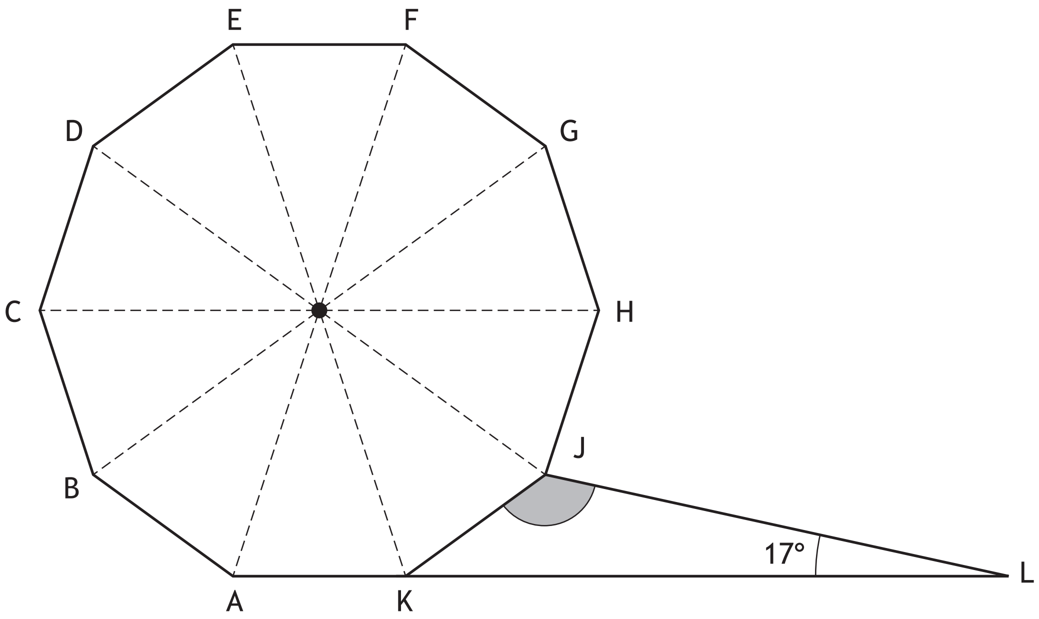
MARKS | DO NOT WRITE IN THIS MARGIN

6. Change the subject of the formula $D = \dfrac{B+4}{C^2}$ to B. **2**

7. Determine the nature of the roots of the function $f(x) = x^2 + 4x - 7$. **2**

8. In the diagram shown below, ABCDEFGHJK is a regular decagon.

- Angle KLJ is 17°.
- AKL is a straight line.

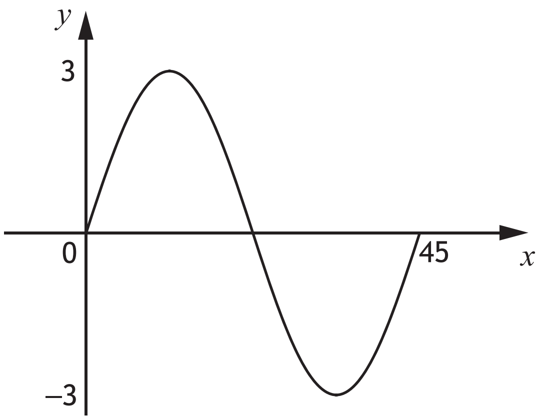


Calculate the size of shaded angle KJL. **2**

MARKS | DO NOT WRITE IN THIS MARGIN

9. Express $\sqrt{50}+\sqrt{45}-\sqrt{2}$ in its simplest form. **3**

10. Part of the graph of $y = a\sin bx°$ is shown in the diagram.



(a) State the value of a. **1**

(b) State the value of b. **1**

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[Turn over

MARKS DO NOT WRITE IN THIS MARGIN

11. Simplify $\left(m^{-2}\right)^4 \times m^{-5}$.

Give your answer with a **positive** power. **3**

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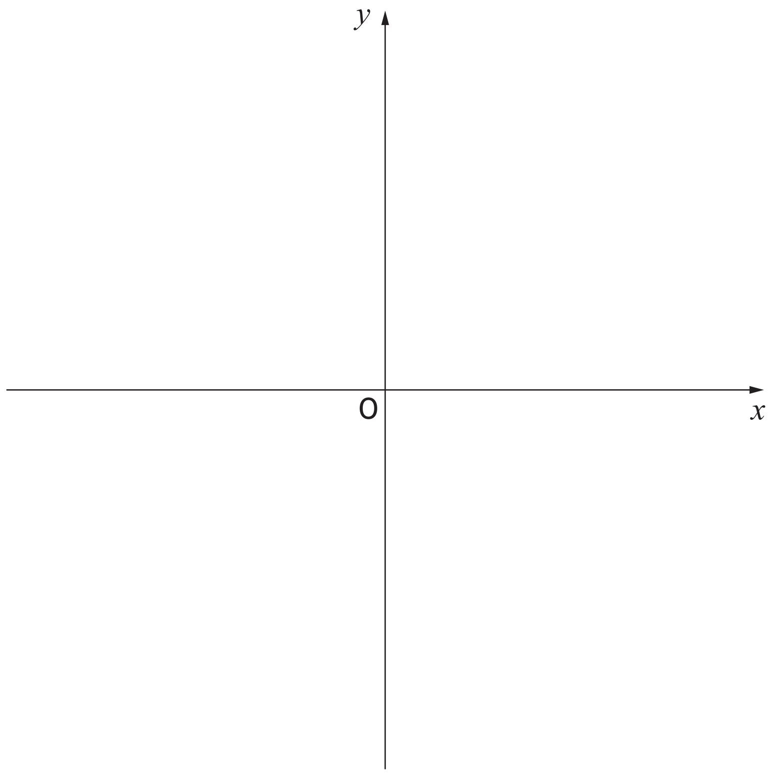
MARKS | DO NOT WRITE IN THIS MARGIN

12. Sketch the graph of $y=(x-6)(x+4)$.

On your sketch, show clearly the points of intersection with the x-axis and the y-axis, and the coordinates of the turning point. **3**

(Additional axes, if required, can be found on *page 15*.)



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[Turn over

MARKS DO NOT WRITE IN THIS MARGIN

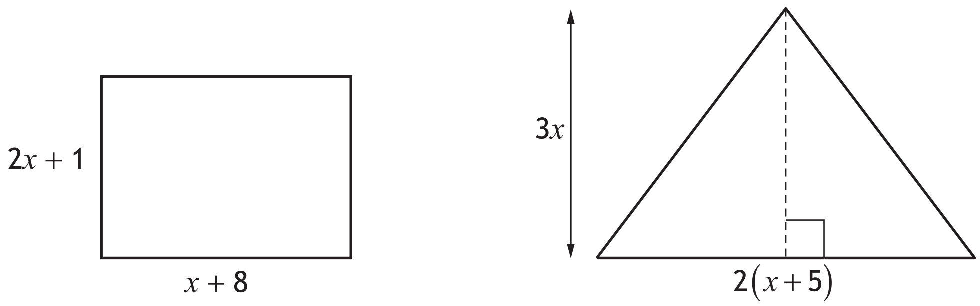
13. Solve the equation

$$\frac{2x}{3} - \frac{5}{6} = 2x.$$

Give your answer in its simplest form. **3**

14. The diagrams below show a rectangle and a triangle.

All measurements are in centimetres.



(a) Find an expression for the area of the **rectangle**. **1**

(b) Given that the area of the rectangle is equal to the area of the triangle, show that $x^2 - 2x - 8 = 0$. **3**

MARKS | DO NOT WRITE IN THIS MARGIN

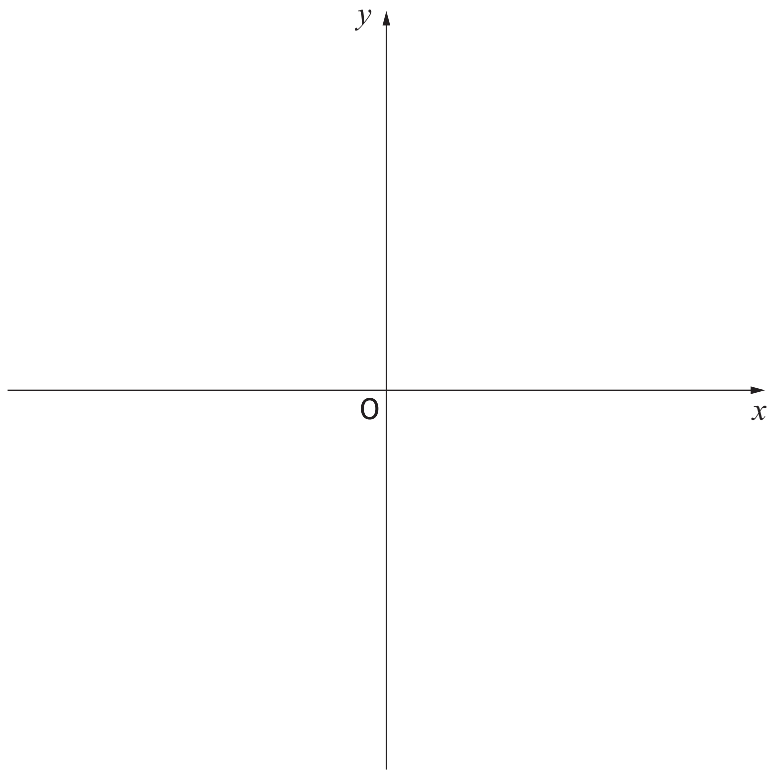
14. (continued)

(c) Hence find, **algebraically**, the length and breadth of the rectangle. **3**

[END OF SPECIMEN QUESTION PAPER]

ADDITIONAL SPACE FOR ANSWERS

Additional axes for use with question 12



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ADDITIONAL SPACE FOR ANSWERS

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MARKS DO NOT WRITE IN THIS MARGIN

ADDITIONAL SPACE FOR ANSWERS

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Mathematics
Paper 1 (Non-calculator)

Marking Instructions

These marking instructions have been provided to show how SQA would mark this specimen question paper.

General marking principles for National 5 Mathematics

Always apply these general principles. Use them in conjunction with the detailed marking instructions, which identify the key features required in candidates' responses.

For each question, the marking instructions are generally in two sections:

generic scheme — this indicates why each mark is awarded
illustrative scheme — this covers methods which are commonly seen throughout the marking

In general, you should use the illustrative scheme. Only use the generic scheme where a candidate has used a method not covered in the illustrative scheme.

(a) Always use positive marking. This means candidates accumulate marks for the demonstration of relevant skills, knowledge and understanding; marks are not deducted for errors or omissions.

(b) If you are uncertain how to assess a specific candidate response because it is not covered by the general marking principles or the detailed marking instructions, you must seek guidance from your team leader.

(c) One mark is available for each •. There are no half marks.

(d) If a candidate's response contains an error, all working subsequent to this error must still be marked. Only award marks if the level of difficulty in their working is similar to the level of difficulty in the illustrative scheme.

(e) Only award full marks where the solution contains appropriate working. A correct answer with no working receives no mark, unless specifically mentioned in the marking instructions.

(f) Candidates may use any mathematically correct method to answer questions, except in cases where a particular method is specified or excluded.

(g) If an error is trivial, casual or insignificant, for example 6 x 6 = 12, candidates lose the opportunity to gain a mark, except for instances such as the second example in point (h) below.

(h) If a candidate makes a transcription error (question paper to script or within script), they lose the opportunity to gain the next process mark, for example

This is a transcription error and so the mark is not awarded.	$x^2+5x+7=9x+4$
	$x-4x+3=0$
This is no longer a solution of a quadratic equation, so the mark is not awarded.	$x=1$

The following example is an exception to the above

	$x^2+5x+7=9x+4$
This error is not treated as a transcription error, as the candidate deals with the intended quadratic equation. The candidate has been given the benefit of the doubt and all marks awarded.	$x-4x+3=0$
	$(x-3)(x-1)=0$
	$x=1$ or 3

(i) **Horizontal/vertical marking**
If a question results in two pairs of solutions, apply the following technique, but only if indicated in the detailed marking instructions for the question.

Example:

	$\bullet^5$	$\bullet^6$
$\bullet^5$	$x=2$	$x=-4$
$\bullet^6$	$y=5$	$y=-7$

Horizontal: $\bullet^5$ $x=2$ and $x=-4$
$\bullet^6$ $y=5$ and $y=-7$

Vertical: $\bullet^5$ $x=2$ and $y=5$
$\bullet^6$ $x=-4$ and $y=-7$

You must choose whichever method benefits the candidate, **not** a combination of both.

(j) In final answers, candidates should simplify numerical values as far as possible unless specifically mentioned in the detailed marking instruction. For example

$\frac{15}{12}$ must be simplified to $\frac{5}{4}$ or $1\frac{1}{4}$

$\frac{43}{1}$ must be simplified to 43

$\frac{15}{0.3}$ must be simplified to 50

$\frac{4/5}{3}$ must be simplified to $\frac{4}{15}$

$\sqrt{64}$ must be simplified to 8*****

*The square root of perfect squares up to and including 144 must be known.

(k) Do not penalise candidates for any of the following, unless specifically mentioned in the detailed marking instructions:

- working subsequent to a correct answer
- correct working in the wrong part of a question
- legitimate variations in numerical answers/algebraic expressions, for example angles in degrees rounded to nearest degree
- omission of units
- bad form (bad form only becomes bad form if subsequent working is correct), for example

  $(x^3+2x^2+3x+2)(2x+1)$ written as

  $(x^3+2x^2+3x+2)\times 2x+1$

  $=2x^4+5x^3+8x^2+7x+2$

  gains full credit

- repeated error within a question, but not between questions or papers

(l) In any 'Show that…' question, where candidates have to arrive at a required result, the last mark is not awarded as a follow-through from a previous error, unless specified in the detailed marking instructions.

(m) You must check all working carefully, even where a fundamental misunderstanding is apparent early in a candidate's response. You may still be able to award marks later in the question so you must refer continually to the marking instructions. The appearance of the correct answer does not necessarily indicate that you can award all the available marks to a candidate.

(n) You should mark legible scored-out working that has not been replaced. However, if the scored-out working has been replaced, you must only mark the replacement working.

(o) If candidates make multiple attempts using the same strategy and do not identify their final answer, mark all attempts and award the lowest mark. If candidates try different valid strategies, apply the above rule to attempts within each strategy and then award the highest mark.

For example:

Strategy 1 attempt 1 is worth 3 marks.	Strategy 2 attempt 1 is worth 1 mark.
Strategy 1 attempt 2 is worth 4 marks.	Strategy 2 attempt 2 is worth 5 marks.
From the attempts using strategy 1, the resultant mark would be 3.	From the attempts using strategy 2, the resultant mark would be 1.

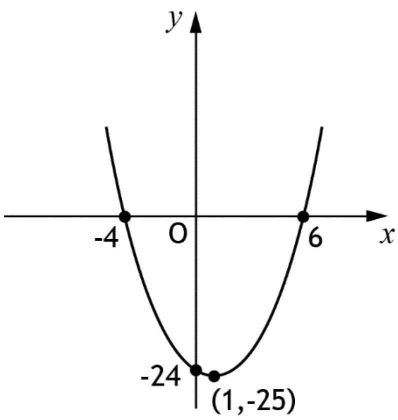
In this case, award 3 marks.

Marking Instructions for each question

Question			Generic scheme	Illustrative scheme	Max mark
1.			•¹ identify common denominator •² answer	•¹ $2\frac{\ldots}{15}+\frac{\ldots}{15}$ **or** $\frac{\ldots}{15}+\frac{\ldots}{15}$ •² $3\frac{2}{15}$ or $\frac{47}{15}$	2
2.			•¹ calculate 2**u** •² answer	•¹ $\begin{pmatrix}-4\\6\\10\end{pmatrix}$ •² $\begin{pmatrix}-4\\10\\3\end{pmatrix}$	2
3.			•¹ correct scaling •² value for one variable •³ value for other variable	•¹ eg $8x+10y=-6$ $30x-10y=25$ **OR** $12x+15y=-9$ $12x-4y=10$ •² $x=0.5$ or $y=-1$ •³ $y=-1$ or $x=0.5$	3
4.			•¹ appropriate fraction •² consistent substitution into length of arc formula •³ calculate length of arc	•¹ $\frac{240}{360}$ or equivalent •² $\frac{240}{360}\times 3{\cdot}14\times 60$ •³ 125·6 (cm)	3

Question			Generic scheme	Illustrative scheme	Max mark
5.			•1 find gradient •2 substitute gradient and a point into $y-b=m(x-a)$ or $y=mx+c$ •3 state equation in simplest form (remove any brackets and collect constants)	•1 $-\frac{8}{4}$ or equivalent •2 $y-(-2)=-\frac{8}{4}(x-3)$ or $y-6=-\frac{8}{4}(x-(-1))$ or $-2=-\frac{8}{4}\times 3+c$ or $6=-\frac{8}{4}\times(-1)+c$ •3 $y=-2x+4$ or equivalent	3
6.			•1 multiply by C^2 •2 subtract 4	•1 $C^2D=B+4$ •2 $B=C^2D-4$ or equivalent	2
7.			•1 calculate discriminant •2 state nature of roots	•1 44 •2 two real and distinct roots	2
8.			•1 calculate the size of angle AKJ or angle JKL •2 calculate the size of angle KJL	•1 AKJ = $72+72$ or JKL = 36 •2 127	2

Question			Generic scheme	Illustrative scheme	Max mark
9.			•[1] simplify $\sqrt{50}$ •[2] simplify $\sqrt{45}$ •[3] express in simplest form	•[1] $5\sqrt{2}$ •[2] $3\sqrt{5}$ •[3] $4\sqrt{2}+3\sqrt{5}$	**3**
10.	(a)		•[1] state the value of a	•[1] 3	**1**
	(b)		•[2] state the value of b	•[2] 8	**1**
11.			**Method 1** •[1] apply $\left(m^a\right)^b = m^{ab}$ •[2] apply $m^a \times m^b = m^{a+b}$ •[3] apply $m^{-a} = \dfrac{1}{m^a}$ **Method 2** •[1] apply $\left(m^a\right)^b = m^{ab}$ •[2] apply $m^{-a} = \dfrac{1}{m^a}$ •[3] complete simplification **Method 3** •[1] apply $m^{-a} = \dfrac{1}{m^a}$ •[2] apply $\left(\dfrac{1}{m^a}\right)^b = \dfrac{1}{m^{ab}}$ •[3] complete simplification	 •[1] m^{-8} •[2] m^{-13} •[3] $\dfrac{1}{m^{13}}$ •[1] m^{-8} •[2] $\dfrac{1}{m^8}$ or $\dfrac{1}{m^5}$ •[3] $\dfrac{1}{m^{13}}$ •[1] $\left(\dfrac{1}{m^2}\right)^4$ or $\dfrac{1}{m^5}$ •[2] $\dfrac{1}{m^8}$ •[3] $\dfrac{1}{m^{13}}$	**3**

Question			Generic scheme	Illustrative scheme	Max mark
12.			•[1] identify roots •[2] identify turning point **OR** y-intercept •[3] identify the turning point **AND** the y-intercept and sketch a consistently annotated parabola	•[1] −4 **AND** 6 •[2] (1, −25) **OR** −24 •[3] (1, −25) **AND** −24 and consistently annotated parabola  	**3**
13.			**Method 1** •[1] multiply throughout by 6 •[2] rearrange •[3] solve for x **Method 2** •[1] rearrange •[2] start to solve for x •[3] solve for x	 •[1] $4x - 5 = 12x$ •[2] $-8x = 5$ or $-5 = 8x$ •[3] $x = -\frac{5}{8}$ or $x = -0 \cdot 625$ •[1] $\frac{4}{3}x = -\frac{5}{6}$ •[2] $x = -\frac{5}{6} \times \frac{3}{4}$ or $24x = -15$ or equivalent •[3] $x = -\frac{5}{8}$ or $x = -0 \cdot 625$	**3**

Question			Generic scheme	Illustrative scheme	Max mark
14.	(a)		•1 find an expression for the area of the rectangle	•1 $(2x+1)(x+8)$ or equivalent	**1**
	(b)		•2 find expanded expression for the area of the rectangle •3 find expanded expression for the area of the triangle •4 equate expanded expressions and rearrange into required form	•2 $2x^2+16x+x+8$ •3 $3x^2+15x$ •4 $2x^2+16x+x+8=3x^2+15x$ $\Rightarrow x^2-2x-8=0$	**3**
	(c)		•5 factorise x^2-2x-8 •6 solve equation •7 reject invalid value of x **and** state length and breadth of rectangle	•5 $(x-4)(x+2)$ •6 $x=4$ **and** $x=-2$ •7 12 (cm) and 9 (cm)	**3**

[END OF SPECIMEN MARKING INSTRUCTIONS]