N5

National Qualifications
SPECIMEN ONLY

Mark

S847/75/01

Mathematics
Paper 1
(Non-Calculator)

Date — Not applicable

Duration — 1 hour 15 minutes

S8477501

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 — 50

Attempt ALL questions.

You may 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.

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S847750101

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: $s = \sqrt{\dfrac{\Sigma(x - \bar{x})^2}{n-1}}$

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

Total marks — 50

Attempt ALL questions

1. Evaluate

$$2\frac{3}{8} \div \frac{5}{16}.$$

2

2. Solve algebraically the inequality

$$11 - 2(1 + 3x) < 39.$$

3

3. Two forces acting on a rocket are represented by vectors **u** and **v**.

$$\mathbf{u} = \begin{pmatrix} 2 \\ -5 \\ -3 \end{pmatrix} \text{ and } \mathbf{v} = \begin{pmatrix} 7 \\ 4 \\ -1 \end{pmatrix}.$$

Calculate $|\mathbf{u} + \mathbf{v}|$, the magnitude of the resultant force.
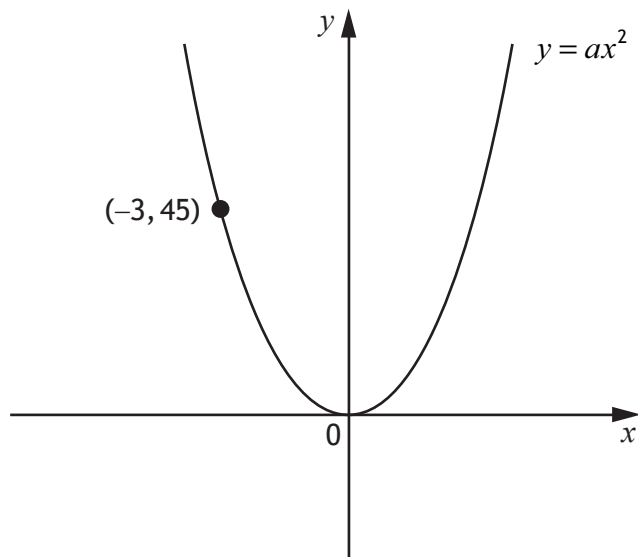
Express your answer as a surd in its simplest form. **3**

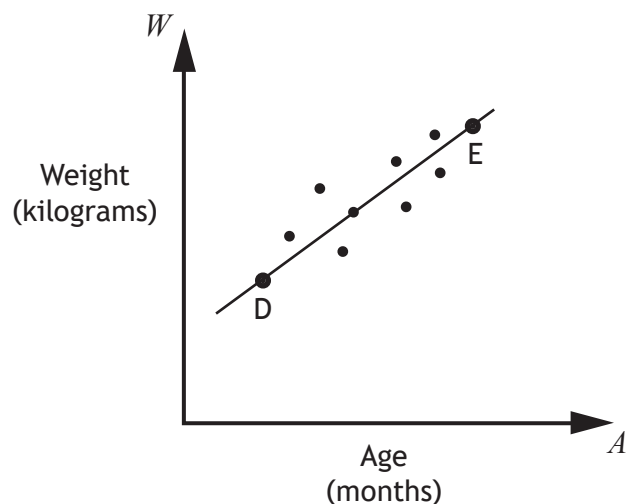**4.** The diagram below shows part of the graph of $y = ax^2$.

Find the value of a.

2

5. Determine the nature of the roots of the function $f(x) = 7x^2 + 5x - 1$.

2

6. A cattle farmer records the weight of some of his calves.

The scattergraph shows the relationship between the age, A months, and the weight, W kilograms, of the calves.

A line of best fit is drawn.

Point D represents a 3-month-old calf which weighs 100 kilograms.

Point E represents a 15-month-old calf which weighs 340 kilograms.

(a) Find the equation of the line of best fit in terms of A and W.

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

6. **(continued)**

(b) Use your equation from part (a) to estimate the weight of a 1-**year**-old calf.

Show your working. **1**

7. Ten couples took part in a dance competition.

The couples were given a score in each round.

The scores in the first round were

16   27   12   18   26   21   27   22   18   17

(a) Calculate the median and semi-interquartile range of these scores.   **3**

(b) In the second round, the median was 26 and the semi-interquartile range was 2·5.

Make two valid comparisons between the scores in the first and second rounds.   **2**

8. Two groups of people go to a theatre.

Bill buys tickets for 5 adults and 3 children.

The total cost of his tickets is £158·25.

(a) Write down an equation to illustrate this information. **1**

(b) Ben buys tickets for 3 adults and 2 children.

The total cost of his tickets is £98.

Write down an equation to illustrate this information. **1**

(c) Calculate the cost of a ticket for an adult and the cost of a ticket for a child. **4**

9. 480 000 tickets were sold for a tennis tournament last year.

This represents 80% of all the available tickets.

Calculate the total number of tickets that were available for this tournament. **3**

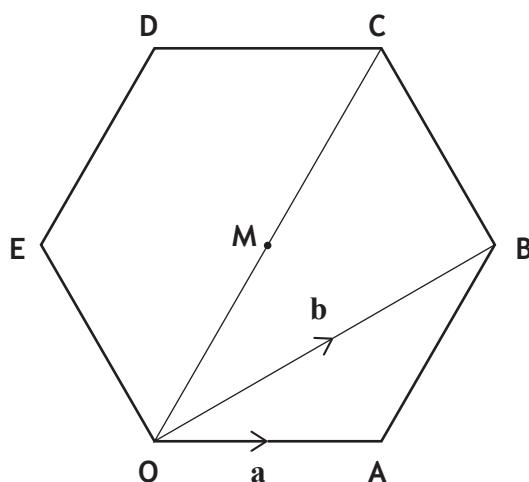**10.** The function $f(x)$ is defined by $f(x) = \dfrac{2}{\sqrt{x}}, \quad x > 0.$

Express $f(5)$ as a fraction with a rational denominator. **2**

11. In the diagram, OABCDE is a regular hexagon with centre M.

Vectors **a** and **b** are represented by $\overrightarrow{OA}$ and $\overrightarrow{OB}$ respectively.

(a) Express $\overrightarrow{AB}$ in terms of **a** and **b**.   1

(b) Express $\overrightarrow{OC}$ in terms of **a** and **b**.   1

12. Part of the graph of $y = a \sin bx°$ is shown in the diagram.
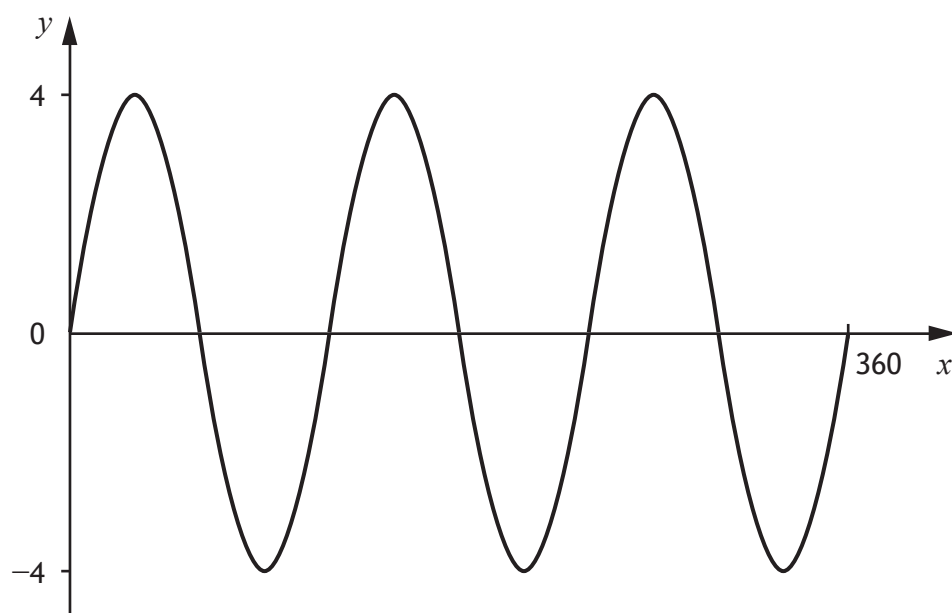
State the values of a and b.

2

13. A parabola has equation $y = x^2 - 8x + 19$.

(a) Write the equation in the form $y = (x - p)^2 + q$. **2**

(b) Sketch the graph of $y = x^2 - 8x + 19$, showing the coordinates of the turning point and the point of intersection with the y-axis. **3**

14. Express

$$\frac{4}{x+2} - \frac{3}{x-4}, \qquad x \neq -2, \, x \neq 4$$

as a single fraction in its simplest form.

3

15. Simplify

$$\tan^2 x° \cos^2 x° .$$
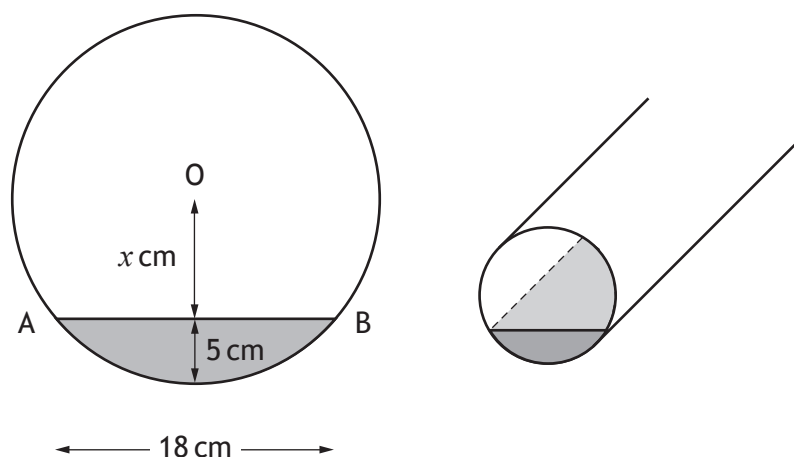
Show your working.

2

16. A cylindrical pipe has water in it as shown.

The depth of the water at the deepest point is 5 centimetres.

The width of the water surface, AB, is 18 centimetres.

The radius of the pipe is r centimetres.

The distance from the centre, O, of the pipe to the water surface is x centimetres.

(a) Write down an expression for x in terms of r.   **1**

(b) Calculate r, the radius of the pipe.   **3**

[END OF SPECIMEN QUESTION PAPER]

ADDITIONAL SPACE FOR ANSWERS

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**Mathematics
Paper 1
(Non-Calculator)**

Marking Instructions

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General marking principles for National 5 Mathematics

This information is provided to help you understand the general principles you must apply when marking candidate responses to questions in this paper. These principles must be read in conjunction with the detailed marking instructions, which identify the key features required in candidate responses.

For each question the marking instructions are generally in two sections, namely generic scheme and illustrative scheme. The generic scheme indicates the rationale for which each mark is awarded. The illustrative scheme covers methods which are commonly seen throughout the marking. In general, markers should use the illustrative scheme and only use the generic scheme where a candidate has used a method not covered in the illustrative scheme.

(a) Marks for each candidate response must <u>always</u> be assigned in line with these general marking principles and the detailed marking instructions for this assessment.

(b) Marking should always be positive. This means that, for each candidate response, marks are accumulated for the demonstration of relevant skills, knowledge and understanding: they are not deducted from a maximum on the basis of errors or omissions.

(c) If a specific candidate response does not seem to be covered by either the principles or detailed marking instructions, and you are uncertain how to assess it, you must seek guidance from your team leader.

(d) Credit must be assigned in accordance with the specific assessment guidelines.

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

(f) Working subsequent to an error must be **followed through**, with possible credit for the subsequent working, provided that the level of difficulty involved is approximately similar. Where, subsequent to an error, the working for a follow through mark has been eased, the follow through mark cannot be awarded.

(g) As indicated on the front of the question paper, full credit should only be given where the solution contains appropriate working. Unless specifically mentioned in the marking instructions, a correct answer with no working receives no credit.

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

(i) As a consequence of an error perceived to be trivial, casual or insignificant, eg $6\times6=12$ candidates lose the opportunity of gaining a mark. However, note the second example in comment **(j)**.

(j) Where a transcription error (paper to script or within script) occurs, the candidate should normally lose the opportunity to be awarded the next process mark, eg

This is a transcription error and so the mark is not awarded.

$$x^2 + 5x + 7 = 9x + 4$$
$$x - 4x + 3 = 0$$
$$x = 1$$

Eased as no longer a solution of a quadratic equation so mark is not awarded.

Exceptionally 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.

$$x^2 + 5x + 7 = 9x + 4$$
$$x - 4x + 3 = 0$$
$$(x - 3)(x - 1) = 0$$
$$x = 1 \text{ or } 3$$

(k) Horizontal/vertical marking
Where a question results in two pairs of solutions, this technique should be applied, but only if indicated in the detailed marking instructions for the question.

Example:

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

Horizontal: $\bullet^5$ $x = 2$ and $x = -4$ Vertical: $\bullet^5$ $x = 2$ and $y = 5$
$\qquad\qquad\,\bullet^6$ $y = 5$ and $y = -7$ $\qquad\qquad\quad\;\bullet^6$ $x = -4$ and $y = -7$

Markers should choose whichever method benefits the candidate, but **not** a combination of both.

(l) In final answers, unless specifically mentioned in the detailed marking instructions, numerical values should be simplified as far as possible, eg:

$\dfrac{15}{12}$ must be simplified to $\dfrac{5}{4}$ or $1\dfrac{1}{4}$ $\dfrac{43}{1}$ must be simplified to 43

$\dfrac{15}{0\cdot3}$ must be simplified to 50 $\dfrac{\,^4\!/\!_5\,}{3}$ must be simplified to $\dfrac{4}{15}$

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

*The square root of perfect squares up to and including 100 must be known.

(m) Unless specifically mentioned in the marking instructions, the following should not be penalised:

- Working subsequent to a correct answer
- Correct working in the wrong part of a question
- Legitimate variations in numerical answers/algebraic expressions, eg angles in degrees rounded to nearest degree
- Omission of units
- Bad form (bad form only becomes bad form if subsequent working is correct), eg
  $(x^3 + 2x^2 + 3x + 2)(2x + 1)$ written as $(x^3 + 2x^2 + 3x + 2) \times 2x + 1$

  $2x^4 + 4x^3 + 6x^2 + 4x + x^3 + 2x^2 + 3x + 2$ written as $2x^4 + 5x^3 + 8x^2 + 7x + 2$ gains full credit

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

(n) In any 'Show that…' question, where the candidate has to arrive at a required result, the last mark of that part is not available as a follow-through from a previous error unless specified in the detailed marking instructions.

(o) All working should be carefully checked, even where a fundamental misunderstanding is apparent early in the candidate's response. Marks may still be available later in the question so reference must be made continually to the marking instructions. The appearance of the correct answer does not necessarily indicate that the candidate has gained all the available marks.

(p) Scored-out working which has not been replaced should be marked where still legible. However, if the scored out working has been replaced, only the work which has not been scored out should be marked.

(q) Where a candidate has made multiple attempts using the same strategy and not identified their final answer, mark all attempts and award the lowest mark.
Where a candidate has tried different valid strategies, apply the above ruling to attempts within each strategy and then award the highest resultant mark.

For example:

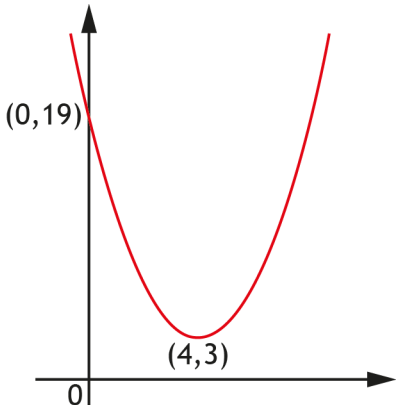|	
Strategy 1 attempt 1 is worth 3 marks.	Strategy 2 attempt 1 is worth 1 mark.
Strategy 1 attempt 2 is worth 4 marks.	Strategy 2 attempt 2 is worth 5 marks.
From the attempts using strategy 1, the resultant mark would be 3.	From the attempts using strategy 2, the resultant mark would be 1.

In this case, award 3 marks.

Marking instructions for each question

Question	Generic scheme	Illustrative scheme	Max mark
1	**Ans:** $7\dfrac{3}{5}$ $\bullet^1$ start simplification **and** know how to divide fractions $\bullet^2$ consistent answer in simplest form	$\bullet^1$ $\dfrac{19}{8}\times\dfrac{16}{5}$ $\bullet^2$ $7\dfrac{3}{5}$ or $\dfrac{38}{5}$	2
2	**Ans:** $x>-5$ $\bullet^1$ expand bracket $\bullet^2$ collect like terms $\bullet^3$ solve for x	$\bullet^1$ $11-2-6x<39$ $\bullet^2$ $-6x<30$ or $-30<6x$ $\bullet^3$ $x>-5$ or $-5<x$	3
3	**Ans:** $7\sqrt{2}$ $\bullet^1$ add vectors correctly $\bullet^2$ know how to find magnitude $\bullet^3$ find magnitude as a surd in its simplest form	$\bullet^1$ $\begin{pmatrix} 9 \\ -1 \\ -4 \end{pmatrix}$ $\bullet^2$ $\sqrt{9^2+(-1)^2+(-4)^2}$ $\bullet^3$ $7\sqrt{2}$	3
4	**Ans:** $a=5$ $\bullet^1$ know to substitute $(-3,\,45)$ into $y=ax^2$ $\bullet^2$ solve equation for a	$\bullet^1$ $45=a(-3)^2$ or equivalent $\bullet^2$ $a=5$	2
5	**Ans: two real and distinct roots** $\bullet^1$ find discriminant $\bullet^2$ state nature of roots	$\bullet^1$ 53 $[5^2-4\times7\times(-1)]$ $\bullet^2$ two real and distinct roots	2

Question		Generic scheme	Illustrative scheme	Max mark
6	**(a)**	**Ans:** $W = 20A + 40$		**3**
		$\bullet^1$ gradient	$\bullet^1$ $\dfrac{240}{12}$ or equivalent	
		$\bullet^2$ substitute gradient and a point into $y - b = m(x - a)$ or $y = mx + c$	$\bullet^2$ $y - 100 = \dfrac{240}{12}(x - 3)$ or $y - 340 = \dfrac{240}{12}(x - 15)$ or $100 = \dfrac{240}{12} \times 3 + c$ or $340 = \dfrac{240}{12} \times 15 + c$	
		$\bullet^3$ state equation in terms of W and A **and** in simplest form (remove any brackets and collect constants)	$\bullet^3$ $W = 20A + 40$ or equivalent	
6	**(b)**	**Ans:** $20 \times 12 + 40 = 280\,\text{kg}$		**1**
		$\bullet^1$ calculate weight using equation from part (a)	$\bullet^1$ $20 \times 12 + 40 = 280\,\text{kg}$ stated explicitly	
7	**(a)**	**Ans: median** $= 19 \cdot 5$, **SIQR** $= 4 \cdot 5$		**3**
		$\bullet^1$ find median	$\bullet^1$ $19 \cdot 5$	
		$\bullet^2$ find quartiles	$\bullet^2$ 17 and 26	
		$\bullet^3$ calculate semi-interquartile range	$\bullet^3$ $4 \cdot 5$	
7	**(b)**	**Ans: valid comments**		**2**
		$\bullet^1$ compare medians	$\bullet^1$ On average the second round's scores are higher	
		$\bullet^2$ compare semi-interquartile ranges	$\bullet^2$ The second round's scores are more consistent.	

Question			Generic scheme	Illustrative scheme	Max mark
8	(a)		**Ans:** $5a + 3c = 158 \cdot 25$ $\bullet^1$ construct equation	$\bullet^1$ $5a + 3c = 158 \cdot 25$	1
8	(b)		**Ans:** $3a + 2c = 98$ $\bullet^1$ construct equation	$\bullet^1$ $3a + 2c = 98$	1

8	(c)		**Ans: Adult ticket costs £22·50**
			       Child ticket costs £15·25
			
			$\bullet^1$ evidence of scaling
			
			$\bullet^2$ follow a valid strategy through to produce values for a and c
			
			$\bullet^3$ calculate correct values for a and c
			
			$\bullet^4$ communicate answers in money
				$\bullet^1$ eg $\begin{array}{l} 10a + 6c = 316 \cdot 50 \\ 9a + 6c = 294 \end{array}$
				
				$\bullet^2$ values for a and c
				
				$\bullet^3$ $a = 22 \cdot 5$ and $c = 15 \cdot 25$
				
				$\bullet^4$ Adult £22·50
				   Child £15·25
					4

9			**Ans:** 600000 $\bullet^1$ know that $80\% = 480000$ $\bullet^2$ begin valid strategy $\bullet^3$ answer	$\bullet^1$ $80\% = 480000$ $\bullet^2$ $10\% = 60000$ or equivalent $\bullet^3$ 600000	3
10			**Ans:** $\dfrac{2\sqrt{5}}{5}$ $\bullet^1$ correct substitution $\bullet^2$ correct answer	$\bullet^1$ $\dfrac{2}{\sqrt{5}}$ $\bullet^2$ $\dfrac{2\sqrt{5}}{5}$	2

Question		Generic scheme	Illustrative scheme	Max mark
11	(a)	**Ans: b − a** •¹ correct answer	•¹ **b − a** or **−a + b**	1
11	(b)	**Ans: 2(b − a)** •¹ correct answer	•¹ **2(b − a)** or **2(−a + b)**	1
12		**Ans:** $a = 4, b = 3$ •¹ state the value of a •² state the value of b	•¹ 4 •² 3	2
13	(a)	**Ans:** $(x − 4)^2 + 3$ •¹ correct bracket with square •² complete process	•¹ $(x − 4)^2$.......... •² $(x − 4)^2 + 3$	2
13	(b)	**Ans:** •¹ coordinates of turning point correct •² sketch parabola with **minimum** turning point consistent with •¹ •³ y-intercept correct	•¹ $(4, 3)$ •² parabola with **minimum** turning point consistent with •¹ •³ $(0, 19)$	3

Question		Generic scheme	Illustrative scheme	Max mark
14		**Ans:** $\dfrac{x-22}{(x+2)(x-4)}$ $\bullet^1$ correct denominator $\bullet^2$ correct numerator $\bullet^3$ remove brackets and collect like terms in numerator	 $\bullet^1$ $(x+2)(x-4)$ $\bullet^2$ $4(x-4)-3(x+2)$ $\bullet^3$ $\dfrac{x-22}{(x+2)(x-4)}$	3
15		**Ans:** $\sin^2 x°$ $\bullet^1$ identify correct trigonometric identity to be used $\bullet^2$ use correct trigonometric identity to simplify expression	 $\bullet^1$ $\dfrac{\sin x}{\cos x}$ or $\dfrac{\sin^2 x}{\cos^2 x}$ $\bullet^2$ $\dfrac{\sin^2 x}{\cos^2 x}\times\cos^2 x=\sin^2 x$	2
16	(a)	**Ans:** $r-5$ $\bullet^1$ state expression	 $\bullet^1$ $r-5$	1
16	(b)	**Ans:** 10·6 $\bullet^1$ correct use of Pythagoras' Theorem $\bullet^2$ expand bracket $\bullet^3$ solve equation	 $\bullet^1$ $r^2=(r-5)^2+9^2$ $\bullet^2$ $r^2=r^2-10r+25+81$ $\bullet^3$ $r=10\cdot6$	3

[END OF SPECIMEN MARKING INSTRUCTIONS]