N5	Nationa Qualifica SPECIM	l ations EN ONI	_Y					Ma	rk	
S847/75/02							٨	Mathe	ema Pape	tics er 2
Date — Not applicable Duration — 1 hour 30 min	utes						* 3	5 8 4 7	750) 2 *
Fill in these boxes and rea	d what is prir	nted below.		Towr	1					
Forename(s)	S	urname						Numbe	er of se	eat
Date of birth Day Month	Year	Scott	ish ca	ndida	te ni	umbe	r			
Total marks — 50										
Attempt ALL questions.										

You may 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

$$ax^{2} + bx + c = 0 \text{ are } x = \frac{-b \pm \sqrt{(b^{2} - 4ac)}}{2a}$$
Sine rule

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

$$a^{2} = b^{2} + c^{2} - 2bc \cos A \text{ or } \cos A = \frac{b^{2} + c^{2} - a^{2}}{2bc}$$
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

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



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Total marks — 50 Attempt ALL questions

 Households in a city produced a total of 125 000 tonnes of waste in 2017. The total amount of waste is expected to fall by 2% each year. Calculate the total amount of waste these households are expected to produce in 2020.





	MARKS DO NOT WRITE IN THIS MARGIN
2. Expand and simplify $(2x+3)(x^2-4x+1)$.	3

3. Factorise fully $3x^2 - 48$.

ſ



									MARKS	DO NOT WRITE IN THIS MARGIN
4.	A school net minute.	ball tear	n record	ed the ni	umber of	sit-ups e	ach play	er completed in a		
	The number	s for the	seven p	layers we	ere:					
		29	27	24	31	22	19	30		
	(a) Calculat	the m	ean and	standard	deviatio	n of the i	numbers	of sit-ups.	4	



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4.	(continued)	MARKS	DO NOT WRITE IN THIS MARGIN
	Some players in the school's hockey team also recorded the number of sit-ups they completed in a minute.		
	Their numbers gave a mean of 29 and a standard deviation of 3.2.		
	(b) Make two valid comments comparing the numbers of sit-ups of the players in the netball team and the hockey team.	2	



- 5. The diagram below shows the position of three towns.Lowtown is due west of Midtown.The distance from:
 - Lowtown to Midtown is 75 kilometres
 - Midtown to Hightown is 110 kilometres
 - Hightown to Lowtown is 85 kilometres.



- Is Hightown directly north of Lowtown?
- Justify your answer.

MARKS DO NOT WRITE IN THIS MARGIN



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6. A theatre group sold 4830 tickets for their show. This was 15% more than they sold last year. How many tickets did they sell last year?



7. A set of stepladders has legs 150 centimetres and 140 centimetres long.



When the stepladder is fully open, the angle between the longer leg and the ground is 66°.



Calculate x° , the size of the angle between the shorter leg and the ground.

3



8. A supermarket sells cylindrical cookie jars which are mathematically similar.



The smaller jar has a height of 15 centimetres and a volume of 750 cubic centimetres.

The larger jar has a height of 24 centimetres.

Calculate the volume of the larger jar.





9. Solve the equation $11\cos x^{\circ} - 2 = 3$, for $0 \le x \le 360$.	3	MARGIN



[Turn over

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- 10. A traffic bollard is in the shape of a cylinder with a hemisphere on top.The bollard has:
 - diameter 24 centimetres
 - height 70 centimetres.



Calculate the volume of the bollard.

Give your answer correct to 3 significant figures.

5

MARKS DO NOT WRITE IN THIS MARGIN



		MARKS	DO NOT WRITE IN THIS MARGIN
11.	Express $\frac{3}{a^2} - \frac{2}{a}$, $a \neq 0$, as a single fraction in its simplest form.	2	



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12. The diagram below shows the circular cross-section of a milk tank.



The radius of the circle, centre O, is 1.2 metres.

The width of the surface of the milk in the tank, represented by ML in the diagram, is 1.8 metres.

Calculate the depth of the milk in the tank.



MARKS	DO NOT WRITE IN
	THIS MARGIN

13. Express $\sin x^{\circ} \cos x^{\circ} \tan x^{\circ}$ in its simplest form. Show your working.

2



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- **14.** In the diagram below:
 - DE is perpendicular to AC
 - AD = 4 centimetres
 - DB = 6 centimetres
 - AE = EC = 3 centimetres.



Calculate the length of BC.

Give your answer correct to one decimal place.



15. The triangle ABC is shown below



 $\overrightarrow{AB} = \mathbf{u}$ and $\overrightarrow{AC} = \mathbf{t}$. G is the point such that $CG = \frac{1}{3}CB$.

Express \overrightarrow{AG} in terms of **u** and **t**. Give your answer in simplest form.

3

[END OF SPECIMEN QUESTION PAPER]



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ADDITIONAL SPACE FOR ANSWERS



ADDITIONAL SPACE FOR ANSWERS



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National Qualifications SPECIMEN ONLY

S847/75/02

Mathematics Paper 2

Marking Instructions

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

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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 $6 \times 6 = 12$, 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



The following example is an exception to the above



(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:

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	$\frac{\frac{4}{5}}{3}$ 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
- (I) 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

Qı	lestio	n	Generic scheme	Illustrative scheme	Max mark
1.			 ¹ know how to decrease by 2% ² know how to calculate new total ³ carry out calculations correctly within a valid strategy 	 ¹ ×0.98 ² 125 000 × 0.98³ ³ 117 649 (tonnes) 	3
2.			 ¹ start to expand ² complete expansion ³ collect like terms which must include a term in x³ and a negative coefficient 	• ¹ evidence of any 3 correct terms eg $2x^3 - 8x^2 + 2x$ • ² $2x^3 - 8x^2 + 2x + 3x^2 - 12x + 3$ • ³ $2x^3 - 5x^2 - 10x + 3$	3
3.			 ¹ begin to factorise ² factorise fully 	• $3(x^2-16)$ • $3(x+4)(x-4)$	2

Q	uestic	n	Generic scheme	Illustrative scheme	Max mark
4.	(a)		Method 1		4
			• ¹ calculate mean	• ¹ 26	
			• ² calculate $(x - \overline{x})^2$	• ² 9, 1, 4, 25, 16, 49, 16	
			• ³ substitute into formula	$\bullet^3 \sqrt{\frac{120}{6}}$	
			• ⁴ calculate standard deviation	• ⁴ 4.47(2)	
			Method 2		
			• ¹ calculate mean	• ¹ 26	
			\bullet^2 calculate $\sum x$ and $\sum x^2$	• ² 182, 4852	
			• ³ substitute into formula	• ³ $\sqrt{\frac{4852 - \frac{182^2}{7}}{6}}$	
			• ⁴ calculate standard deviation	• ⁴ 4.47(2)	
	(b)		• ⁵ valid comment comparing means	 ⁵ eg on average the hockey team recorded a higher number of sit-ups 	2
			• ⁶ valid comment comparing standard deviations	 ⁶ eg the hockey team's numbers of sit-ups were more consistent 	

Q	uestic	n	Generic scheme	Illustrative scheme	Max mark
5.			Method 1 •1 valid strategy	• ¹ $75^2 + 85^2$ and 110^2	3
			• ² evaluation	$e^{2}75^{2} + 85^{2} = 12850$ and $110^{2} = 12100$	
			• ³ explicit comparison	• ³ $75^2 + 85^2 \neq 110^2$	
			• ⁴ conclusion with valid reason	\bullet^4 No, since not right-angled	
			Method 2		
			• ¹ valid strategy	• ¹ $75^2 + 85^2 = 12850$	
			• ² evaluation	• ² $\sqrt{12850} = (113.357)$	
			• ³ explicit comparison	• ³ 110 ≠ 113(.357)	
			• ⁴ conclusion with valid reason	• ⁴ No, since not right-angled	
			Method 3		
			• ¹ valid strategy	• ¹ $(\cos x =) \frac{75^2 + 85^2 - 110^2}{2 \times 75 \times 85}$	
			• ² evaluation	• ² $(\cos x =) \frac{750}{12750} \left(=\frac{1}{17}\right)$	
			• ³ explicit comparison	• ³ 86(.6) \neq 90	
			$ullet^4$ conclusion with valid reason	• ⁴ No, since not right-angled	
6.			• ¹ evidence that $115\% = 4830$	• ¹ 115% = 4830	4
				4830	
			• ² begin valid strategy	• ² $1\% = \frac{1000}{115}$ or equivalent	
			 ³ complete calculation within valid strategy 	• ³ 4200	

Question			Generic scheme	Illustrative scheme	Max mark
7.			• ¹ correct substitution into sin rule	• $\frac{\sin x}{150} = \frac{\sin 66}{140}$ or $\frac{150}{\sin x} = \frac{140}{\sin 66}$	3
			• ² rearrange equation	• $\sin x = \frac{150\sin 66}{140}$	
			• ³ calculate x	• ³ $x = 78(.18)$	
8.			Method 1 • ¹ linear scale factor	• ¹ $\frac{24}{15}$ or equivalent	3
			• ² know to multiply volume by cube of linear scale factor	$\bullet^2 \left(\frac{24}{15}\right)^3 \times 750$	
			 ³ calculate volume (calculation must include a power of the linear scale factor) 	• ³ 3072 (cm ³)	
9.			• ¹ rearrange equation	• ¹ $\cos x = \frac{5}{11}$	5
			• ² find first value of x	• ² 63	
			• ³ find second value of x	• ³ 297	
10.			• ¹ correct substitution into formula for volume of sphere	$\bullet^1 \frac{4}{3} \times \pi \times 12^3$	3
			• ² consistent substitution into formula for volume of cylinder	• ² $\pi \times 12^2 \times 58$	
			• ³ know to add volume of hemisphere to volume of cylinder	• ³ $\frac{1}{2} \times \frac{4}{3} \times \pi \times 12^3 + \pi \times 12^2 \times 58$	
			 ⁴ all calculations correct (must involve the sum or difference of two volume calculations involving π) 	• ⁴ (3619.1 + 26238.5) = 29 857	
			• ⁵ round final answer to 3 significant figures and state correct units	• ⁵ 29 900 cm ³	

Question			Generic scheme	Illustrative scheme	Max mark
11.			• ¹ valid common denominator	• ¹ $\frac{1}{a^2}$ or $\frac{1}{a^3}$ or $\frac{1}{a^2 \times a}$	2
			• ² answer in simplest form	$\bullet^2 \frac{3-2a}{a^2}$	
12.			 ¹ marshal facts and recognise right angled triangle 	• ¹ 0.9 x 1.2	4
			• ² consistent Pythagoras statement	• $x^2 = 1.2^2 - 0.9^2$	
			• ³ calculate x	• ³ 0.8 or 0.79()	
			• ⁴ calculate width	• ⁴ 2.0(cm) or 1.99(cm)	
13.			• ¹ correct substitution for $\tan x$	• $\sin x \cos x \frac{\sin x}{\cos x}$	2
			• ² express in simplest form	• ² $\sin^2 x$	
14.			• ¹ identify cos A or angle A	• $\cos A = \frac{3}{4}$ or $A = 41.4$	4
			 ² substitute into cosine rule (cos A or angle A must have been found using trigonometry) 	• 2 BC ² = 6 ² + 10 ² - 2 × 6 × 10 × $\frac{3}{4}$ or	
				$BC^2 = 6^2 + 10^2 - 2 \times 6 \times 10 \times \cos 41.4$	
			• ³ calculate BC ²	• 3 BC ² = 46	
			• ⁴ calculate BC correct to one decimal place	• 4 BC = 6.8 (cm)	

Question			Generic scheme	Illustrative scheme	Max mark
15.			• ¹ express \overrightarrow{AG} in terms of \overrightarrow{AC} and \overrightarrow{CB} or express \overrightarrow{CB} in terms of u and t	• ¹ $\overrightarrow{AC} + \frac{1}{3}\overrightarrow{CB}$ or $\overrightarrow{CB} = -\mathbf{t} + \mathbf{u}$	3
			\bullet^2 express \overrightarrow{AG} in terms of u and t	$\bullet^2 t + \frac{1}{3} \left(-t + u \right)$	
			• ³ express \overrightarrow{AG} in simplest form	• ³ $\frac{2}{3}t + \frac{1}{3}u$ or equivalent	

[END OF SPECIMEN MARKING INSTRUCTIONS]