

FOR OFFICIAL USE



National  
Qualifications  
SPECIMEN ONLY

Mark

SQ29/N5/02

Mathematics  
Paper 2

Date — Not applicable

Duration — 1 hour and 30 minutes



\* S Q 2 9 N 5 0 2 \*

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

You may use a calculator.

Attempt ALL questions.

Use **blue** or **black** ink. Pencil may be used for graphs and diagrams only.

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

Square-ruled paper is provided at the back of this booklet.

Full credit will be given only to solutions which contain appropriate working.

State the units for your answer where appropriate.

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.



\* S Q 2 9 N 5 0 2 0 1 \*

## FORMULAE LIST

The roots of  $ax^2 + bx + c = 0$  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:  $a^2 = b^2 + c^2 - 2bc \cos A$  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:  $s = \sqrt{\frac{\Sigma(x - \bar{x})^2}{n-1}} = \sqrt{\frac{\Sigma x^2 - (\Sigma x)^2/n}{n-1}}$ , where  $n$  is the sample size.



\* S Q 2 9 N 5 0 2 0 2 \*

MARKS

DO NOT  
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1. Beth normally cycles a total distance of 56 miles per week.  
She increases her distance by 15% each week for the next three weeks.  
How many miles will she cycle in the third week?

3

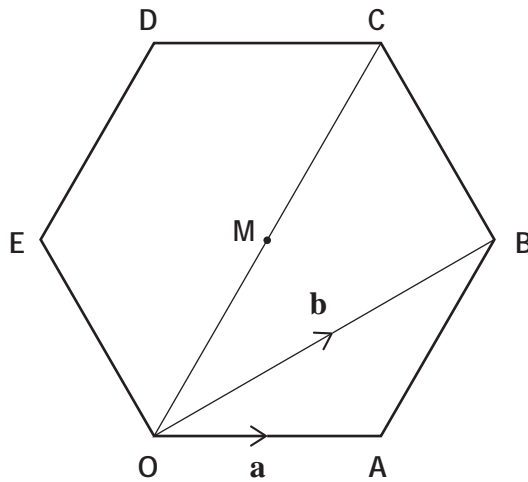
2. There are  $3 \times 10^5$  platelets per millilitre of blood.  
On average, a person has 5.5 litres of blood.  
On average, how many platelets does a person have in their blood?  
Give your answer in scientific notation.

2



\* S Q 2 9 N 5 0 2 0 3 \*

3. In the diagram, OABCDE is a regular hexagon with centre M. Vectors  $\mathbf{a}$  and  $\mathbf{b}$  are represented by  $\overrightarrow{OA}$  and  $\overrightarrow{OB}$  respectively.



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

1

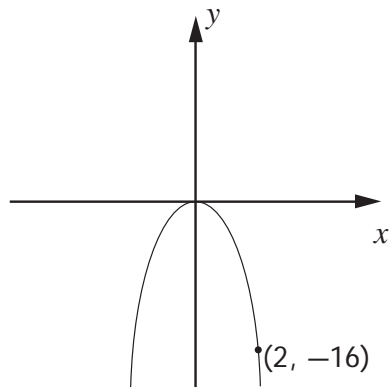
(b) Express  $\overrightarrow{OC}$  in terms of  $\mathbf{a}$  and  $\mathbf{b}$ .

1

Total marks 2



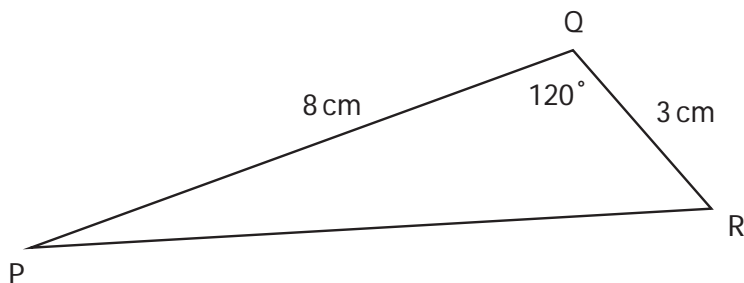
4. The graph with equation  $y = kx^2$  is shown below.



The point  $(2, -16)$  lies on the graph.  
Determine the value of  $k$ .

2

5. In triangle PQR,  $PQ = 8$  centimetres,  $QR = 3$  centimetres and angle  $PQR = 120^\circ$ .



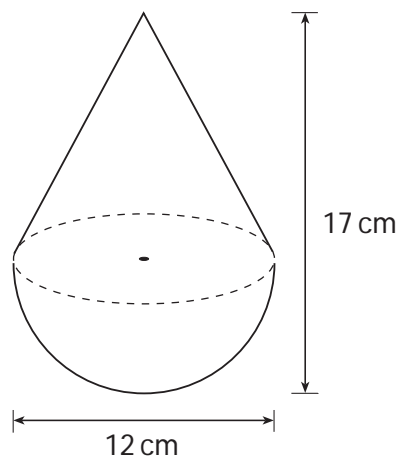
Calculate the length of PR.

3

MARKS

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6. A child's toy is in the shape of a hemisphere with a cone on top, as shown in the diagram.



The toy is 12 centimetres wide and 17 centimetres high.

Calculate the volume of the toy.

Give your answer correct to 2 significant figures.

5



MARKS

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7. This year Adèle paid £465 for her car insurance.  
This is an increase of 20% on last year's payment.  
How much did Adèle pay last year?

3

8. A frozen food company uses machines to pack sprouts into bags.  
A sample of six bags is taken from Machine A and the number of sprouts in  
each bag is counted.  
The results are shown below.

23      19      21      20      19      24

- (a) Calculate the mean and standard deviation of this sample.

3

- (b) Another sample of six bags is taken from Machine B.  
This sample has a mean of 19 and a standard deviation of 2.3.  
Write down two valid comparisons between the samples.

2

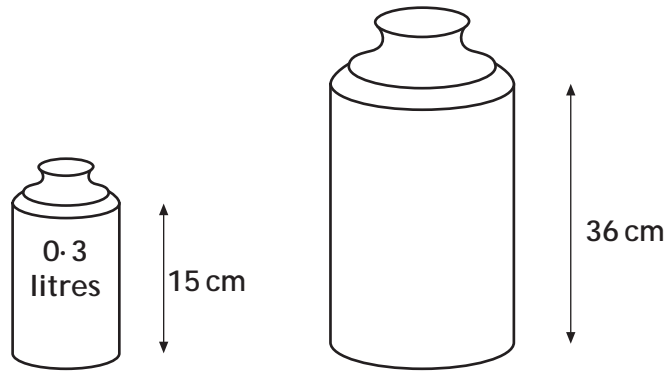
Total marks 5



MARKS

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9. Screenwash is available in two different sized bottles, 'Mini' and 'Maxi'.  
The bottles are mathematically similar.



Calculate the volume of the 'Maxi' bottle.

3

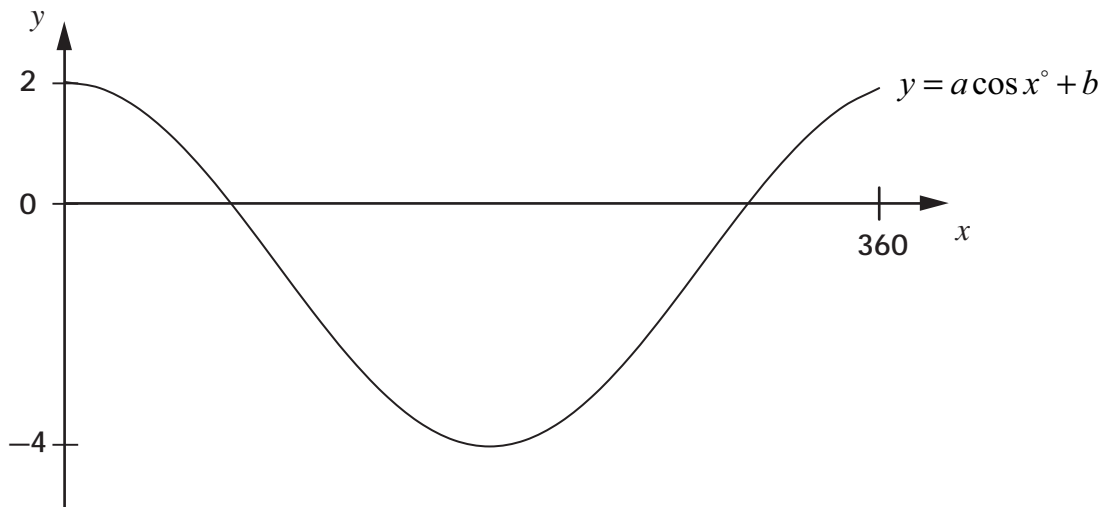




MARKS

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10. Part of the graph of  $y = a \cos x^\circ + b$  is shown below.



(a) Explain how you can tell from the graph that  $a = 3$  and  $b = -1$ . 2

(b) Calculate the  $x$ -coordinates of the points where the graph cuts the  $x$ -axis. 4

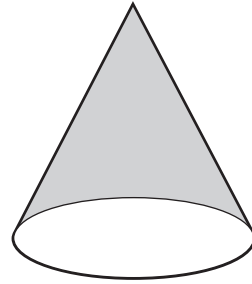
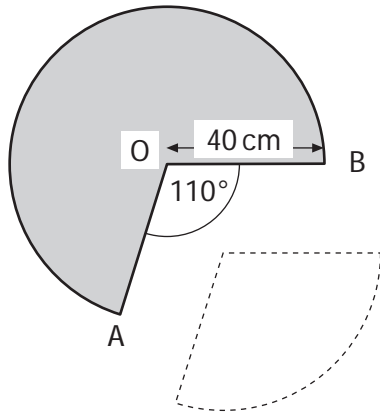
Total marks 6



MARKS

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11. A cone is formed from a paper circle with a sector removed as shown.  
The radius of the paper circle is 40 centimetres.  
Angle AOB is  $110^\circ$ .



- (a) Calculate the area of the sector removed from the circle.

3

- (b) Calculate the circumference of the base of the cone.

3

Total marks 6



\* S Q 2 9 N 5 0 2 1 0 \*



12. Find the range of values of  $p$  such that the equation  $px^2 - 2x + 3 = 0$ ,  $p \neq 0$ , has no real roots.

MARKS

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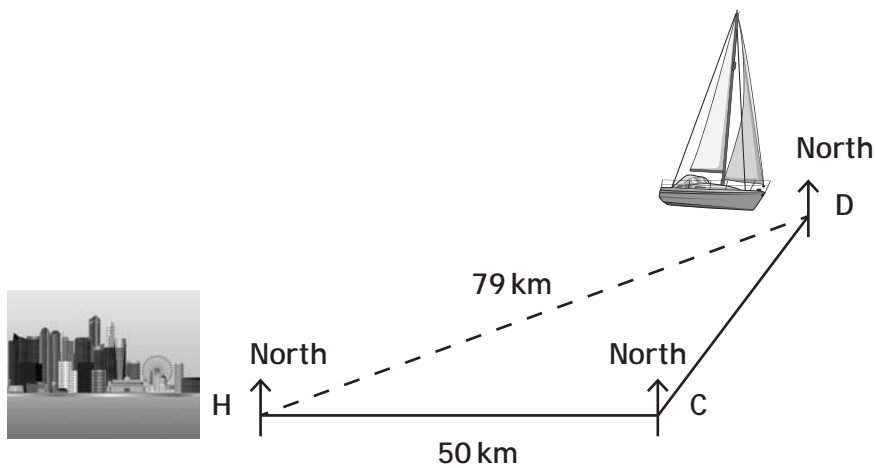
4

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\* S Q 2 9 N 5 0 2 1 1 \*

13. A yacht sails from a harbour H to a point C, then to a point D as shown below.



C is 50 kilometres due east of H.

D is on a bearing of  $040^\circ$  from C and is 79 kilometres from H.

- (a) Calculate the size of angle CDH.

4

- (b) Hence, calculate the bearing on which the yacht must sail to return directly to the harbour.

2

Total Marks 6

[END OF SPECIMEN QUESTION PAPER]



ADDITIONAL SPACE FOR ANSWERS

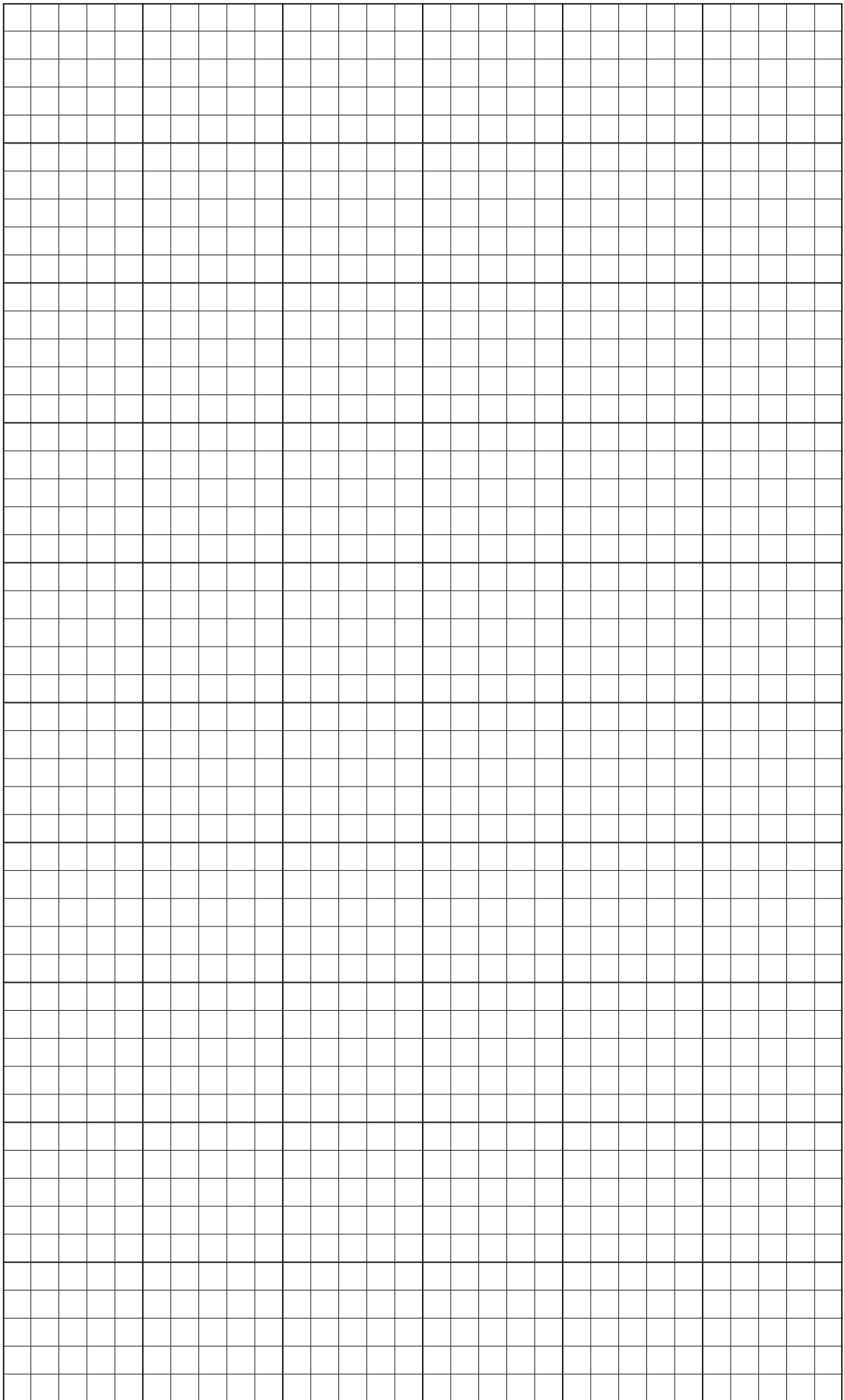


\* S Q 2 9 N 5 0 2 1 3 \*

ADDITIONAL SPACE FOR ANSWERS



\* S Q 2 9 N 5 0 2 1 4 \*





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SQ29/N5/01

Mathematics  
Paper 2

## Marking Instructions

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These Marking Instructions have been provided to show how SQA would mark this Specimen Question Paper.

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## Part One: 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 specific Marking Instructions for each question. The marking schemes are written to assist in determining the ‘minimal acceptable answer’ rather than listing every possible correct and incorrect answer.*

- (a) Marks for each candidate response must always be assigned in line with these general marking principles and the specific Marking Instructions for the relevant question.
- (b) Marking should always be positive, ie marks should be awarded for what is correct and not deducted for errors or omissions.
- (c) Credit must be assigned in accordance with the specific assessment guidelines.
- (d) Candidates may use any mathematically correct method to answer questions except in cases where a particular method is specified or excluded.
- (e) 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 is easier, candidates lose the opportunity to gain credit.
- (f) Where transcription errors occur, candidates would normally lose the opportunity to gain a processing mark.
- (g) Scored out or erased working which has not been replaced should be marked where still legible. However, if the scored out or erased working has been replaced, only the work which has not been scored out should be judged.
- (h) Unless specifically mentioned in the specific assessment guidelines, do not penalise:
  - Working subsequent to a correct answer
  - Correct working in the wrong part of a question
  - Legitimate variations in solutions
  - Bad form
  - Repeated error within a question

Part Two: Specific Marking Instructions for each question

Question		Marking scheme Give one mark for each •	Max mark	Illustrations of evidence for awarding a mark at each •
1		<b>Ans: 85·169 miles</b> • <sup>1</sup> multiplying factor • <sup>2</sup> power of 3 • <sup>3</sup> answer	3	• <sup>1</sup> 1·15 • <sup>2</sup> 1·15 <sup>3</sup> • <sup>3</sup> 85·169 or 85·17 or 85·2 or 85
2		<b>Ans: 1·65 × 10<sup>9</sup></b> • <sup>1</sup> correct method • <sup>2</sup> answer	2	• <sup>1</sup> 3 × 10 <sup>5</sup> × 5·5 × 1000 • <sup>2</sup> 1·65 × 10 <sup>9</sup>
3	a	<b>Ans: b – a</b> • <sup>1</sup> answer	1	• <sup>1</sup> <b>b – a</b>
3	b	<b>Ans: 2(b – a)</b> • <sup>1</sup> answer	1	• <sup>1</sup> <b>2(b – a)</b>
4		<b>Ans: – 4</b> • <sup>1</sup> correct substitution into equation • <sup>2</sup> state value of <i>k</i>	2	• <sup>1</sup> $-16 = k \times 2^2$ • <sup>2</sup> – 4
5		<b>Ans: 9·8 cm</b> • <sup>1</sup> correct application of cosine rule for PR <sup>2</sup> • <sup>2</sup> correct value for PR <sup>2</sup> • <sup>3</sup> answer	3	• <sup>1</sup> $8^2 + 3^2 - 2 \times 8 \times 3 \times \cos 120^\circ$ • <sup>2</sup> 97 • <sup>3</sup> 9·8(488.....)

6		<p><b>Ans: 870 cm<sup>3</sup></b></p> <ul style="list-style-type: none"> <li>•<sup>1</sup> know how to calculate volume of toy</li> <li>•<sup>2</sup> substitute correctly into formula for volume of hemisphere</li> <li>•<sup>3</sup> substitute correctly into formula for volume of cone</li> <li>•<sup>4</sup> calculate volume correctly</li> <li>•<sup>5</sup> round to 2 significant figures</li> </ul>	<p><b>5</b></p> <ul style="list-style-type: none"> <li>•<sup>1</sup> add volume of cone and volume of hemisphere</li> <li>•<sup>2</sup> <math>\frac{1}{2} \times \frac{4}{3} \times \pi \times 6^3</math> (= 452.389...)</li> <li>•<sup>3</sup> <math>\frac{1}{3} \times \pi \times 6^2 \times 11</math> (= 414.690...)</li> <li>•<sup>4</sup> 867.079...</li> <li>•<sup>5</sup> 870</li> </ul>
7		<p><b>Ans: £387.50</b></p> <ul style="list-style-type: none"> <li>•<sup>1</sup> know that 120% = 465</li> <li>•<sup>2</sup> know to divide 465 by 1.2</li> <li>•<sup>3</sup> answer</li> </ul>	<p><b>3</b></p> <ul style="list-style-type: none"> <li>•<sup>1</sup> 120% = 465</li> <li>•<sup>2</sup> 100% = 465 ÷ 1.2</li> <li>•<sup>3</sup> 387.50</li> </ul>
8	a	<p><b>Ans: mean = 21 standard deviation = 2.1</b></p> <ul style="list-style-type: none"> <li>•<sup>1</sup> calculate mean</li> <li>•<sup>2</sup> start to calculate standard deviation</li> <li>•<sup>3</sup> answer</li> </ul>	<p><b>3</b></p> <ul style="list-style-type: none"> <li>•<sup>1</sup> 21</li> <li>•<sup>2</sup> as far as <math>\Sigma(x - \bar{x})^2 = 22</math> or <math>\Sigma x^2 = 2668</math></li> <li>•<sup>3</sup> 2.0976</li> </ul>
8	b	<p><b>Ans: two valid statements</b></p> <ul style="list-style-type: none"> <li>•<sup>1</sup> compare means</li> <li>•<sup>2</sup> compare standard deviations</li> </ul>	<p><b>2</b></p> <ul style="list-style-type: none"> <li>•<sup>1</sup> Machine A, on average, packs more sprouts into a bag</li> <li>•<sup>2</sup> The number of sprouts packed in a bag by Machine A is more consistent</li> </ul>

9		<p><b>Ans: 4·1472 litres</b></p> <ul style="list-style-type: none"> <li>•<sup>1</sup> find linear scale factor</li> <li>•<sup>2</sup> find volume scale factor</li> <li>•<sup>3</sup> calculate volume</li> </ul>	3	<ul style="list-style-type: none"> <li>•<sup>1</sup> <math>\frac{36}{15}</math> (= 2·4)</li> <li>•<sup>2</sup> <math>\left(\frac{36}{15}\right)^3</math> (= 2·4<sup>3</sup> = 13·824)</li> <li>•<sup>3</sup> 4·1 or 4·15 or 4·147 or 4·1472</li> </ul>
10	a	<p><b>Ans: half of [2 – (–4)] graph moved down 1</b></p> <ul style="list-style-type: none"> <li>•<sup>1</sup> correct explanation of 3</li> <li>•<sup>2</sup> correct explanation of –1</li> </ul>	2	<ul style="list-style-type: none"> <li>•<sup>1</sup> half of [2 – (–4)] , or equivalent</li> <li>•<sup>2</sup> graph of <math>y = \cos x^\circ</math> moved down 1, or equivalent</li> </ul>
10	b	<p><b>Ans: 70·5°, 289·5°</b></p> <ul style="list-style-type: none"> <li>•<sup>1</sup> form equation</li> <li>•<sup>2</sup> rearrange equation</li> <li>•<sup>3</sup> find one value</li> <li>•<sup>4</sup> find second value</li> </ul>	4	<ul style="list-style-type: none"> <li>•<sup>1</sup> <math>3\cos x^\circ - 1 = 0</math></li> <li>•<sup>2</sup> as far as <math>\cos x^\circ = \frac{1}{3}</math></li> <li>•<sup>3</sup> 70·5</li> <li>•<sup>4</sup> 289·5</li> </ul>
11	a	<p><b>Ans: 1536 cm<sup>2</sup></b></p> <ul style="list-style-type: none"> <li>•<sup>1</sup> correct fraction of area</li> <li>•<sup>2</sup> correct formula</li> <li>•<sup>3</sup> all calculations correct</li> </ul>	3	<ul style="list-style-type: none"> <li>•<sup>1</sup> <math>\frac{110}{360}</math></li> <li>•<sup>2</sup> <math>\frac{110}{360} \times \pi \times 40^2</math></li> <li>•<sup>3</sup> 1535·8...</li> </ul>
11	b	<p><b>Ans: 175 cm</b></p> <ul style="list-style-type: none"> <li>•<sup>1</sup> correct fraction of circumference</li> <li>•<sup>2</sup> correct formula</li> <li>•<sup>3</sup> all calculations correct</li> </ul>	3	<ul style="list-style-type: none"> <li>•<sup>1</sup> <math>\frac{250}{360}</math></li> <li>•<sup>2</sup> <math>\frac{250}{360} \times \pi \times 80</math></li> <li>•<sup>3</sup> 174·5...</li> </ul>

12		<p><b>Ans:</b> <math>p &gt; \frac{1}{3}</math></p> <ul style="list-style-type: none"> <li>•<sup>1</sup> know to use discriminant</li> <li>•<sup>2</sup> correct values of <math>a</math>, <math>b</math> and <math>c</math></li> <li>•<sup>3</sup> form correct inequation</li> <li>•<sup>4</sup> solve inequation</li> </ul>	4	<ul style="list-style-type: none"> <li>•<sup>1</sup> <math>b^2 - 4ac</math></li> <li>•<sup>2</sup> <math>a = p, b = -2, c = 3</math></li> <li>•<sup>3</sup> <math>4 - 12p &lt; 0</math></li> <li>•<sup>4</sup> <math>p &gt; \frac{1}{3}</math></li> </ul>
13	a	<p><b>Ans:</b> <math>29^\circ</math></p> <ul style="list-style-type: none"> <li>•<sup>1</sup> calculate angle CDH</li> <li>•<sup>2</sup> correct use of sine rule</li> <li>•<sup>3</sup> rearrange equation</li> <li>•<sup>4</sup> find angle CDH</li> </ul>	4	<ul style="list-style-type: none"> <li>•<sup>1</sup> <math>130^\circ</math></li> <li>•<sup>2</sup> <math>\frac{50}{\sin \text{CDH}} = \frac{79}{\sin 130^\circ}</math></li> <li>•<sup>3</sup> <math>\sin \text{CDH} = \frac{50 \sin 130^\circ}{79}</math></li> <li>•<sup>4</sup> <math>29^\circ</math></li> </ul>
13	b	<p><b>Ans:</b> <math>249^\circ</math></p> <ul style="list-style-type: none"> <li>•<sup>1</sup> use alternate angle</li> <li>•<sup>2</sup> find correct bearing</li> </ul>	2	<ul style="list-style-type: none"> <li>•<sup>1</sup> angle alternate to given bearing = <math>40^\circ</math></li> <li>•<sup>2</sup> <math>249^\circ</math></li> </ul>

Total Marks for Paper 2 – 50

[END OF SPECIMEN MARKING INSTRUCTIONS]