Centre Number	Candidate Number	Name

CAMBRIDGE INTERNATIONAL EXAMINATIONS
International General Certificate of Secondary Education

MATHEMATICS

0580/03
0581/03

Paper 3

May/June 2003

2 hours

Candidates answer on the Question Paper.
Additional Materials: Electronic calculator
Geometrical instruments
Mathematical tables (optional)
Tracing paper (optional)

READ THESE INSTRUCTIONS FIRST

Write your Centre number, candidate number and name on all the work you hand in.
Write in dark blue or black pen in the spaces provided on the Question Paper.
You may use a soft pencil for any diagrams or graphs.
Do not use staples, paper clips, highlighters, glue or correction fluid.

Answer **all** questions.
If working is needed for any question it must be shown below that question.
The number of marks is given in brackets [ ] at the end of each question or part question.
The total of the marks for this paper is 104.
Electronic calculators should be used.
If the degree of accuracy is not specified in the question, and if the answer is not exact, give the answer to three significant figures. Give answers in degrees to one decimal place.
For π, use either your calculator value or 3.142.

If you have been given a label, look at the details. If any details are incorrect or missing, please fill in your correct details in the space given at the top of this page.

Stick your personal label here, if provided.

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This document consists of **13** printed pages and **3** blank pages.

University of Cambridge Local Examinations Syndicate

[Turn over

1 Fifty students take part in a quiz.
The table shows the results.

Number of correct answers	5	6	7	8	9	10	11	12
Number of students	4	7	8	7	10	6	5	3

(a) How many students had 6 correct answers?

Answer(a).....7..... [1]

(b) How many students had less than 11 correct answers?

4+7+8+7+10+6 = 42

Answer(b).....42..... [1]

(c) Find

(i) the modal number of correct answers,

Answer(c)(i).....9..... [1]

(ii) the median number of correct answers,

For 50 students the median is between the 25th and the 26th when in order.

Both have 8 correct answers, which is the median.

Answer(c)(ii).....8..... [2]

(iii) the mean number of correct answers.

(4 x 5)+(7 x 6)+(8 x 7)+(7 x 8)+(10 x 9)+(6 x 10)+(5 x 11)+(3 x 12)

= 415

415 ÷ 50

= 8.3

Answer(c)(iii).....8.3..... [3]

(d) A bar chart is drawn to show the results.
The height of the bar for the number of students who had 5 correct answers is 2 cm.
What is the height of the bar for the number of students who had 9 correct answers?

5 correct, 4 students with height 2cm.

So 1cm represents 2 students.

9 correct is 10 students, represented by 10 ÷ 2 = 5cm

Answer(d).....5.....cm [2]

(e) A pie chart is drawn to show the results.
What is the angle for the number of students who had 11 correct answers?

5 students had 11 correct answers.
Angle = 5 ÷ 50 x 360

Answer(e).....36°..... [2]

(f) The students who had the most correct answers shared a top prize of $22.50.
How much did each of these students receive?

3 students shared the prize of $22.50
Each received 22.5 ÷ 3
= $7.50

Answer(f) $.....7.50..... [2]

(g) Work out the percentage of students who had **less than** 7 correct answers.

11 students had less than 7 correct.
11 ÷ 50 x 100
= 22%

Answer(g).....22.....% [2]

(h) A student is chosen at random from the fifty students.
What is the probability that this student had

(i) exactly 10 correct answers,

$\frac{6}{50}$ or 0.12 or 12%

Answer(h)(i).....12%..... [1]

(ii) at least 10 correct answers,

(6 + 5 + 3) ÷ 50 = $\frac{14}{50}$

Answer(h)(ii).....$\frac{14}{50}$..... [1]

(iii) more than 1 correct answer?

Answer(h)(iii).....1..... [1]

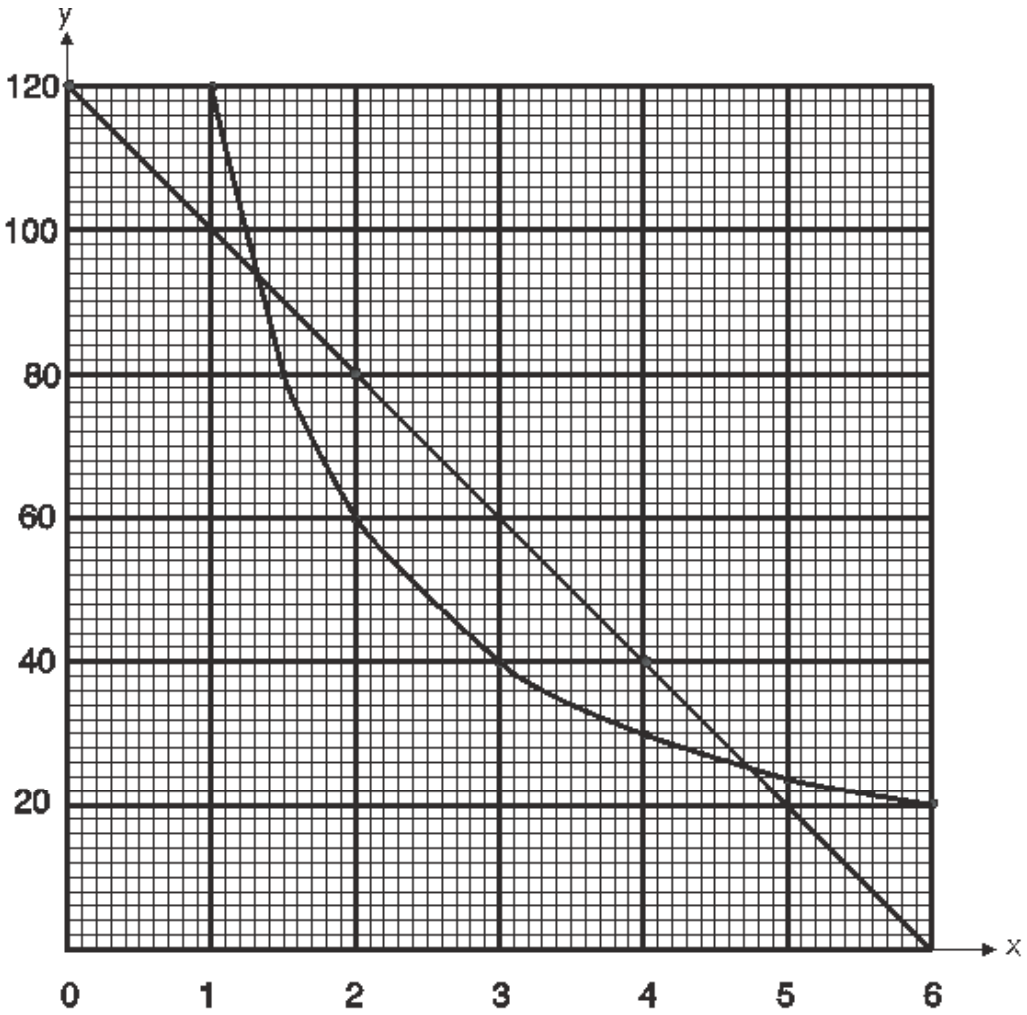
[Turn over

2 **(a)** Complete the table for the equation $y = \frac{120}{x}$.

x	1	1.5	2	3	4	5	6
y	120	80	60	40	30	24	20

[3]

(b) On the grid below, draw the curve $y = \frac{120}{x}$ for $1 \leqslant x \leqslant 6$.



[4]

(c) Use your graph to find x when $y = 70$.

Answer(c) $x =$ 1.7 [1]

(d) Complete the table for the equation $y = 120 - 20x$.

x	0	2	4	6
y	120	80	40	0

[2]

(e) On the same grid above, draw the graph of $y = 120 - 20x$ for $0 \leqslant x \leqslant 6$. [2]

(f) The graphs of $y = \frac{120}{x}$ and $y = 120 - 20x$ intersect at two points.
Write down the coordinates of these two points.

Answer(f) (1.9, 98) and (4.6, 24) [2]

(g) Write down the gradient of the line $y = 120 - 20x$.

Answer(g) −20 [2]

[Turn over

3 **(a)** Bottles of water cost 25 cents each.

(i) Find the cost of 7 bottles in cents.

7 x 25 = 175 cents

Answer(a)(i)……175……..cents [1]

(ii) Write down an expression in b for the cost of b bottles in cents.

b x 25 or better is 25b

Answer(a)(ii)……25b……..cents [1]

(iii) Change your answer to **part (i)** into dollars.

175 cents = $1.75

Answer(a)(iii) $……1.75…… [1]

(iv) Write down an expression in b for the cost of b bottles in dollars.

25b/100 or b/4 or 0.25b

Answer(a)(iv) $……0.25b…… [1]

(b) The total cost, T, of n bars of chocolate is given by $T = nc$.

(i) Write c in terms of T and n.

T = nc => c = T/n

Answer(b)(i) c = ……T/n…… [1]

(ii) What does c represent?

Answer(b)(ii) ……The cost of 1 bar (of chocolate)…… [1]

(c) The average cost of a book is $\$A$.

(i) The total cost of 8 books is \$36.
Find the value of A.

A = $36 ÷ 8 = $4.50

Answer(c)(i) A = ……$4.50…… [1]

(ii) One of the 8 books is removed.
The cost of this book is \$6.60.
Find the new value of A.

A = ($36 - $6.60)/7
= $4.20

Answer(c)(ii) A = ……$4.20…… [2]

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(iii) The total cost of x books is $\$y$.
Write an expression for A in terms of x and y.

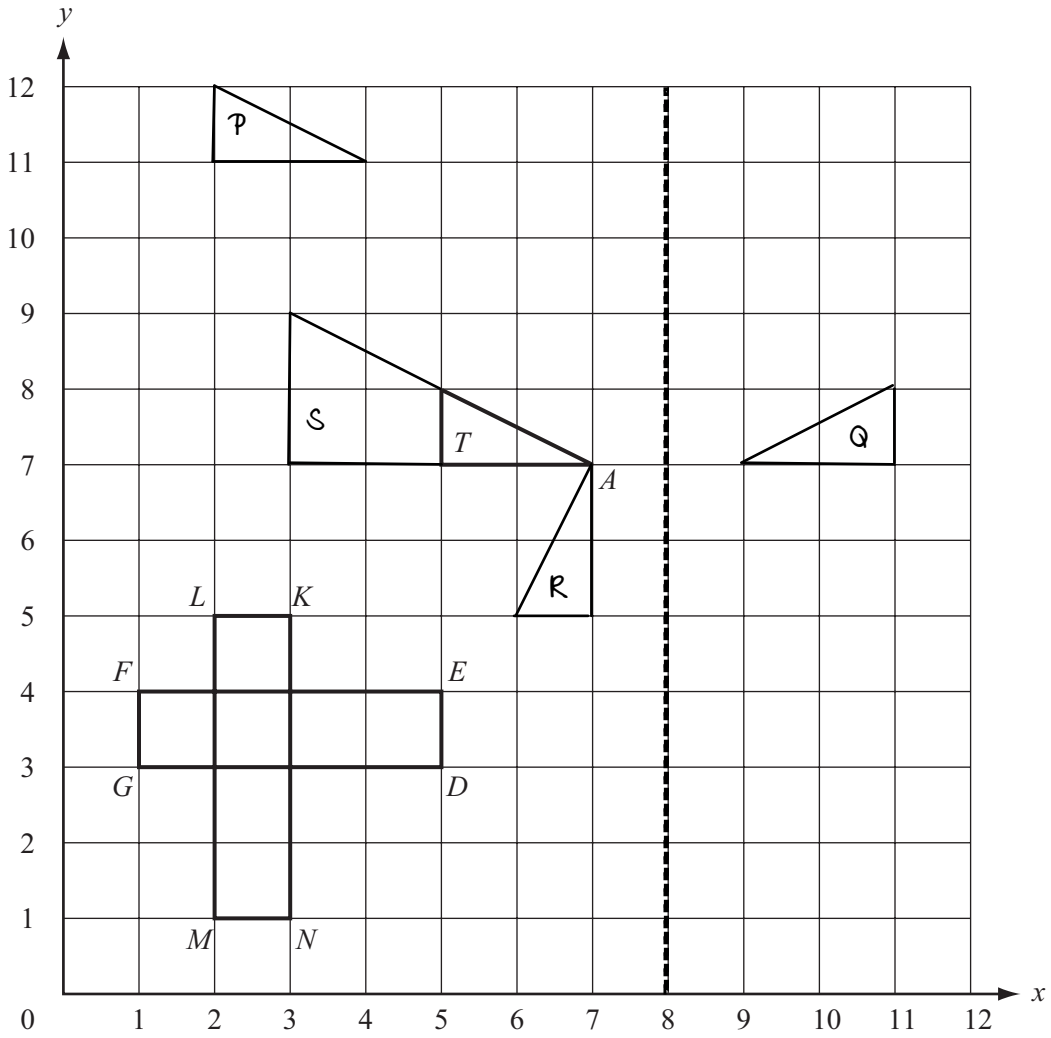
Answer(c)(iii) $A =$ y/x [1]

(iv) One of the x books is removed.
The cost of this book is \$7.
Write a new expression for A in terms of x and y.

Answer(c)(iv) $A =$ (y − 7)/(x − 1) [2]

[Turn over

4



(a) Draw accurately the image of triangle T under the following transformations.

(i) Translate triangle T by the vector $\begin{pmatrix} -3 \\ 4 \end{pmatrix}$. Label it P. [2]

(ii) Reflect triangle T in the line $x = 8$. Label it Q. [2]

(iii) Rotate triangle T about the point A through 90° anti-clockwise. Label it R. [2]

(iv) Enlarge triangle T with centre of enlargement A and scale factor 2. Label it S. [2]

(b) Describe fully the single transformation which maps

(i) triangle *P* onto triangle *T*,

Answer(b)(i) P => T is a translation with vector $\begin{pmatrix} 3 \\ -4 \end{pmatrix}$ [2]

(ii) triangle *S* onto triangle *T*.

Answer(b)(ii) Enlargement Scale Factor 1/2 Centre A [3]

(c) The rectangle *DEFG* is rotated onto the rectangle *KLMN*, with *D* mapped onto *K*.

Write down

(i) the angle of the rotation,

Answer(c)(i) 90° [1]

(ii) the coordinates of the centre of the rotation.

Answer(c)(ii) (3 , 3) [2]

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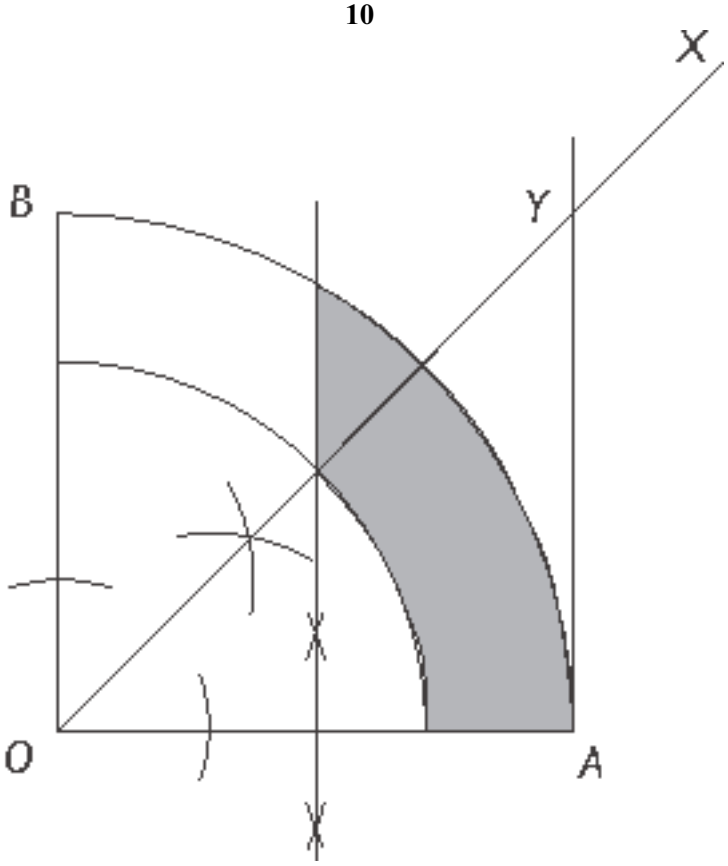

The quarter-circle above has centre O and radius 7 cm.

(a) Using a straight edge and compasses only construct

(i) the perpendicular bisector of AO, [2]

(ii) the locus of points inside the quarter-circle which are 5 cm from O. [2]

(b) Shade the region, inside the quarter-circle, containing the points which are more than 5 cm from O and nearer to A than O. [1]

(c) **(i)** The line OX bisects angle AOB and is 12 cm long.
Draw OX accurately. [2]

(ii) Draw accurately the tangent to the quarter-circle at A. [1]

(iii) This tangent meets the line OX at Y.
Measure the length of AY.

Answer(c)(iii) AY = 6.8 to 7.2 cm [1]

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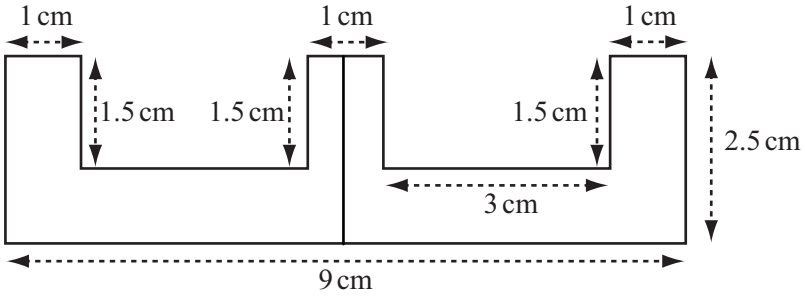

In the diagram above, all the angles are right angles.

(a) Show that the area of the shape is 13.5 cm^2.

Answer(a) Area = (9 x 1) + (1.5 x 1 x 3)
= 9 + 4.5 = 13.5

[2]

(b) The shape is the cross-section of a metal prism of length 2.8 **metres.** Calculate the volume of the prism in cubic centimetres.

Volume = Area of cross-section x length
= 13.5 square cm. x 2.8m
2.8m = 280cm

Volume = 13.5 x 280
= 3780 cubic cm.

Answer(b).....3780.....cm^3 [3]

(c) A metal cuboid is melted down so that prisms as described in **part (b)** can be made. The cuboid measures 2 metres by 1.2 metres by 0.8 metres.

(i) Calculate the volume of the cuboid in cubic metres,

Volume = length x width x height
= 2 x 1.2 x 0.8
= 1.92 cubic metres

Answer(c)(i).....1.92.....m^3 [2]

(ii) Calculate the volume of the cuboid in cubic centimetres.

All measurements in centimetres gives 200 x 120 x 80

Answer(c)(ii).....1 920 000.....cm^3 [2]

(iii) Calculate the number of prisms which can be made.

Number of prisms is volume in (c)(ii) ÷ volume in (b)
= 1 920 000 ÷ 3780
= 507.936...
= 507

Answer(c)(iii).....507..... [2]

(d) Draw any lines of symmetry of the shape on the diagram above. [1]

(e) Describe the rotational symmetry of the shape above.

Answer(e).....(order) 1 or no symmetry..... [1]

[Turn over

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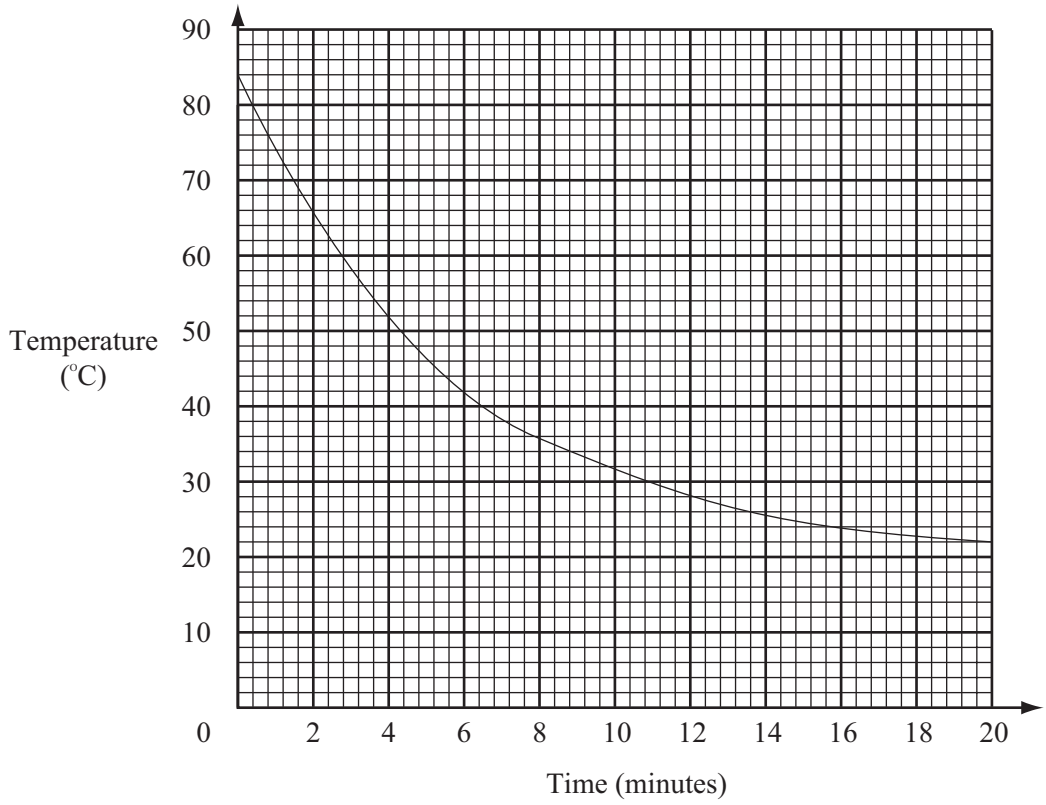

The graph shows the temperature of a cup of tea cooling down in a room.

(a) What is the temperature of the tea after

(i) 0 minutes,

Answer(a)(i) 84° [1]

(ii) 20 minutes?

Answer(a)(ii) 22° [1]

(b) After how many minutes is its temperature 30 °C?

Answer(b) 11 minutes [1]

(c) By how much has its temperature gone down between 4 minutes and 8 minutes?

the temperature has gone from 52 to 36 degrees.

Answer(c) 16 degrees [1]

(d) **(i)** Complete the table which shows falls in temperature.

Between	0 and 4 minutes	4 and 8 minutes	8 and 12 minutes	12 and 16 minutes
Fall in temperature	32	16	8	4

[3]

(ii) What pattern do you notice about these falls in temperature?

Answer(d)(ii) Halving or dividing by 2 [1]

(e) Estimate the room temperature.

Answer(e)..... 20 °C [1]

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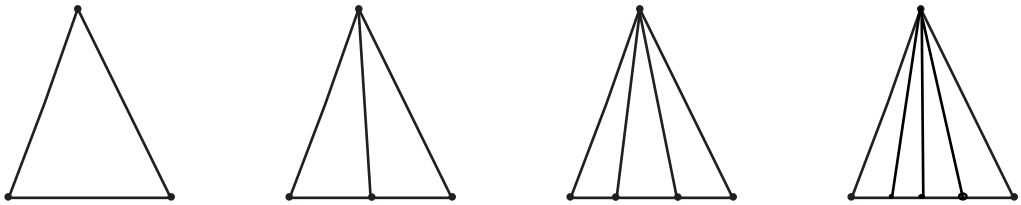
Diagram 1 | Diagram 2 | Diagram 3 | Diagram 4



3 dots
1 triangle

4 dots
3 triangles

5 dots
6 triangles

6 dots
10 triangles

Look at the diagrams above.

(a) Complete Diagram 4 to continue the pattern. [2]

(b) Complete the table below.

Diagram	1	2	3	4	5		*n*
Number of dots	3	4	5	6	7		n+2

[3]

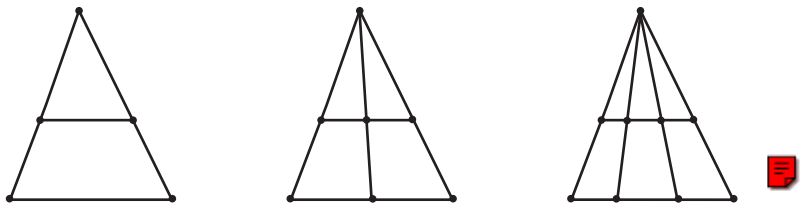
(c) Complete the table below.

Diagram	1	2	3	4	5	6		10
Number of triangles	1	3	6	10	15	21		55

[3]

(d) A line is now drawn inside each of the diagrams as shown below.

Diagram 1 | Diagram 2 | Diagram 3



2 triangles

6 triangles

How many triangles are there in Diagram 3?

Answer(d)..... 12 .....[2]

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Summary of Comments on IGCSE Mathematics Paper 3 June 2003

Page: 2

Q1(a) Reading the table for 6 correct answers.

Q1(b) Take care not to include 11.

Q1(c)(i) 10 is identified as the highest frequency but the mode is the number of correct answers with the highest frequency.
Need to find the number of correct answers for the middle when in order.

(ii) There are four less than 6, eleven less than 7, nineteen less than 8 and twenty-six less than 9. So the 25^{th} and 26^{th} in order both have 8 correct answers.

(iii) Mean is the total number of correct answers divided by the total number of students. 4 students had 5 correct giving 4 x 5 = 20 correct answers, and so on for the total number of correct answers.

Q1(d) Alternatively, 4 students with height 2cm.
10 students with height $10 \div 4 \times 2 = 5$cm.
Take care to use number of students, not number of answers which would give $9 \div 5 \times 2 = 3.6$.

Page: 3

Q1(e) Again take care not to give $11 \div 50 \times 360$.
The whole pie chart is 360°. Each sector is a fraction of 360.

Q1(f) Identify 3 students who had 12 correct answers and then divide the prize by three.

Q1(g) Percentage =

$$\frac{\text{Number in the required section}}{\text{Total Number}} \times 100$$

Take care not to include the 8 students with 7 correct.
SC 1 was awarded for 19/50.

Q1(h) Probability must be either fraction, decimal or percentage and no other form should be used. Also make sure that the value of any probability is between 0 and 1.

Page: 4

Q2(a) Divide 120 by each of the x values to find the y values.

Q2(b) Plot the points carefully and join with a smooth curve. The curve should go through all the points with no gaps.

Q2(c) 1.6 to 1.8 allowed. Give the x value as accurately as possible.

Q2(d) Multiply x by 20 and subtract from 120.

Q2(e) The line should be drawn using a ruler and go through all the points.

Page: 5

Q2(f) While these are the expected ranges, the values marked should be from the candidate's graph, provided the graph is the basically correct shape.

Q2(g) An understanding of $y = mx + c$ would immediately give the value of m, the gradient.
Alternatively M1 is awarded for rise/run seen but the second mark is for the exact answer.
SC1 is given for an answer of 20.

Page: 6

Q3(a)(i) Straightforward multiplication.
(ii) Replace the number by the letter to give the expression.
(iii) Divide by 100 (100 cents = \$1).

(iv) Simplest form is not asked for but is acceptable provided simplification is done correctly.

Q3(b)(i) Divide both sides by n. Avoid the common error of $c = Tn$.

(ii) A very specific statement is needed. Do not just write 'cost' or 'chocolate'.

Q3(c)(i) Straightforward division.

(ii) Be careful with a calculator. Either use brackets or work out the subtraction first, ($29.40) and then divide by 7.

(iii) If the working in parts (i) and (ii) is shown it is easier to substitute the numbers with the appropriate letters.

(iv) Remember that there is one less book in part (iv) although B1 was awarded for one of the two expressions seen.

Page: 8

Q4(a)(i) The triangle T is moved 3 squares to the left and 4 squares up.

(ii) $x = 8$ is the vertical line through 8 on the horizontal axis.

(iii) Make sure the rotation is in the correct direction and through the angle of 90°.

(iv) As the centre A is on the triangle, it stays in the same place. The distances of the other points from A are doubled.
The use of tracing paper is strongly recommended for the first three parts. Centres should provide it for the examination.

Page: 9

Q4(b)(i) This is the reverse of (a)(i) and so only the signs change.

(ii) Still enlargement even though it reduces. Scale factor is the inverse of multiplying by two but expressed as 1/2. The centre remains the same.

Q4(c)(i) Direction and centre are not required here. Best not to give what is not asked for. '270° clockwise' would be acceptable but not just '270°' .

(ii) Here the centre must be the same distance from K as it is from D. Tracing paper again could help but it is not difficult to realise that it is at the intersection of DG and KN.

Page: 10

Q5 (a)(i) Place the compass point at O, with radius greater than 3.5cm and draw arcs above and below the line OA. With the same radius, place the compass point at A and draw arcs intersecting the previous arcs. Join the intersection points of the arcs.

(a)(ii) Set the compasses to 5cm and draw a quarter circle centre O.

(b) Shade the region of the quarter-circle radius 5cm which is to the right of the bisector of AO.

(c)(i) Place the compass point at O and draw short arcs on OB and OA. Open the compasses to a larger radius, place the point on the intersections of these arcs and create two intersecting arcs. Join this intersection point to O and extend the line to 12cm.

(c)(ii) Draw a vertical line just touching the point A.

Q5(c)(iii) 6.8 to 7.2 cm
(The diagram is accurate to the measurements, when printed out, and it shows the method for the various constructions)

<u>Construction lines are vital and should be clearly seen</u>

Page: 11

Q6(a) Where the answer is given in the question full working must be shown together with a statement of the answer. There are several other correct methods of splitting the shape to find the area.
The second M mark is for using correct values for the offered solution.

Q6(b) As the Area is given in part (a), it should be used to find the volume. Conversion of 2.8 m to cm is necessary for units to agree.

Q6(c)(i) Standard volume formula for a cuboid.

(ii) Alternatively, as 100cm = 1m
100^3 cubic cm = 1 cubic m
$1.92 \times 1\,000\,000$ is calculated.
With this method take care not to give the common error of 1000 cu.cm. = 1cu.m

(iii) As this is referring to complete prisms the answer is not rounded up.

This question is a case of follow through marks being given if an early error is made but the working is shown.

Q6(e) Shapes that display no rotational symmetry are said to have order 1, since in turning the shape through 360° it is on top of itself just once.
Order 0 does not exist.

Page: 12

Q7(a) Careful reading of the vertical scale. It is 2 degrees for each small square.

Q7(b) Careful reading of the horizontal scale.
2 minutes for each large square.

Q7(c) Again careful reading of the scale.

Q7(d) Continue in the same way as part (c).

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Q7(e) After 20 minutes it would be expected that the tea would be nearly down to room temperature, but would not go below. The graph indicates that it is reducing at a slower rate and a limit of 20 degrees seems likely. Answers greater than 20 but less than 22 are acceptable.

Q8(a) Three lines need to be drawn from the top vertex creating 6 dots and 10 triangles.
Use a ruler and show the dots clearly.

Q8(b) Observe the pattern is to add 2 to the diagram number to find the number of dots. The algebraic expression expresses this rule.

Q8(c) The difference between the number of triangles increases by 1 each time. These are in fact known as triangle numbers.

Easiest method for diagram 10 is to continue progressively until that that value is reached.

Q8(d) The extra line causes the number of triangles to be doubled.
Although it is possible to count the triangles, it is very easy to miss 1 or more of them.
Later parts of questions are usually related to earlier parts and give some progression towards the solutions of the more difficult parts of a question.
SC1 mark awarded for 10 or 11 triangles found.