X056/201

NATIONAL QUALIFICATIONS 2000

THURSDAY, 25 MAY
9.00 AM – 9.45 AM

MATHEMATICS INTERMEDIATE 2 Paper 1 (Non-calculator)

Read carefully

1 **You may NOT use a calculator.**

2 There are three Sections in this paper.

Section A assesses the compulsory units Mathematics 1 and 2.
Section B assesses the optional unit Mathematics 3.
Section C assesses the optional unit Applications of Mathematics.

Candidates must attempt **all** questions in Section A (Mathematics 1 and 2) **and**

either Section B (Mathematics 3)

or Section C (Applications of Mathematics).

3 Full credit will be given only where the solution contains appropriate working.

4 Square-ruled paper is provided.

SCOTTISH QUALIFICATIONS AUTHORITY

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: Area $= \frac{1}{2}ab \sin C$

Volume of a sphere: Volume $= \dfrac{4}{3}\pi r^3$

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

Volume of a cylinder: Volume $= \pi r^2 h$

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

SECTION A (Mathematics 1 and 2)

ALL candidates should attempt this Section.

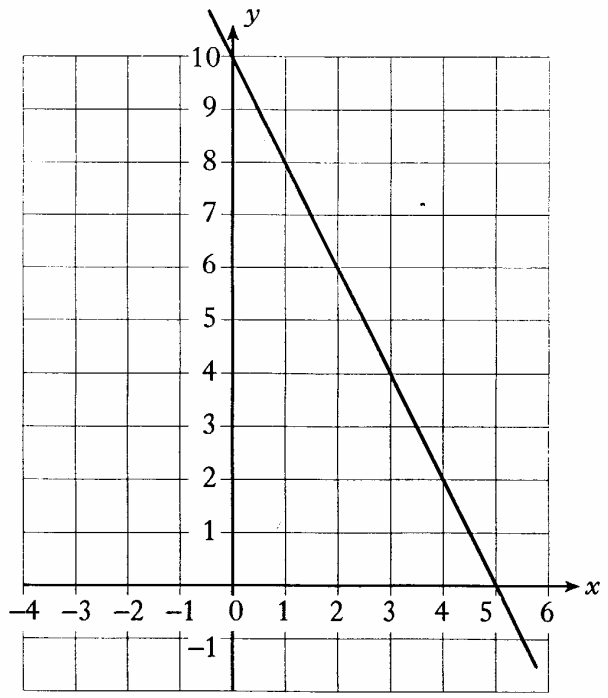
A1. A group of students scored the following marks in a test.

9 5 6 8 6 9 7 8 6 5

(*a*) Construct a frequency table from the above data and add a cumulative frequency column. **2**

(*b*) What is the probability that a student chosen at random from this group scored less than 8? **1**

A2.



Find the equation of the straight line. **3**

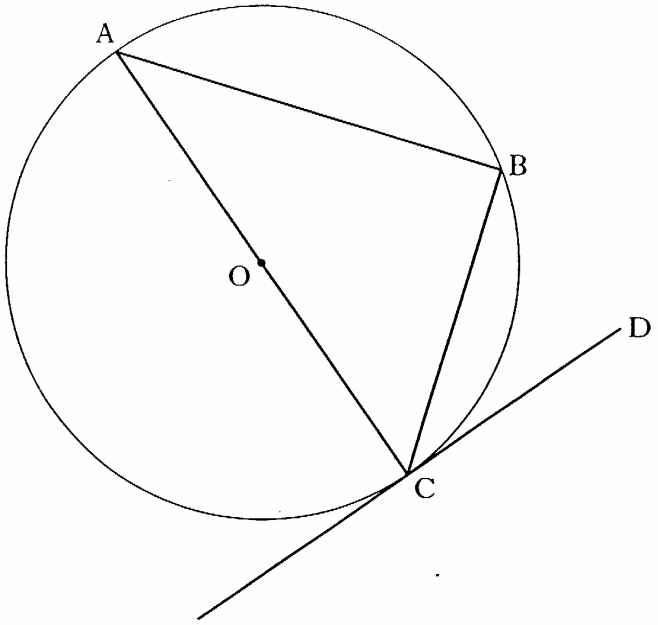
[Turn over

A3. Factorise

Marks

$9a^2 - 25b^2$. **2**

A4.



- A, B and C are points on the circumference of a circle, centre O.
- CD is a tangent to the circle.
- Angle BCD = 25°.

Calculate the size of angle BAC.
Show all working. **3**

Marks

A5. A manufacturer of matches claims that there are "on average 60 matches per box".

A sample of eleven boxes contains the following numbers of matches per box.

58, 62, 60, 65, 59, 60, 59, 62, 61, 61, 64

(*a*) From the above data, find the median, the lower quartile and the upper quartile. **2**

(*b*) Comment on the claim made above. **1**

(*c*) Construct a boxplot for the data. **2**

(*d*) A different sample of matchboxes was taken.
The boxplot, shown below, was drawn for the new data.

Does this new data support the manufacturer's claim?
Give a reason for your answer. **1**

[END OF SECTION A]

Candidates should now attempt
EITHER Section B (Mathematics 3) on *Pages six and seven*
OR Section C (Applications of Mathematics) on *Page eight.*

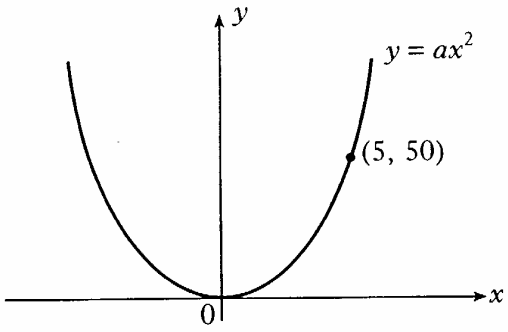
[Turn over

Marks

SECTION B (Mathematics 3)

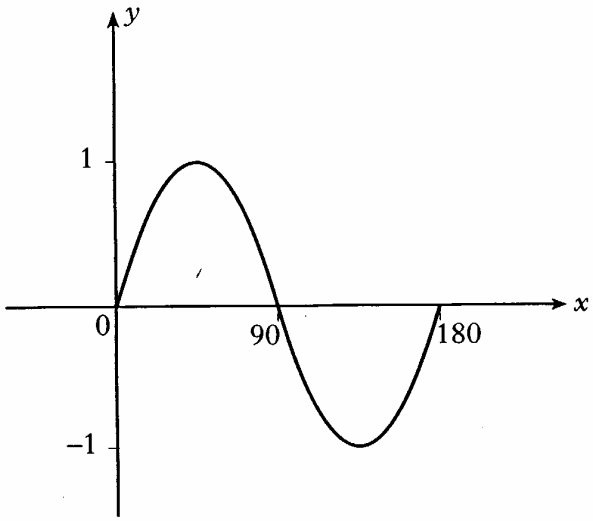
ONLY candidates doing the course Mathematics 1, 2 and 3 should attempt this Section.

B6. The diagram below shows the graph of $y = ax^2$.



Find the value of a. **2**

B7.



The graph of $y = \sin bx°$ is shown in the diagram.

State the value of b. **1**

Marks

B8. (*a*) Express $\frac{a^{\frac{1}{2}} \times a^{\frac{5}{2}}}{a^2}$ in its simplest form. **2**

(*b*) Express $\frac{2}{\sqrt{3}}$ as a fraction with a rational denominator. **2**

(*c*) Express $\frac{2}{x} + \frac{4}{x+3}$, $x \neq 0$, $x \neq -3$, as a single fraction in its simplest form. **3**

[END OF SECTION B]

[Turn over

SECTION C (Applications of Mathematics)

ONLY candidates doing the course Mathematics 1, 2 and Applications of Mathematics should attempt this Section.

C6. Stephen plans to go to a concert. The ticket costs £49·00. He works 2 hours overtime on Friday night at time and a half, and $2\frac{1}{2}$ hours overtime on Saturday morning at double time.

If his basic pay is £6·80 per hour, will his overtime pay cover the cost of the ticket?

You must give a reason for your answer. **4**

C7. The distance, s metres, travelled by a moving object is given by the formula

$$s = \frac{(u+v)t}{2}$$

where u metres per second is the initial velocity,
v metres per second is the final velocity
and t seconds is the time taken.

(*a*) Calculate s when $u = 3$, $v = 7$ and $t = 4$. **3**

(*b*) Calculate t when $s = 35$, $u = 5$ and $v = 9$. **3**

[END OF SECTION C]

[END OF QUESTION PAPER]

X056/202

NATIONAL QUALIFICATIONS 2000

THURSDAY, 25 MAY
10.05 AM – 11.35 AM

MATHEMATICS INTERMEDIATE 2 Paper 2

Read carefully

1 **Calculators may be used in this paper.**

2 There are three Sections in this paper.

Section A assesses the compulsory units Mathematics 1 and 2.
Section B assesses the optional unit Mathematics 3.
Section C assesses the optional unit Applications of Mathematics.

Candidates must attempt **all** questions in Section A (Mathematics 1 and 2) **and**

either Section B (Mathematics 3)

or Section C (Applications of Mathematics).

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SCOTTISH QUALIFICATIONS AUTHORITY

FORMULAE LIST

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Marks

SECTION A (Mathematics 1 and 2)

ALL candidates should attempt this Section.

A1. A hotel inspector recorded the volume of wine, in millilitres, in a sample of six glasses.

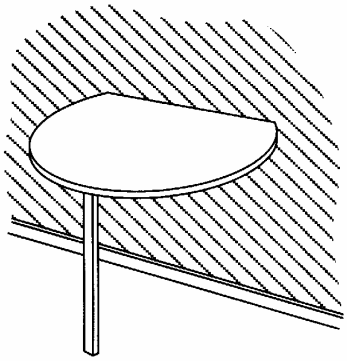
120 126 125 131 130 124

Use an appropriate formula to calculate the standard deviation.
Show clearly all your working. **4**

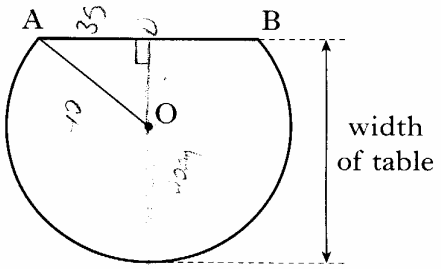
A2. Multiply out the brackets and collect like terms.

$(3x + 2)(x - 1) + 4x$ **3**

A3. The diagram shows a fold-away table whose top is in the shape of part of a circle.



- The centre of the circle is O.
- AB is a chord of the circle.
- AB is 70 centimetres.
- The radius, OA, is 40 centimetres.

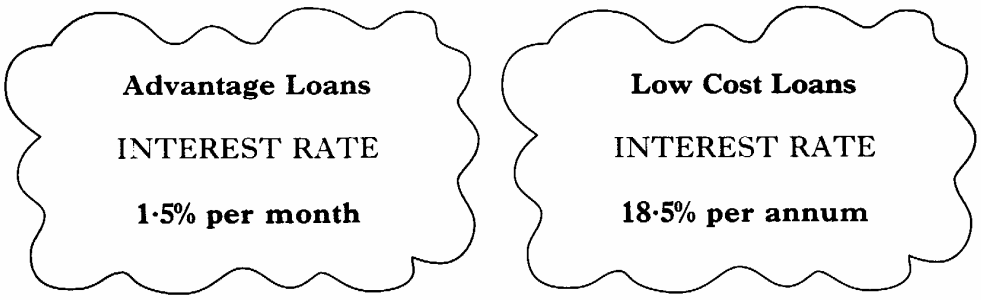


Find the width of the table. **4**

[Turn over

Marks

A4. Michael wishes to borrow £1000 for 3 months. He can choose from **Advantage Loans** or **Low Cost Loans**.



Which company costs less?
Give a reason for your answer. **4**

A5. The cost of hiring a car depends on the number of days the car is hired and the number of litres of petrol used.

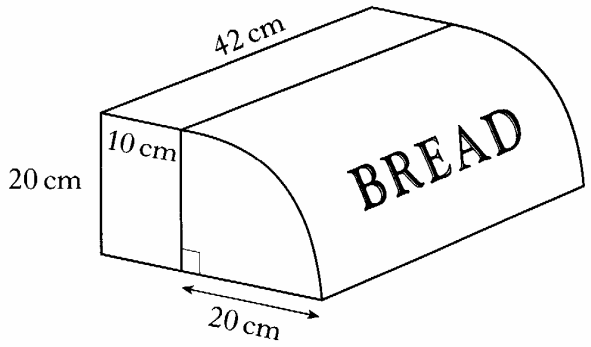
(*a*) David hired a car for 3 days and used 50 litres of petrol. The total cost was £88·50.
Let x pounds be the cost per day of hiring a car, and y pounds be the cost of one litre of petrol.
Write down an equation in x and y which satisfies the above condition. **1**

(*b*) Anne hired the same model of car for 4 days and used 60 litres of petrol. The total cost was £113·00.
Write down a second equation in x and y which satisfies this condition. **1**

(*c*) Find the cost per day of hiring the car and the cost of one litre of petrol. **4**

Marks

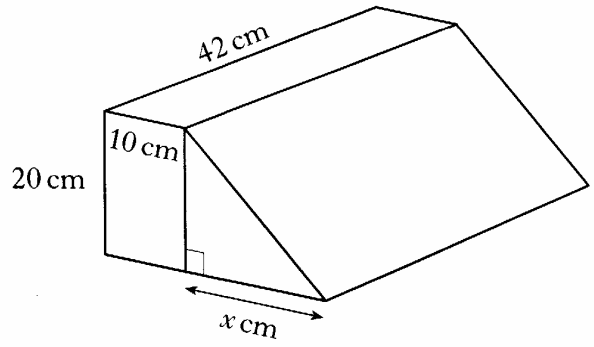
A6. A bread bin is in the shape of a prism as shown below.



The cross-section of the bread bin consists of a rectangle 20 centimetres by 10 centimetres and a quarter circle.

(*a*) Calculate the volume of the bread bin.
Give your answer in cubic centimetres, correct to 3 significant figures. **4**

(*b*) The design is changed so that the volume remains the same. The cross-section is now a rectangle 20 centimetres by 10 centimetres and a right-angled triangle as shown in the diagram below.

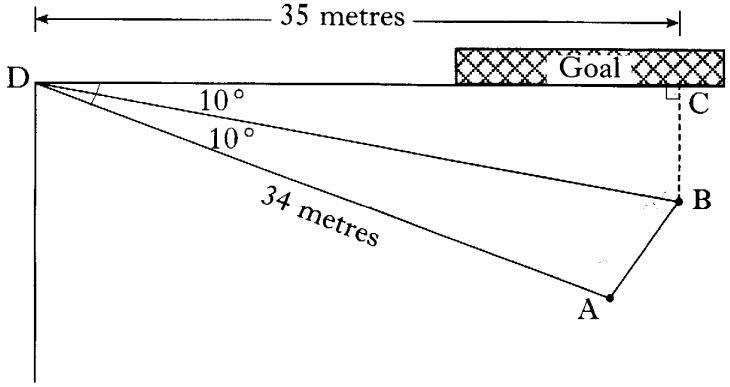


Find x. **3**

[Turn over

A7.

Marks

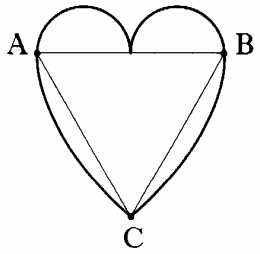


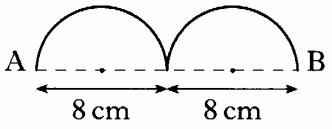
The diagram shows part of a football pitch with players at A, B, C and D.
BC is perpendicular to CD.
CD = 35 metres, angle CDB = 10°, angle BDA = 10°, AD = 34 metres.
Find the distance from A to B. **5**

Marks

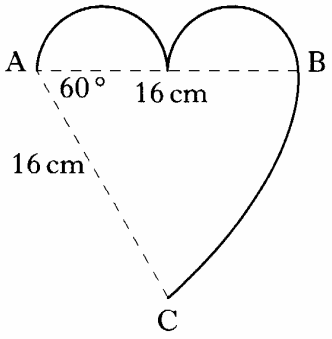
A8. Heart-shaped cards have been designed for St Valentine's Day.

The template used is shown opposite with the key points A, B and C indicated.

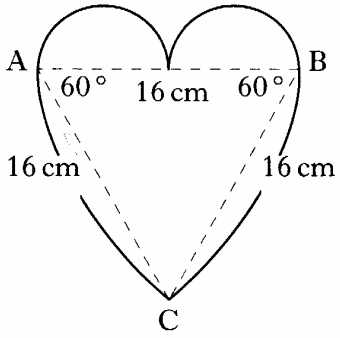




The top of the template was formed by drawing two semi-circles, each with diameter 8 centimetres.



One side of the template was formed by drawing an arc BC of a circle centre A, where angle BAC = 60°.



The template was completed by drawing arc AC of a circle centre B, where angle ABC = 60°.

Find the perimeter of the template. **5**

[END OF SECTION A]

Candidates should now attempt
EITHER Section B (Mathematics 3) on *Pages eight and nine*
OR Section C (Applications of Mathematics) on *Pages ten and eleven.*

[Turn over

Marks

SECTION B (Mathematics 3)

ONLY candidates doing the course Mathematics 1, 2 and 3 should attempt this Section.

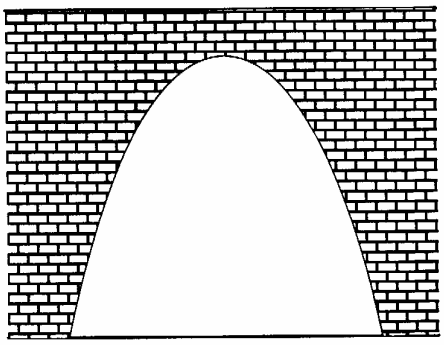
B9. (*a*) Change the subject of the formula $r = \frac{st}{q}$ to s. **2**

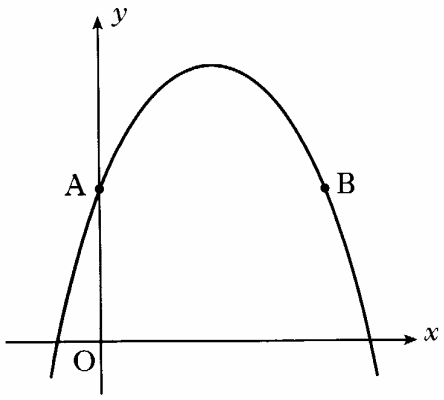
(*b*) Use an appropriate formula to solve the quadratic equation

$$3x^2 - 2x - 6 = 0.$$

Give your answer correct to 1 decimal place. **4**

B10.





The arch of a railway bridge is represented by a parabola. The equation of the parabola is

$$y = 20 - (x - 3)^2.$$

(*a*) State the coordinates of the maximum turning point of the parabola. **2**

(*b*) State the equation of the axis of symmetry. **1**

(*c*) Points A and B have the same y-coordinate.
A is the point (0, 11). State the coordinates of B. **2**

Marks

B11. (*a*) Solve the equation

$$4\sin x° - 1 = 0, \qquad 0 \leq x < 360. \qquad \textbf{3}$$

(*b*) Show that

$$\frac{1-\cos^2 A}{\cos^2 A} = \tan^2 A. \qquad \textbf{2}$$

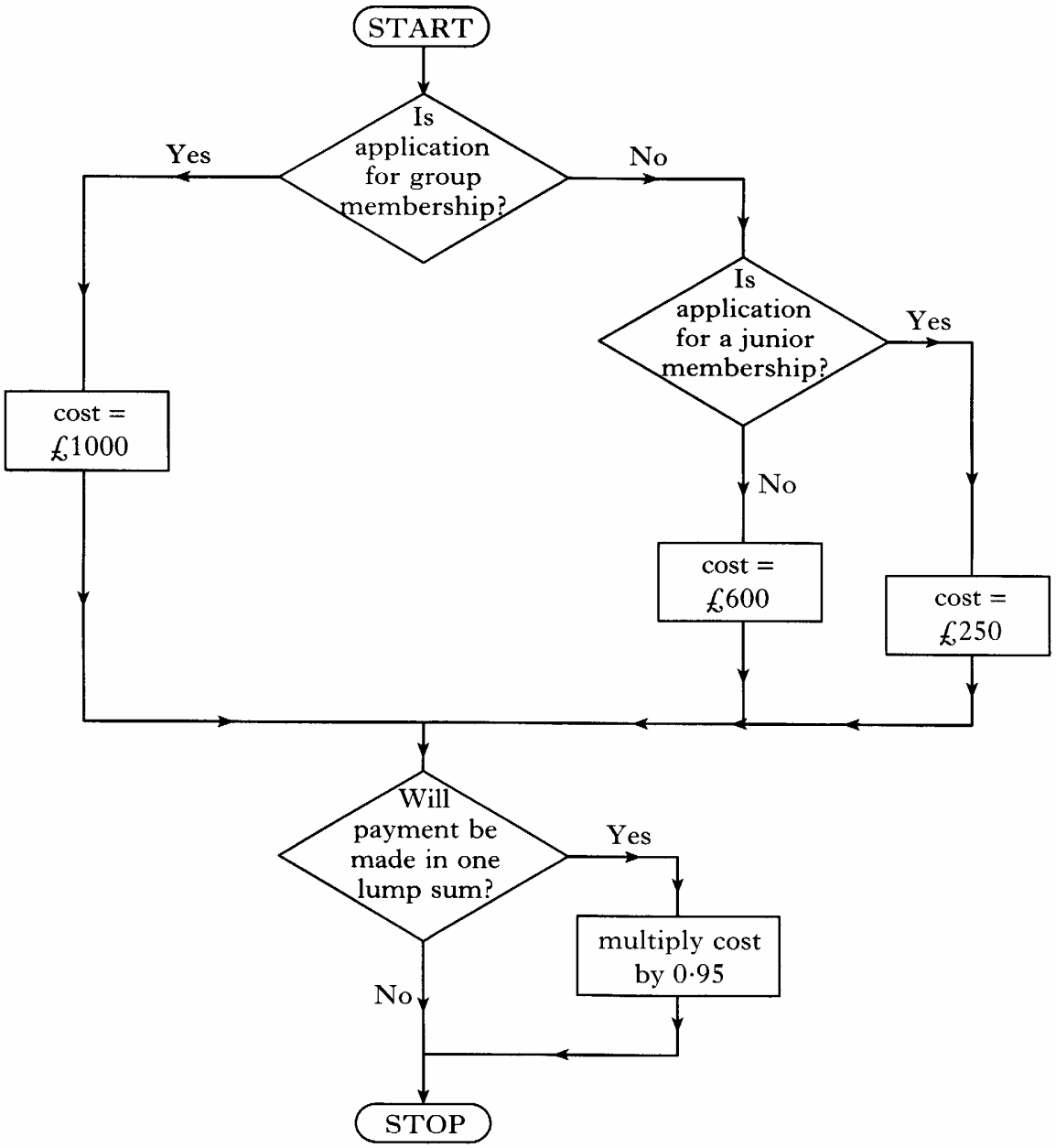
[*END OF SECTION B*]

[Turn over

SECTION C (Applications of Mathematics)

ONLY candidates doing the course Mathematics 1, 2 and Applications of Mathematics should attempt this Section.

C9. The flowchart below shows how to calculate the cost of joining a sports club.



Use the flowchart to calculate the cost for an adult who wants to make the payment in one lump sum. **4**

Marks

C10. Lorna Simpson sells double glazing. She has a basic salary of £12 500 per year. In addition to her basic salary she earns 10% commission on all her sales. Last year she sold £50 000 worth of double glazing products.

(*a*) Calculate her gross annual salary for last year. **2**

(*b*) The table below shows the rates of tax applicable for last year.

Rates of Tax	*Taxable Income £*
Lower rate 20%	1 to 4300
Basic rate 23%	4301 to 27 100
Higher rate 40%	over 27 100

Lorna's total tax allowance is £4195.
Calculate her annual tax bill for last year. **5**

C11. A survey was carried out to find the waiting time for telephone calls to be answered at a call centre. The results are shown below.

Time in seconds	*Number of calls*
20 – 34	9
35 – 49	10
50 – 64	14
65 – 79	19
80 – 94	22
95 –109	35
110 –124	21
125 –139	20

Calculate the mean waiting time in seconds. **5**

[END OF SECTION C]

[END OF QUESTION PAPER]