

Candidate Name \_\_\_\_\_

Centre Number      Candidate  
Number

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**CAMBRIDGE INTERNATIONAL EXAMINATIONS**  
**Joint Examination for the School Certificate**  
**and General Certificate of Education Ordinary Level**

**MATHEMATICS (SYLLABUS D)**

**4024/1**

**PAPER 1**

**OCTOBER/NOVEMBER SESSION 2002**

2 hours

Candidates answer on the question paper.  
Additional materials:  
Geometrical instruments

**TIME**    2 hours

**INSTRUCTIONS TO CANDIDATES**

Write your name, Centre number and candidate number in the spaces at the top of this page.

Answer **all** questions.

Write your answers in the spaces provided on the question paper.

If working is needed for any question it must be shown in the space below that question.

Omission of essential working will result in loss of marks.

**NEITHER ELECTRONIC CALCULATORS NOR MATHEMATICAL TABLES  
MAY BE USED IN THIS PAPER.**

**INFORMATION FOR CANDIDATES**

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 80.

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**This question paper consists of 15 printed pages and 1 blank page.**



**ELECTRONIC CALCULATORS MUST NOT BE USED IN THIS PAPER**

1 (a) Express  $\frac{17}{40}$  as a percentage.

(b) Find the decimal number which is exactly halfway between 4.7 and 5.0.

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

(b) ..... [1]

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2 Evaluate

(a)  $7\frac{1}{4} - 6\frac{2}{3}$ ,

(b)  $3\sqrt{2} \times 5\sqrt{2}$ .

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

(b) ..... [1]

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3 (a) Factorise  $x^2 - 5x + 6$ .

(b) Given that  $x = 4$  is a solution of the equation  $x^2 + 3x + c = 0$ ,  
find the value of  $c$ .

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

(b)  $c =$  ..... [1]

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- 4 Each interior angle of a regular polygon is  $150^\circ$ .  
Calculate the number of sides of the polygon.

Answer ..... [2]

- 
- 5 (a) Evaluate  $15.05 \div 0.5$ .
- (b) The rate of exchange between Swiss francs (F) and British pounds (£) was  $2.4F = \text{£}1$ .  
Calculate the number of pounds received in exchange for 60F.

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

(b) £ ..... [1]

- 
- 6 (a) On a journey, a cyclist travelled 1 kilometre in  $x$  minutes.  
On a second journey, the cyclist travelled for  $y$  hours at the same average speed as on the first journey.  
Find an expression, in terms of  $x$  and  $y$ , for the number of kilometres he travelled on the second journey.

(b)  $\frac{t \times t^3}{\sqrt{t}} = t^n$ .

Find the value of  $n$ .

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

(b)  $n =$  ..... [1]

7 Expressed as the product of prime factors,

$$198 = 2 \times 3^2 \times 11 \quad \text{and} \quad 90 = 2 \times 3^2 \times 5.$$

Use these results to find

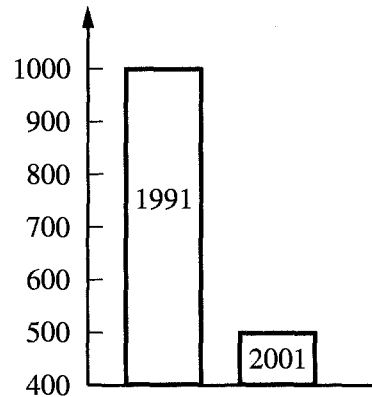
- (a) the smallest integer,  $k$ , such that  $198k$  is a perfect square,
- (b) the highest common factor of 198 and 90.

Answer (a)  $k = \dots\dots\dots$  [1]

(b)  $\dots\dots\dots$  [1]

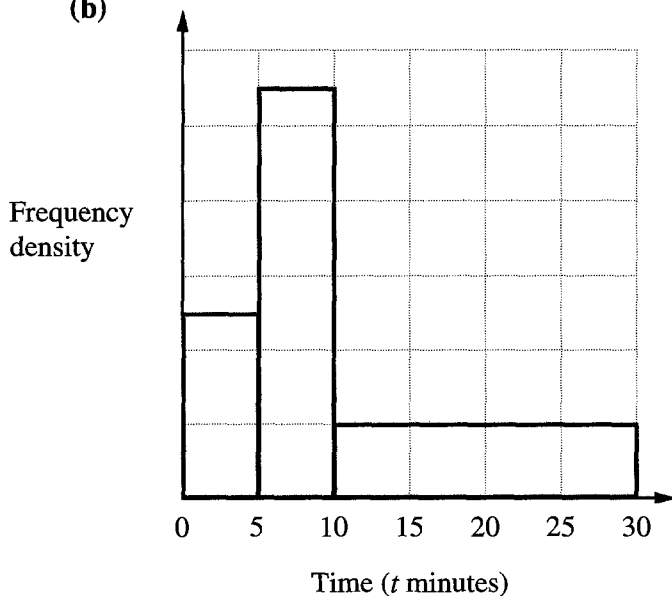
8 (a) An article in a newspaper reported that the number of crimes had been reduced by half from 1991 to 2001. The article contained the bar chart shown here. Explain why this bar chart might be considered misleading.

Number of crimes committed



Answer (a)  $\dots\dots\dots$   
 $\dots\dots\dots$  [1]

(b)



The histogram alongside shows the distribution of times taken by a group of students to travel to school. 11 students took at least 5 but less than 10 minutes. Complete the table in the answer space.

Answer (b)

Time ( $t$ minutes)	Number of students
$0 \leq t < 5$	
$5 \leq t < 10$	11
$10 \leq t < 30$	

[2]

- 9 The temperature at 0900 is  $-4^{\circ}\text{C}$ .  
The temperature at 1500 is  $14^{\circ}\text{C}$ .
- (a) Find the difference between the two temperatures.
- (b) Assuming that the temperature rises at a steady rate, find
- (i) the temperature at 1300,
  - (ii) the time when the temperature is  $12.5^{\circ}\text{C}$ .

Answer (a) .....  $^{\circ}\text{C}$  [1]

(b)(i) .....  $^{\circ}\text{C}$  [1]

(ii) ..... [1]

- 
- 10 (a) A sum of money is divided in the ratio 4 : 3.  
The larger part is \$7.20.  
Find the smaller part.
- (b) Express the ratio 700 g to 1.75 kg in its lowest terms.  
Give your answer in the form  $m : n$ , where  $m$  and  $n$  are integers.

Answer (a) \$ ..... [1]

(b) ..... : ..... [2]

**11** Find

- (a) the missing number in the sequence 1, 3, 6, ..., 15, 21, 28,
- (b) the 7th term in the sequence whose  $n$ th term is  $3n - 1$ ,
- (c) an expression, in terms of  $n$ , for the  $n$ th term of the sequence 5, 9, 13, 17, 21, ....

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

(b) ..... [1]

(c) ..... [1]

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**12** The population of Europe is approximately  $7.0 \times 10^8$ .  
The population of Asia is approximately  $3.5 \times 10^9$ .  
The mean mass of the population of Europe is approximately 62 kg.

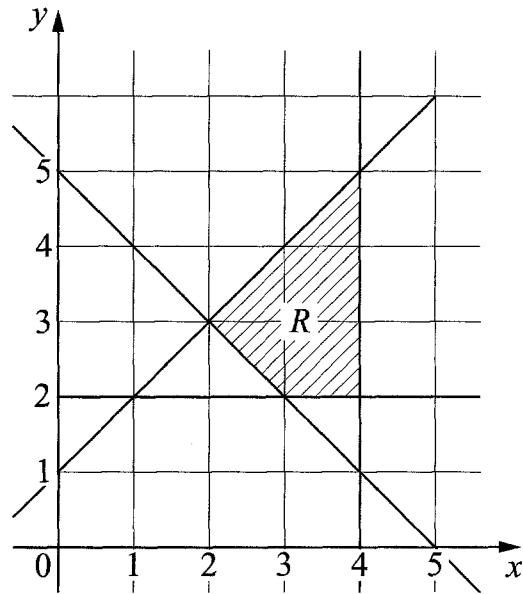
- (a) Giving your answers in standard form, estimate
  - (i) the total mass of the population of Europe,
  - (ii) how many more people live in Asia than in Europe.
- (b) Express the population of Europe as a percentage of the population of Asia.

Answer (a)(i) ..... kg [1]

(ii) ..... [1]

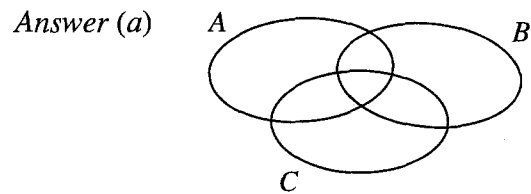
(b) ..... % [1]

- 13 The region  $R$  is defined by 4 inequalities. Two of these are  $x \leq 4$  and  $x + y \geq 5$ . Write down the other two inequalities.



Answer.....  
 ..... [3]

- 14 (a) In the Venn diagram in the answer space, shade the region  $(A \cup B) \cap C$ .



[1]

- (b) All 30 students in a class study **at least one** of the two subjects History and Geography.  
 Twice as many study History as Geography.  
 8 students study **only** Geography.  
 By drawing a Venn diagram, or otherwise, find the number of students who study both History and Geography.

Answer (b) ..... [2]

15 The table below shows the number of children living in the houses on a road.

Number of Children	0	1	2	3	4	5	6
Number of Houses	3	7	5	4	0	0	1

Find

- (a) the modal number of children,
- (b) the median number of children,
- (c) the mean number of children.

Answer (a) Mode = ..... [1]

(b) Median = ..... [1]

(c) Mean = ..... [1]

16  $A = \begin{pmatrix} 5 & 3 \\ -2 & 0 \end{pmatrix}$  and  $B = \begin{pmatrix} 1 & 3 \\ 2 & -3 \end{pmatrix}$

Find

- (a)  $A - 2B$ ,
- (b)  $A^{-1}$ .

Answer (a)  $A - 2B = \begin{pmatrix} & \\ & \end{pmatrix}$  [2]

(b)  $A^{-1} = \begin{pmatrix} & \\ & \end{pmatrix}$  [2]



17 Given that  $f(x) = 3x + 7$ , find

(a)  $f(-2)$ ,

(b)  $f^{-1}(x)$ ,

(c) The value of  $x$  for which

$$f(x) = f^{-1}(x).$$

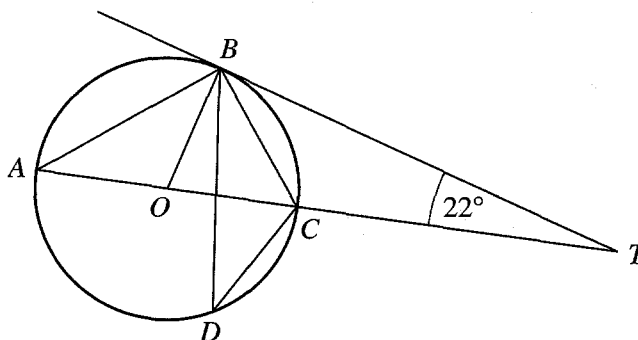
Answer (a)  $f(-2) = \dots\dots\dots$  [1]

(b)  $f^{-1}(x) = \dots\dots\dots$  [1]

(c)  $x = \dots\dots\dots$  [2]

- 18** In the diagram,  $TB$  is a tangent to the circle, centre  $O$ .

$TO$  meets the circle at  $C$  and  $A$ .  
 $D$  is another point on the circle.  
 $\hat{BTC} = 22^\circ$ .



- (a) Use the letters in the diagram to name two right angles.
- (b) Find
- $\hat{OAB}$ ,
  - $\hat{ABT}$ ,
  - $\hat{BDC}$ .

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

(b)(i)  $\hat{OAB} =$  ..... [1]

(ii)  $\hat{ABT} =$  ..... [1]

(iii)  $\hat{BDC} =$  ..... [1]

- 19** The force of attraction between two magnets is  $F$  Newtons.  
This force is inversely proportional to the square of the distance,  $d$  centimetres, between the magnets.

- (a) When the magnets are a certain distance apart, the force is 10 Newtons.  
What is the force when this distance is doubled?
- (b) (i) Write down a formula connecting  $F$ ,  $d$  and a constant  $k$ .
- (ii) When the magnets are 3 cm apart, the force is 2 Newtons.  
Find the force when they are 5 cm apart.

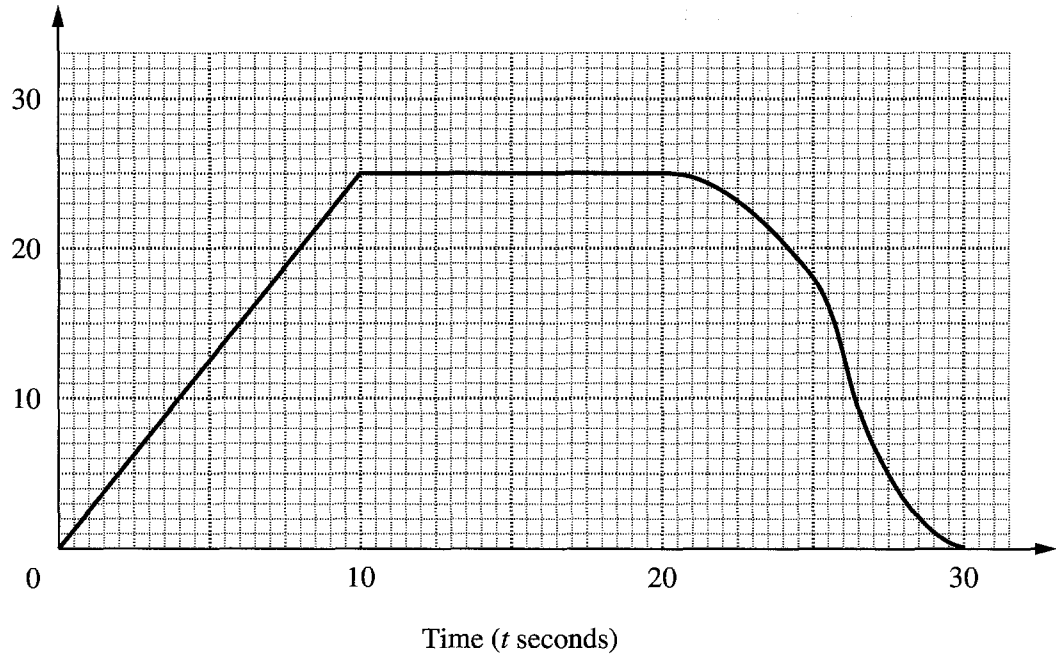
Answer (a) ..... Newtons [1]

(b)(i) ..... [1]

(ii) ..... Newtons [2]

20

Speed  
(metres per  
second)



The diagram is the speed–time graph of a car’s journey.

Find

- (a) the speed when  $t = 6$ ,
- (b) the acceleration when  $t = 6$ ,
- (c) the distance travelled in the first 20 seconds,
- (d) the value of  $t$  when the retardation is greatest.

Answer (a) ..... m/s [1]

(b)..... m/s<sup>2</sup> [1]

(c) ..... m [1]

(d)  $t =$  ..... [1]

21 (a) Simplify  $2e + 3f - 2(e + f)$ .

(b) Solve the inequality  $a - 2 < 4(5 - a)$ .

(c) Solve the simultaneous equations

$$\begin{aligned}x &= 2y + 11, \\4x + 3y &= 0.\end{aligned}$$

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

(b) ..... [2]

(c)  $x =$  .....

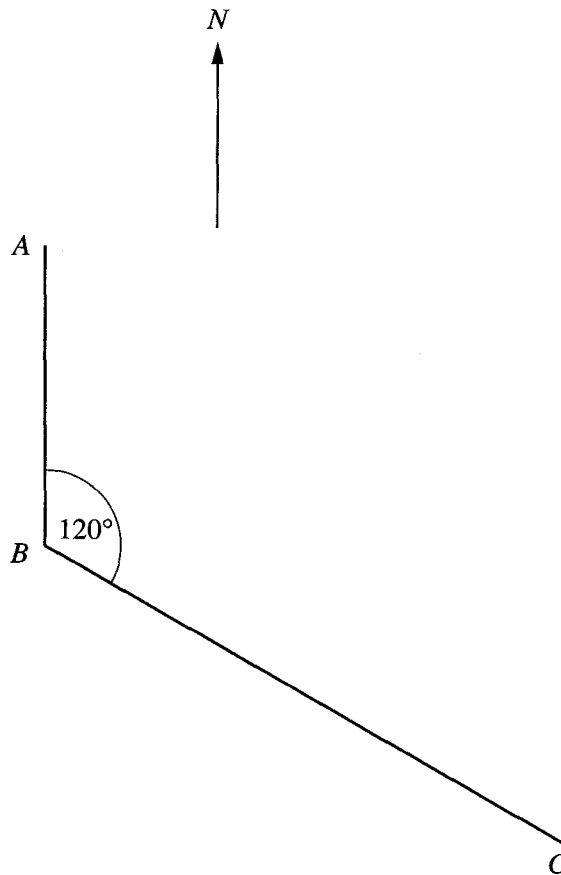
$y =$  ..... [2]

- 22 Three shops,  $A$ ,  $B$  and  $C$  are such that  $B$  is 800 m due South of  $A$  and such that  $C$  is 1600 m from  $B$  on a bearing of  $120^\circ$ .  
A map is being drawn to a scale of 1 cm to 200 m.  
The positions of  $A$ ,  $B$  and  $C$  are shown below.  
Another shop,  $D$ , is 1200 m from  $C$  on a bearing of  $057^\circ$ .

- (a) Complete the map to show the position of  $D$ .
- (b) A new shop is to be built
- I equidistant from  $B$  and  $C$ ,
  - II nearer to  $BC$  than  $BA$ ,
  - III at least 1200 m from  $C$ .

By constructing 3 loci corresponding to I, II and III, find where the shop could be built and label the extreme positions  $S$  and  $P$ .

Answer



[6]

23 The diagram below shows three triangles *A*, *B* and *C*.

- (a) Describe **fully** the **single** transformation which maps triangle *A* onto
- (i) triangle *B*,
  - (ii) triangle *C*.

Answer (a)(i) .....

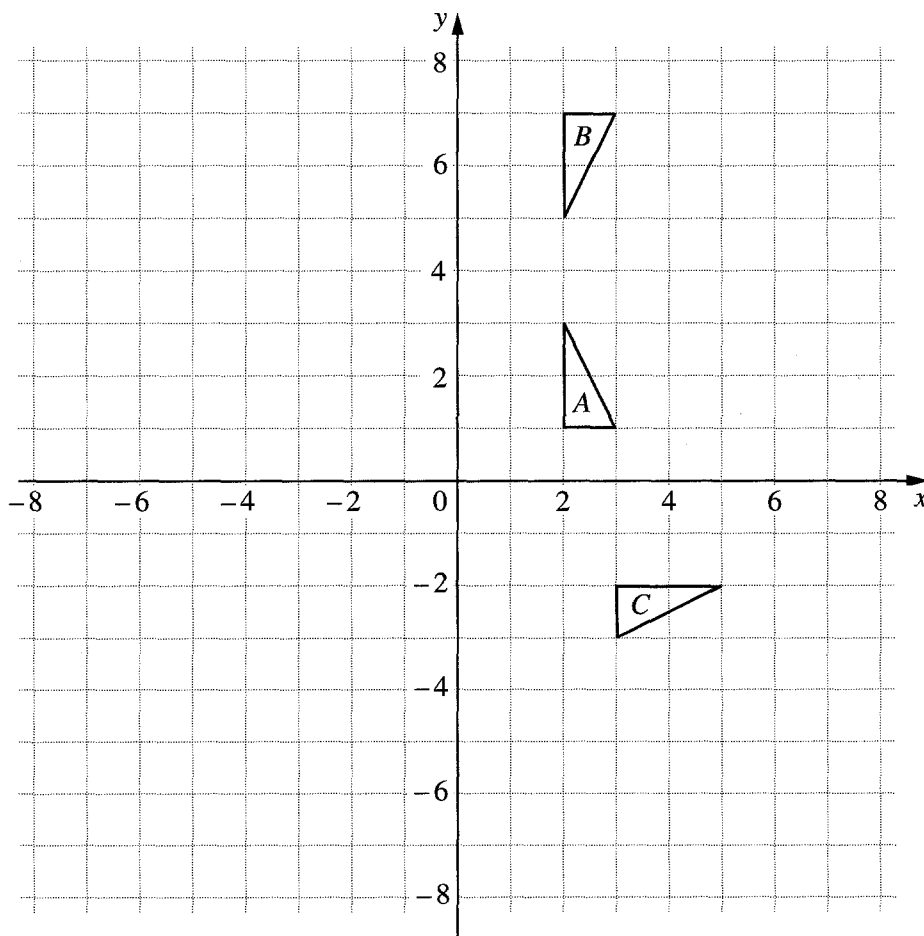
..... [2]

(ii) .....

..... [2]

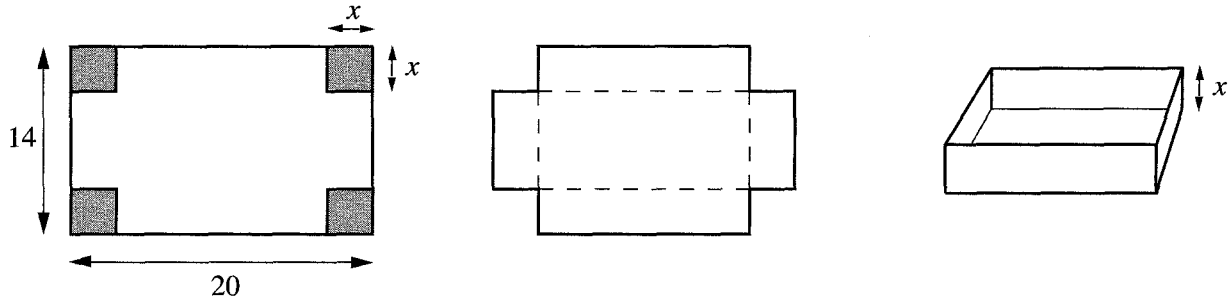
- (b) Triangle *A* is mapped onto triangle *D* by the transformation represented by the matrix  $\begin{pmatrix} -2 & 0 \\ 0 & -2 \end{pmatrix}$ .

Draw and label triangle *D* on the diagram.



[2]

- 24 A rectangular piece of card measures 20 cm by 14 cm. Squares of side  $x$  cm are cut from the four corners and the card is folded to make an open box.



- (a) Show that the volume,  $V$  cm<sup>3</sup>, of the box is given by  

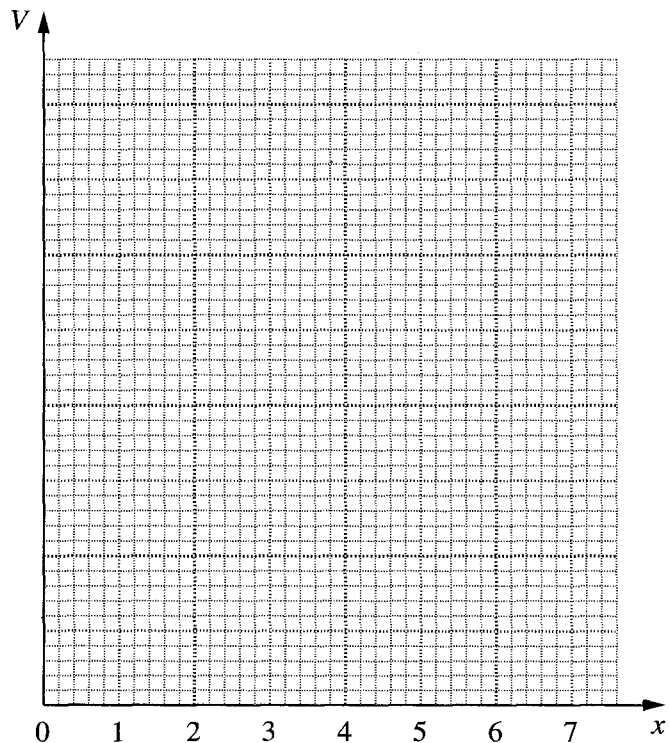
$$V = 4x(10 - x)(7 - x).$$

Answer (a) .....

..... [1]

- (b) You are asked to find the value of  $x$  which will produce the greatest volume of the box.  
 You should use the table and the grid to help you in your investigation.  
 Marks will be awarded for clear working.

$x$	
0	
1	
2	
.	
.	
.	
.	
.	
.	



Answer (b)  $x =$  ..... [4]

