

Centre Number						Candidate Number				
Surname										
Other Names										
Candidate Signature										



General Certificate of Secondary Education  
Higher Tier  
January 2013

# Mathematics (Linear)

# 43652H

## Paper 2

Tuesday 15 January 2013 1.30 pm to 3.30 pm

# H

<p><b>For this paper you must have:</b></p> <ul style="list-style-type: none"> <li>• a calculator</li> <li>• mathematical instruments.</li> </ul>	
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### Time allowed

- 2 hours

### Instructions

- Use black ink or black ball-point pen. Draw diagrams in pencil.
- Fill in the boxes at the top of this page.
- Answer **all** questions.
- You must answer the questions in the spaces provided. Do not write outside the box around each page or on blank pages.
- Do all rough work in this book.

### Information

- The marks for questions are shown in brackets.
- The maximum mark for this paper is 105.
- The quality of your written communication is specifically assessed in Questions 2, 12 and 23. These questions are indicated with an asterisk (\*).
- You may ask for more answer paper, tracing paper and graph paper. These must be tagged securely to this answer book.

### Advice

- In all calculations, show clearly how you work out your answer.

For Examiner's Use	
Examiner's Initials	
Pages	Mark
3	
4 – 5	
6 – 7	
8 – 9	
10 – 11	
12 – 13	
14 – 15	
16 – 17	
18 – 19	
20 – 21	
22 – 23	
TOTAL	



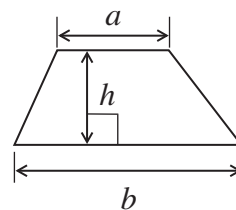
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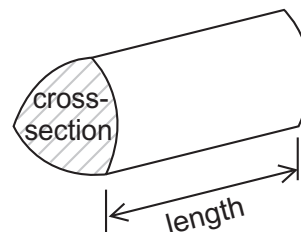
# 43652H

## Formulae Sheet: Higher Tier

**Area of trapezium** =  $\frac{1}{2}(a+b)h$

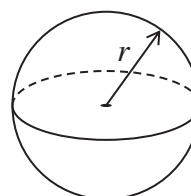


**Volume of prism** = area of cross-section  $\times$  length



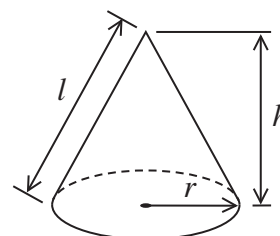
**Volume of sphere** =  $\frac{4}{3}\pi r^3$

**Surface area of sphere** =  $4\pi r^2$



**Volume of cone** =  $\frac{1}{3}\pi r^2 h$

**Curved surface area of cone** =  $\pi r l$

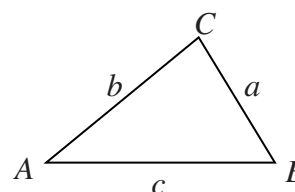


**In any triangle ABC**

**Area of triangle** =  $\frac{1}{2}ab \sin C$

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

**Cosine rule**  $a^2 = b^2 + c^2 - 2bc \cos A$



**The Quadratic Equation**

The solutions of  $ax^2 + bx + c = 0$ , where  $a \neq 0$ , are given by

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$



Answer **all** questions in the spaces provided.

**1** Pens cost 15 pence each.  
Rulers cost 20 pence each.

**1 (a)** Write down an expression for the cost of  $x$  pens and  $y$  rulers.

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Answer ..... (2 marks)

**1 (b)** A school buys 150 pens and 90 rulers.

The total cost is reduced by  $\frac{1}{5}$

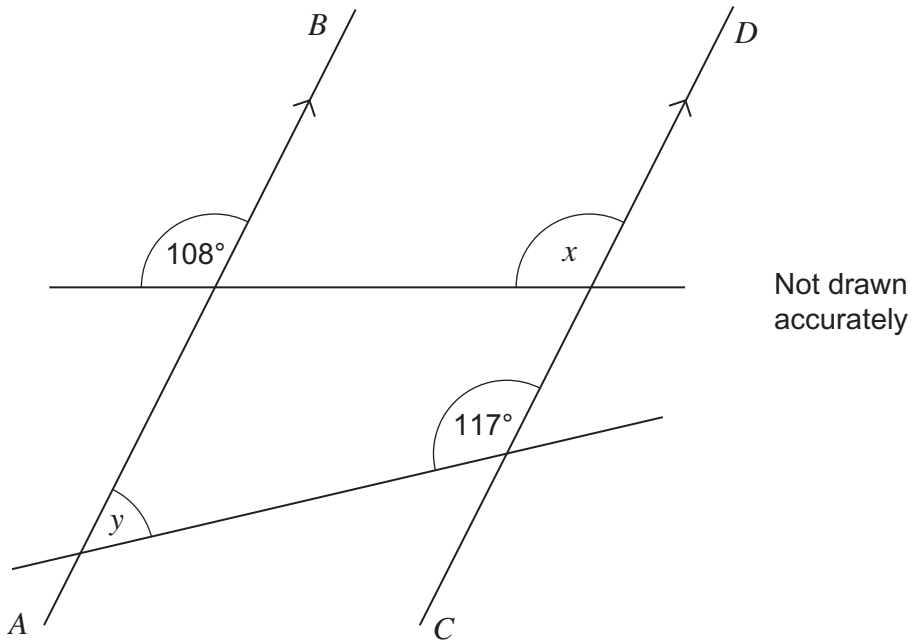
How much does the school pay?

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Answer £ ..... (5 marks)



2 *AB* is parallel to *CD*.



\*2 (a) Write down the size of angle *x*.  
Give a reason for your answer.

Answer ..... degrees

Reason .....  
(2 marks)

2 (b) Work out the size of angle *y*.

Answer ..... degrees (2 marks)



**3** Jan wants to carpet her room.  
 The room is a rectangle, length 5 m and width 3.6 m.  
 She uses this formula to work out the cost of the carpet.

$$C = \frac{50A}{3} + 45$$

$C$  is the cost in pounds and  $A$  is the area of the room in  $m^2$ .

How much should the carpet cost?

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Answer £ ..... (4 marks)

**4** Jack works eight hours each day.  
 He is paid £6.50 per hour.  
 He shares his wages with Kim in the ratio

$$\text{Jack} : \text{Kim} = 4 : 1$$

Jack saves his share.

How many working days will it take Jack to save £1040?

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Answer ..... (5 marks)



**5** Put the numbers 1, 2 or 3 on each card so that when a card is picked at random

- the probability of picking a 2 is greater than  $\frac{1}{2}$
- the probability of picking a 1 is twice the probability of picking a 3.

(2 marks)

**6 (a)** Work out the value of  $7^3$

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Answer ..... (1 mark)

**6 (b)** The sum of two consecutive cube numbers is 341.

Work out the two numbers.

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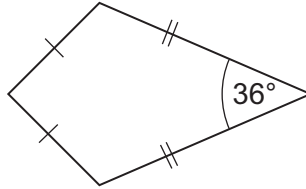
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Answer ..... and ..... (2 marks)



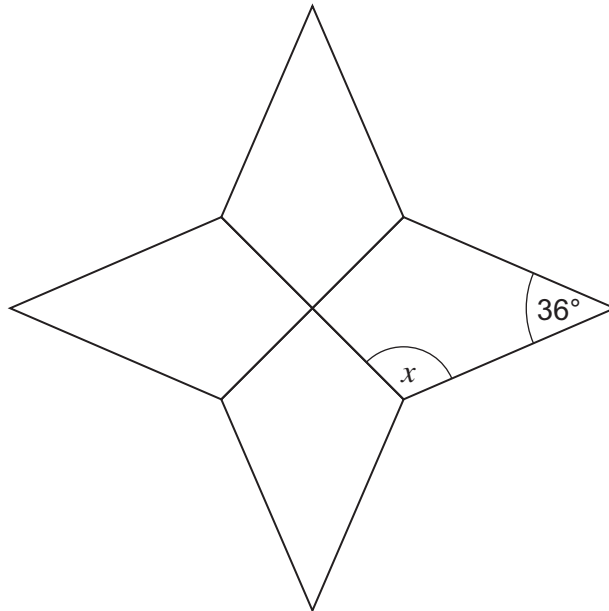
7 The diagram shows a kite.

Not drawn accurately



Four identical kites are joined to make this shape.

Not drawn accurately



Work out the size of angle  $x$ .

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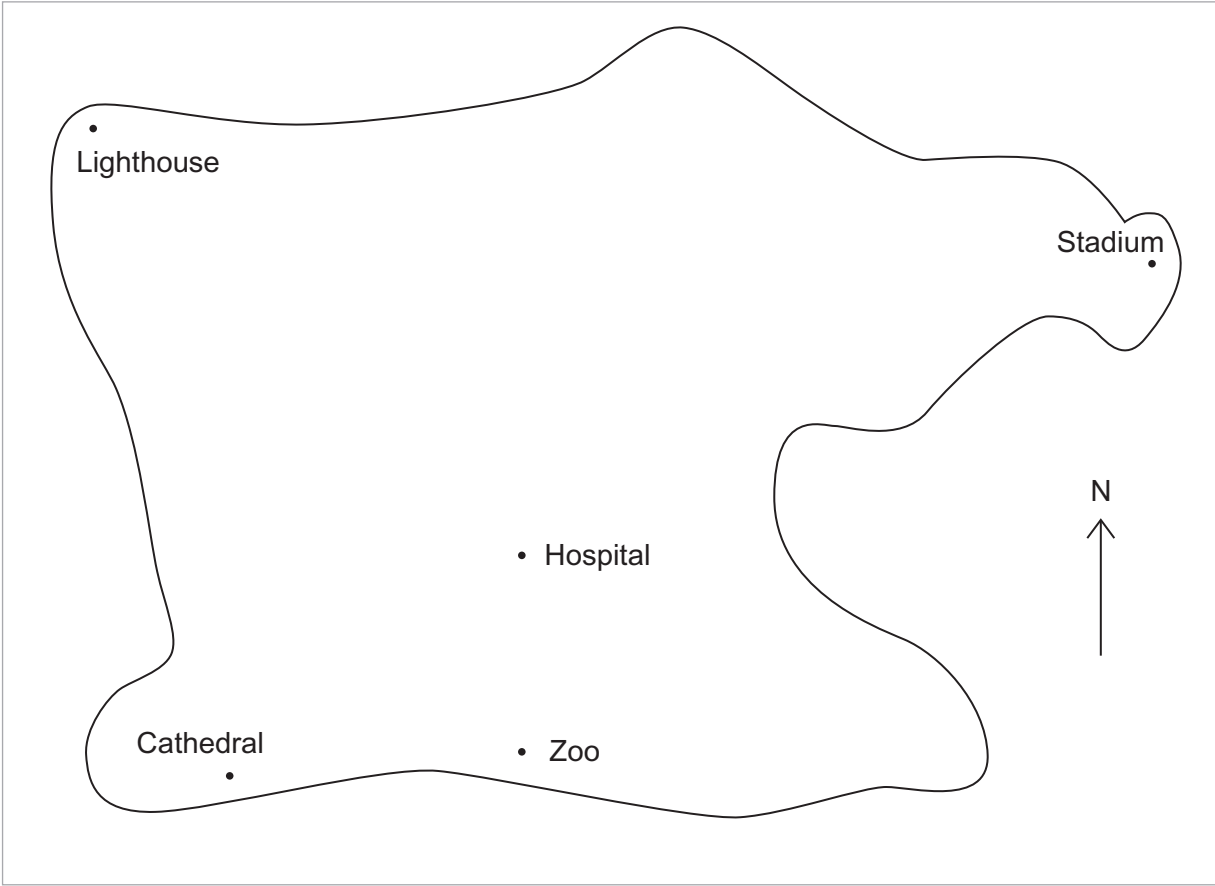
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Answer ..... degrees (4 marks)



8



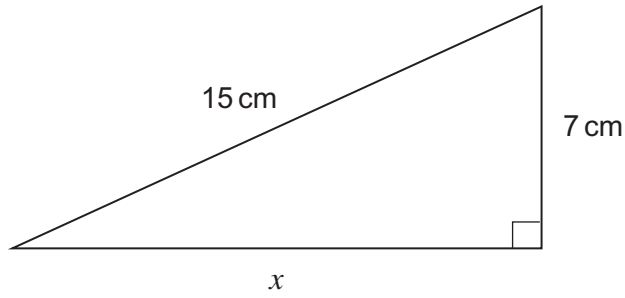
The airport is on a bearing of  $040^\circ$  from the Hospital and  $270^\circ$  from the Stadium.

Mark the position of the Airport on the map.

(3 marks)



9 Work out length  $x$ .



Not drawn accurately

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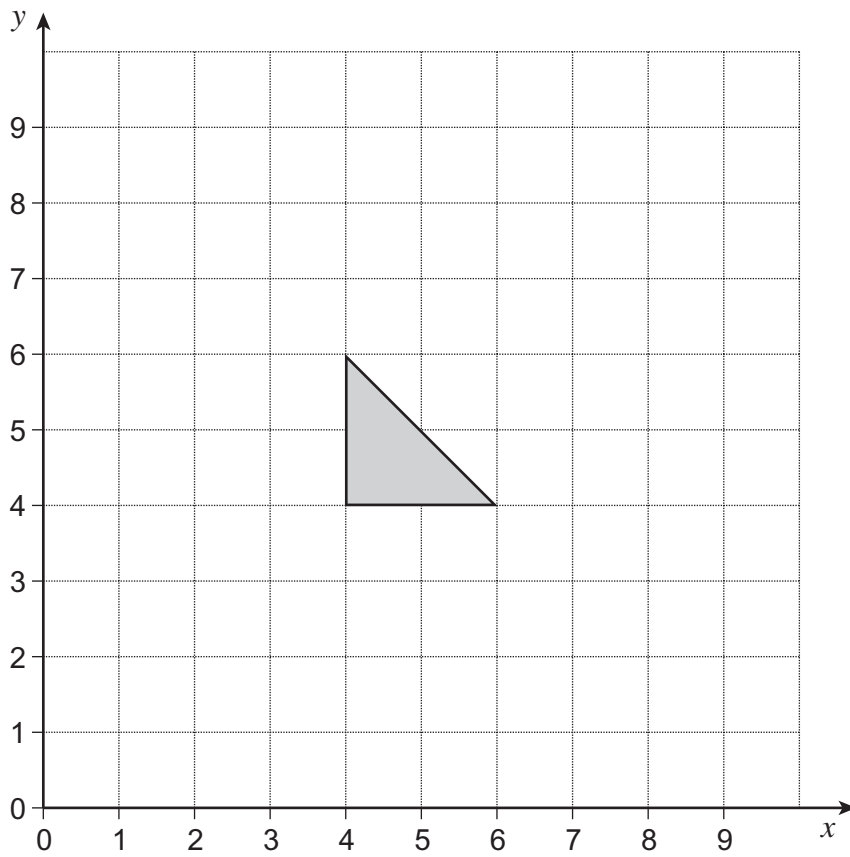
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Answer ..... cm (3 marks)

Turn over for the next question



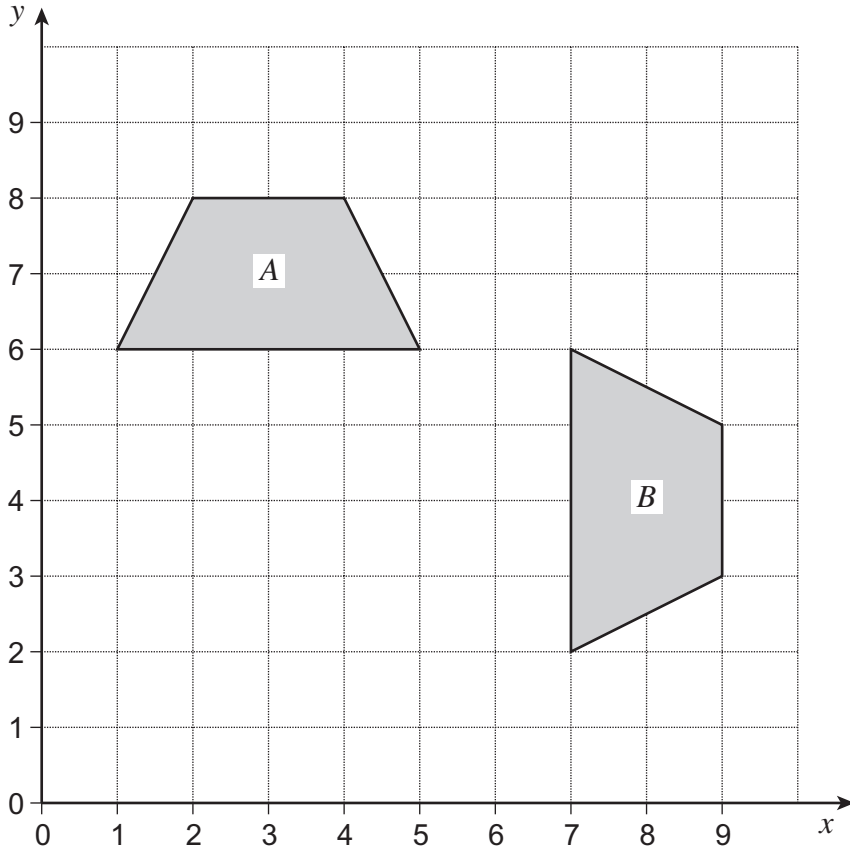
10 (a) Translate the shape by the vector  $\begin{pmatrix} 2 \\ 3 \end{pmatrix}$



(2 marks)



10 (b)



Describe fully the **single** transformation that takes shape *A* to shape *B*.

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(3 marks)

Turn over for the next question



**11** An ordinary fair dice is rolled 120 times.  
How many times would you expect to roll a 6?

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.....

Answer ..... (2 marks)

**\*12** Samples are taken from a production line.  
The number of faulty items is shown.

	Sample A	Sample B	Sample C
Sample size	300	250	400
Number of faulty items	42	33	48

Which sample has the biggest **proportion** of faulty items?

You **must** show your working.

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Answer ..... (3 marks)



**13 (a)** Expand and simplify  $2(a + 3) + 5(a - 1)$

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.....

Answer ..... (2 marks)

**13 (b)** Simplify  $5c^4d^2 \times c^2d^3$

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Answer ..... (2 marks)

**13 (c)** Simplify fully  $\frac{8(x - 3)^2}{4(x - 3)(x + 3)}$

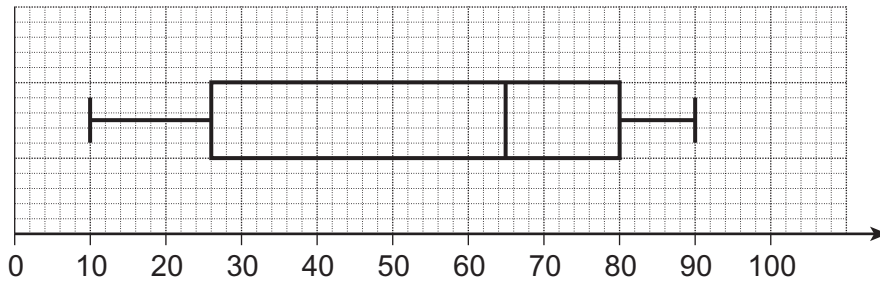
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Answer ..... (2 marks)

**Turn over for the next question**



14 The diagram shows a box plot.



14 (a) Write down the median.

Answer ..... (1 mark)

14 (b) Work out the interquartile range.

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.....

Answer ..... (1 mark)



15 (a) Factorise fully  $4x^2 - 6xy$

.....  
.....

Answer ..... (2 marks)

15 (b) Solve  $\frac{2w - 1}{4} = 2 - w$

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$w =$  ..... (3 marks)

Turn over for the next question

7
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Turn over ►



16 80 patients gave information about how long they waited to see the doctor.

Time, $T$ , (minutes)	Frequency		
$0 \leq T < 10$	5		
$10 \leq T < 20$	22		
$20 \leq T < 30$	28		
$30 \leq T < 40$	21		
$40 \leq T < 50$	4		

16 (a) Work out an estimate of the mean time that the patients waited.

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Answer ..... minutes (4 marks)

16 (b) The doctor says, "70% of our patients wait less than 30 minutes to be seen."

Is she correct?  
You **must** show your working.

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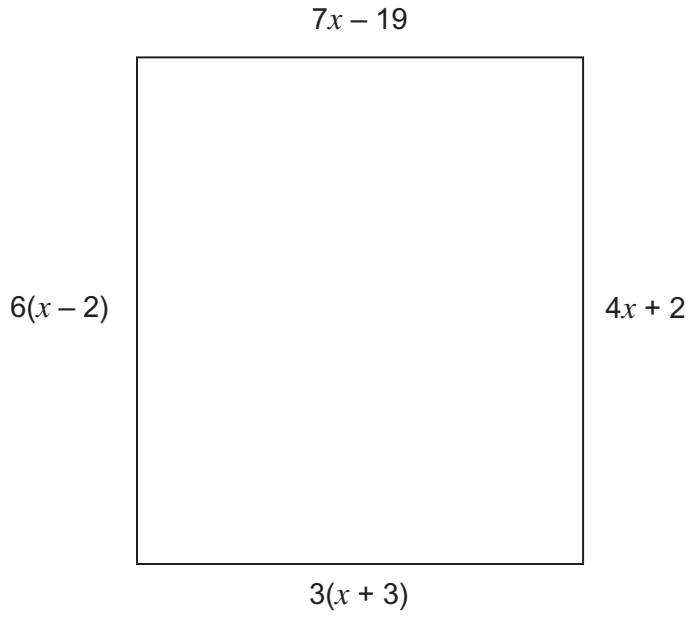
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Answer ..... (3 marks)



17 Show that **all** sides of this quadrilateral could be equal.



Not drawn  
accurately

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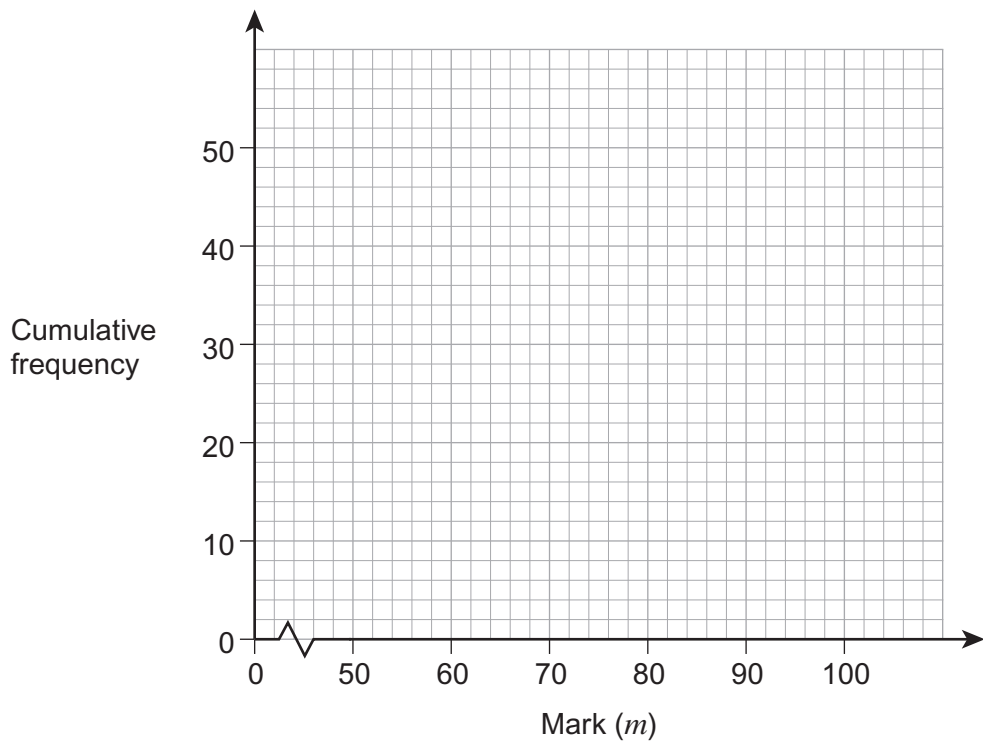
(5 marks)



**18** The table shows the marks of 50 students in a test.

Mark ( $m$ )	Number of students	
$50 < m \leq 60$	2	
$60 < m \leq 70$	3	
$70 < m \leq 80$	20	
$80 < m \leq 90$	16	
$90 < m \leq 100$	9	

**18 (a)** Draw a cumulative frequency diagram for the data.



(3 marks)

**18 (b)** Students who scored between 72 and 85 marks are chosen for extra lessons.

Estimate the number of students chosen.

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Answer ..... (3 marks)



19 These are the times for 200 people to get to work.

Time, $t$ , (minutes)	Number of people
$0 < t \leq 10$	7
$10 < t \leq 30$	21
$30 < t \leq 40$	78
$40 < t \leq 50$	64
$50 < t \leq 100$	30

A 10% sample, stratified by time, is taken.

Complete the table.

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Time, $t$ , (minutes)	Number of people in the sample
$0 < t \leq 10$	
$10 < t \leq 30$	
$30 < t \leq 40$	
$40 < t \leq 50$	
$50 < t \leq 100$	

(3 marks)



**20**  $R$  is inversely proportional to  $A$ .

$$R = 12.1 \text{ when } A = 1.5$$

**20 (a)** Work out a formula connecting  $R$  and  $A$ .

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Answer ..... (3 marks)

**20 (b)** Work out the value of  $R$  when  $A = 4$

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Answer ..... (2 marks)

**21** £1800 is invested at 4% compound interest per year.

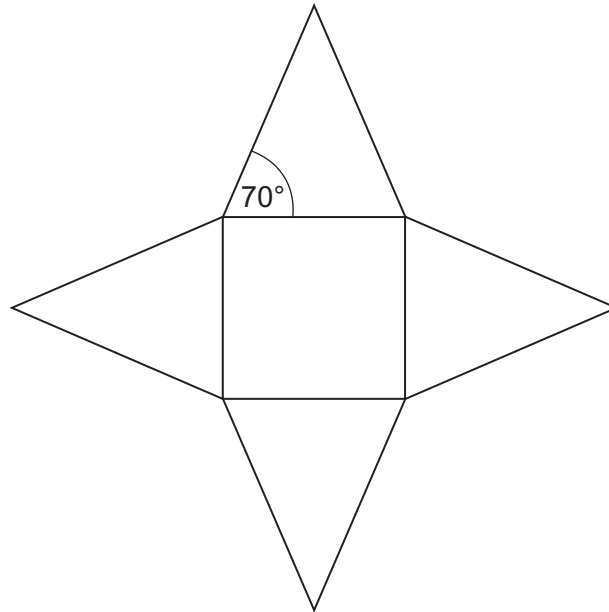
How many years will it take for the investment to be worth £2000?

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Answer ..... years (4 marks)



22 The diagram shows the net of a square-based pyramid.



Not drawn  
accurately

The area of the square base is  $36 \text{ cm}^2$ .

Work out the area of one triangular face.

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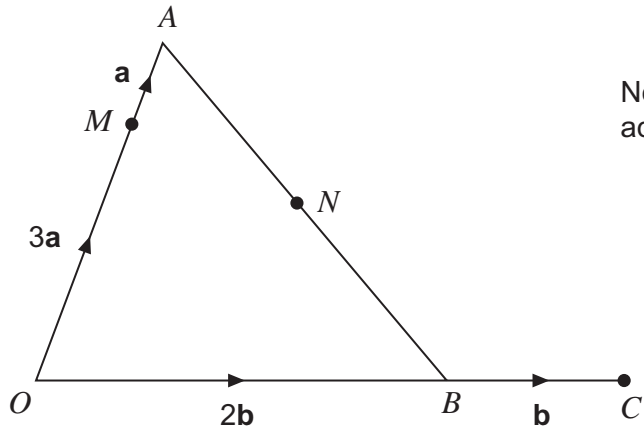
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Answer .....  $\text{cm}^2$  (5 marks)



23

$OAB$  is a triangle.  
 $OBC$  is a straight line.



Not drawn  
accurately

$$\vec{OA} = 4\mathbf{a}$$

$$\vec{OB} = 2\mathbf{b}$$

$$\vec{BC} = \mathbf{b}$$

$$\vec{OM} = 3\mathbf{a}$$

$N$  is the midpoint of  $AB$ .

23 (a) Work out  $\vec{MN}$  in terms of  $\mathbf{a}$  and  $\mathbf{b}$ .  
Simplify your answer.

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Answer ..... (3 marks)



\* 23 (b) Show that  $M$ ,  $N$  and  $C$  lie on a straight line.

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(3 marks)

24 Solve the simultaneous equations.

$$y = x + 4$$
$$y = 2x^2 + 3x - 1$$

Give your answers to 2 decimal places.

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Answer ..... (6 marks)

**END OF QUESTIONS**



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