Centre Number						Candidate Number				
Surname										
Other Names										
Candidate Signature										

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	

General Certificate of Secondary Education
Higher Tier
January 2013

Mathematics (Linear) 43652H

Paper 2

H

Tuesday 15 January 2013 1.30 pm to 3.30 pm

For this paper you must have:
- a calculator
- mathematical instruments.

Time allowed
- 2 hours

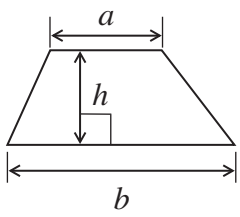
Instructions
- Use black ink or black ball-point pen. Draw diagrams in pencil.
- Fill in the boxes at the top of this page.
- Answer **all** questions.
- You must answer the questions in the spaces provided. Do not write outside the box around each page or on blank pages.
- Do all rough work in this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

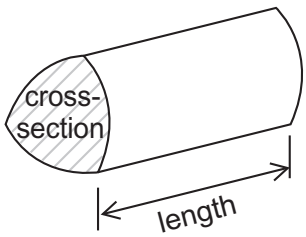
Advice
- In all calculations, show clearly how you work out your answer.

Formulae Sheet: Higher Tier

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

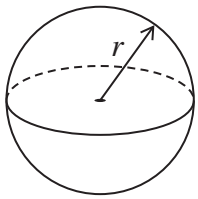


Volume of prism = area of cross-section × length



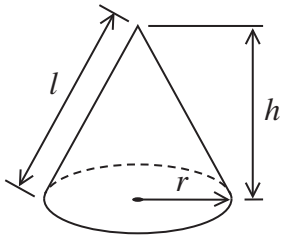
Volume of sphere = $\frac{4}{3}\pi r^3$

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



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

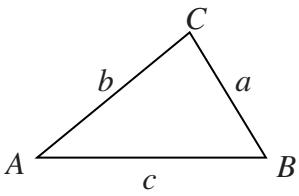
Curved surface area of cone = $\pi r l$



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.

.....

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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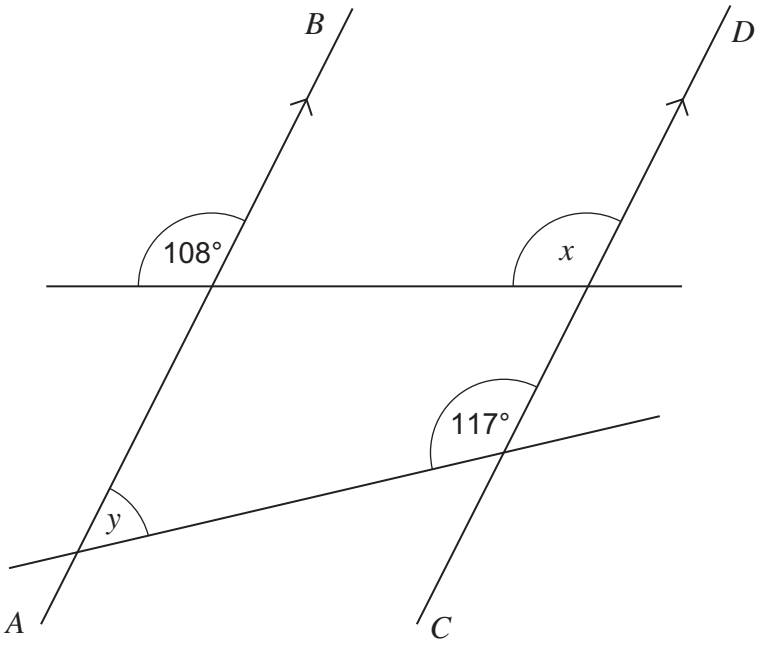
Answer £ ..... *(5 marks)*

7

Turn over ▶

2 AB is parallel to CD.



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***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

Jack : Kim = 4 : 1

Jack saves his share.

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

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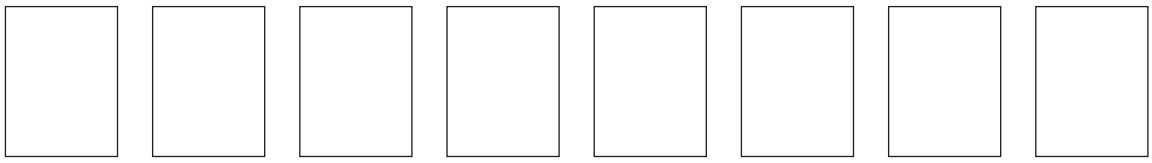
Answer ..... *(5 marks)*

13

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

7 The diagram shows a kite.

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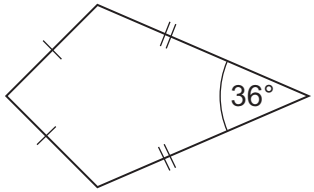

Four identical kites are joined to make this shape.

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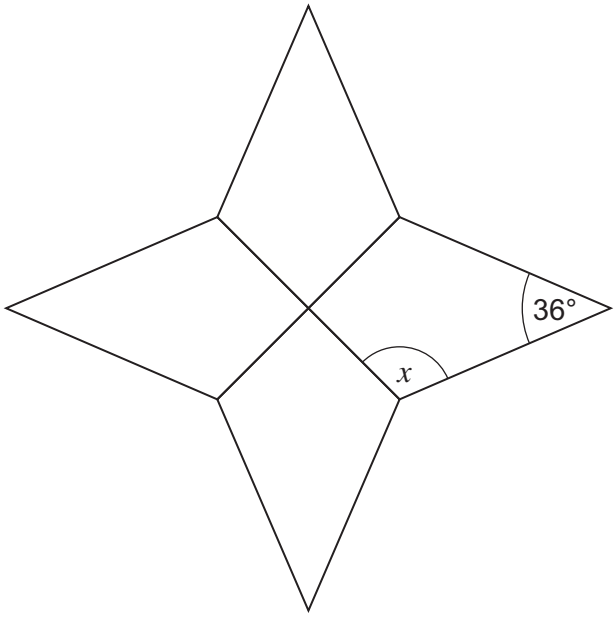

Work out the size of angle x.

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Answer ..... degrees *(4 marks)*

9

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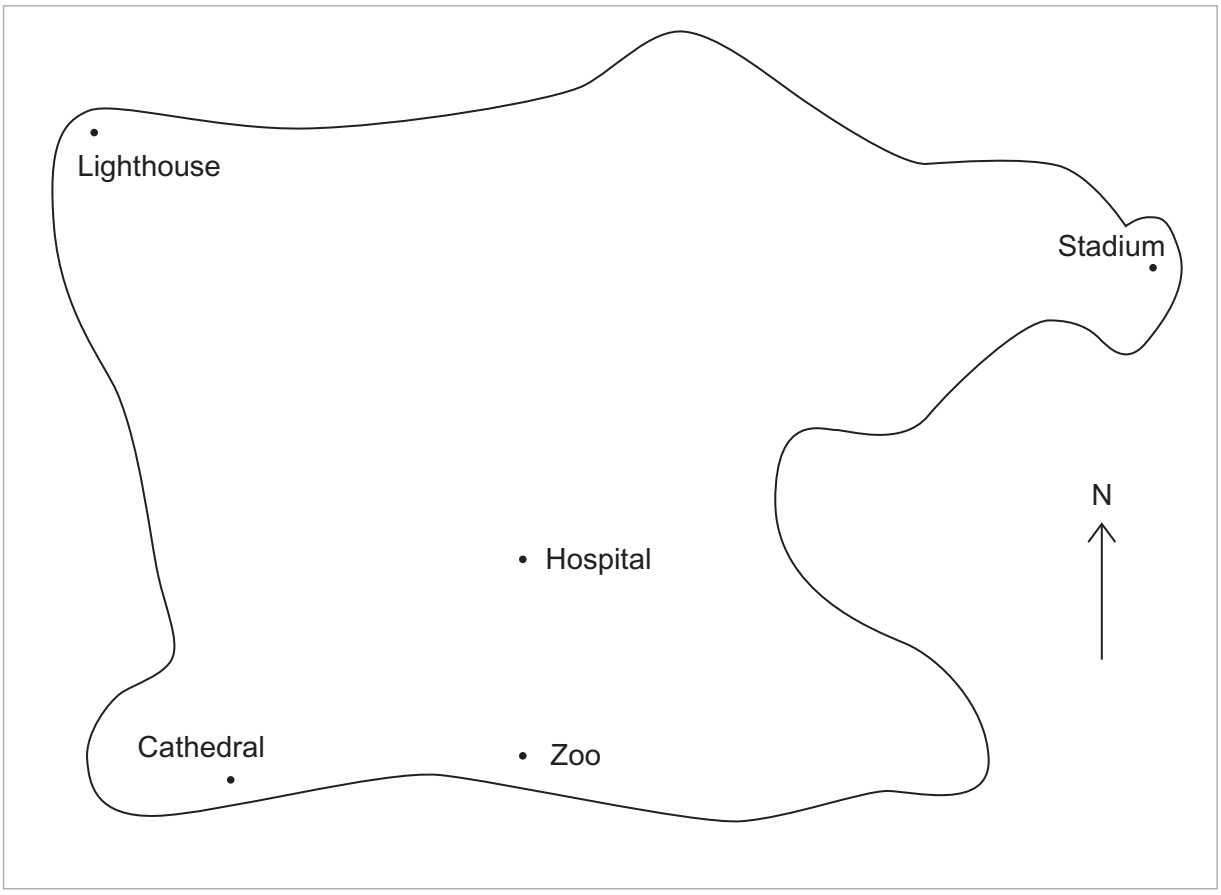
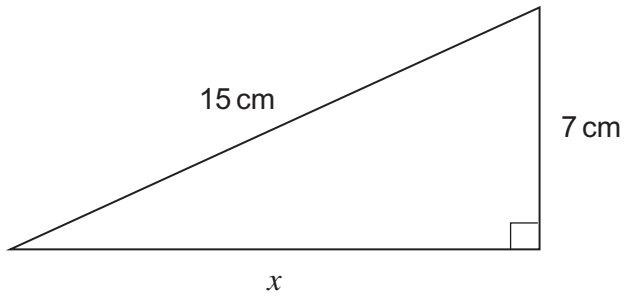


The airport is on a bearing of 040º from the Hospital and 270º from the Stadium.

Mark the position of the Airport on the map.

(3 marks)

9 Work out length x.



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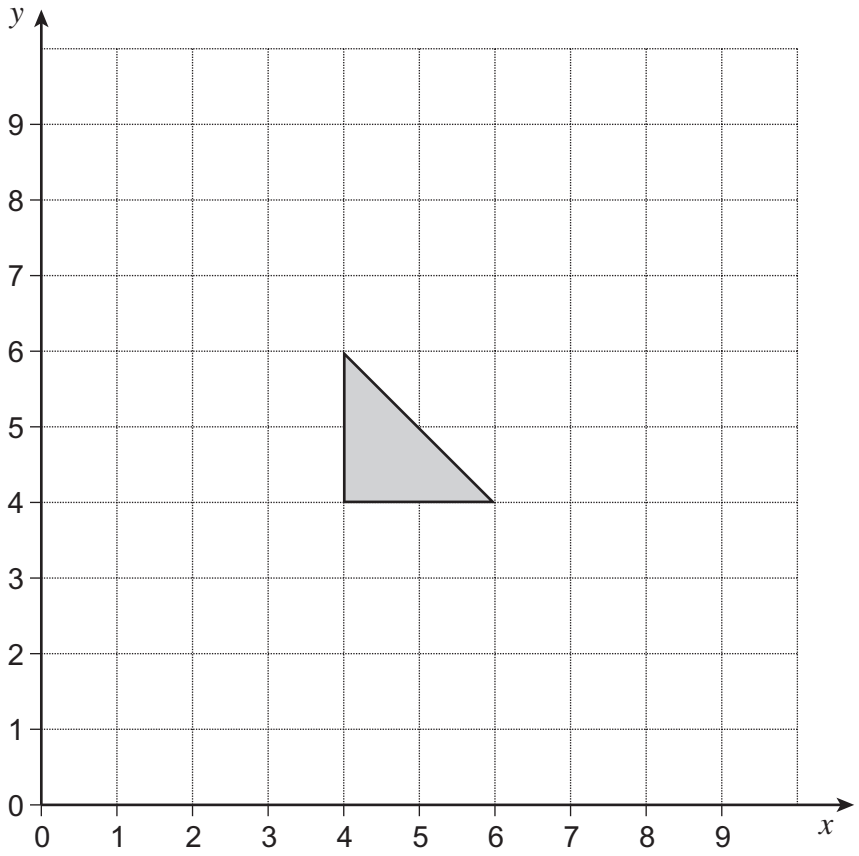
Answer ..... cm *(3 marks)*

Turn over for the next question

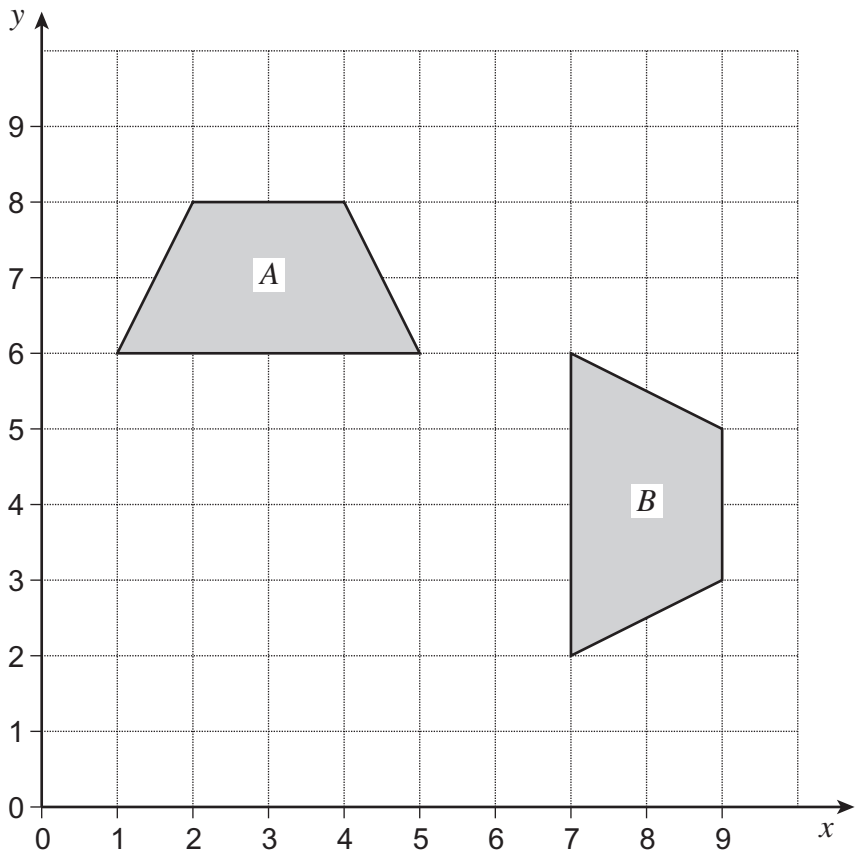
6

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

5

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 $\dfrac{8(x - 3)^2}{4(x - 3)(x + 3)}$

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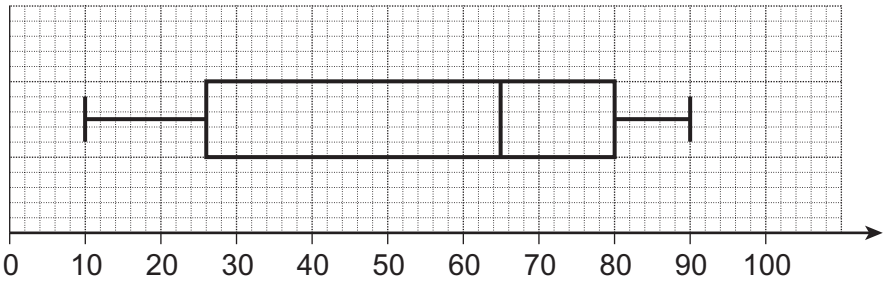
Answer ..... *(2 marks)*

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 $4x^2 - 6xy$

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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

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

Time, T, (minutes)	Frequency		
$0 \leqslant T < 10$	5		
$10 \leqslant T < 20$	22		
$20 \leqslant T < 30$	28		
$30 \leqslant T < 40$	21		
$40 \leqslant T < 50$	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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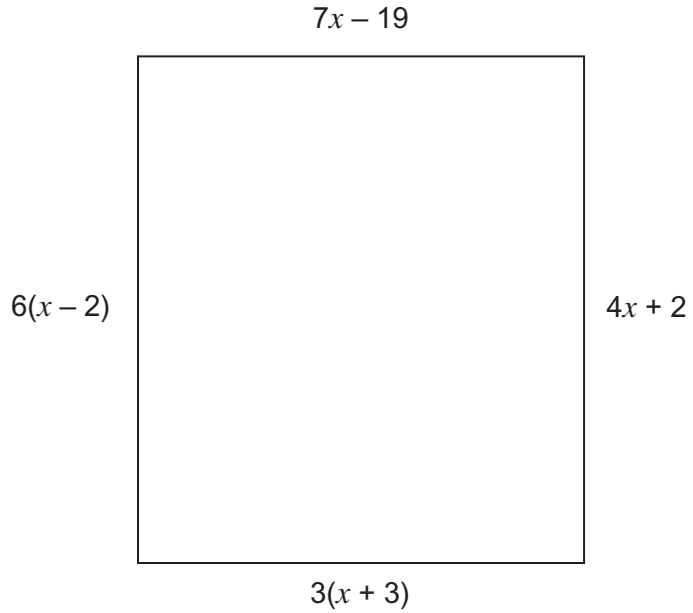
Answer ..... *(3 marks)*

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



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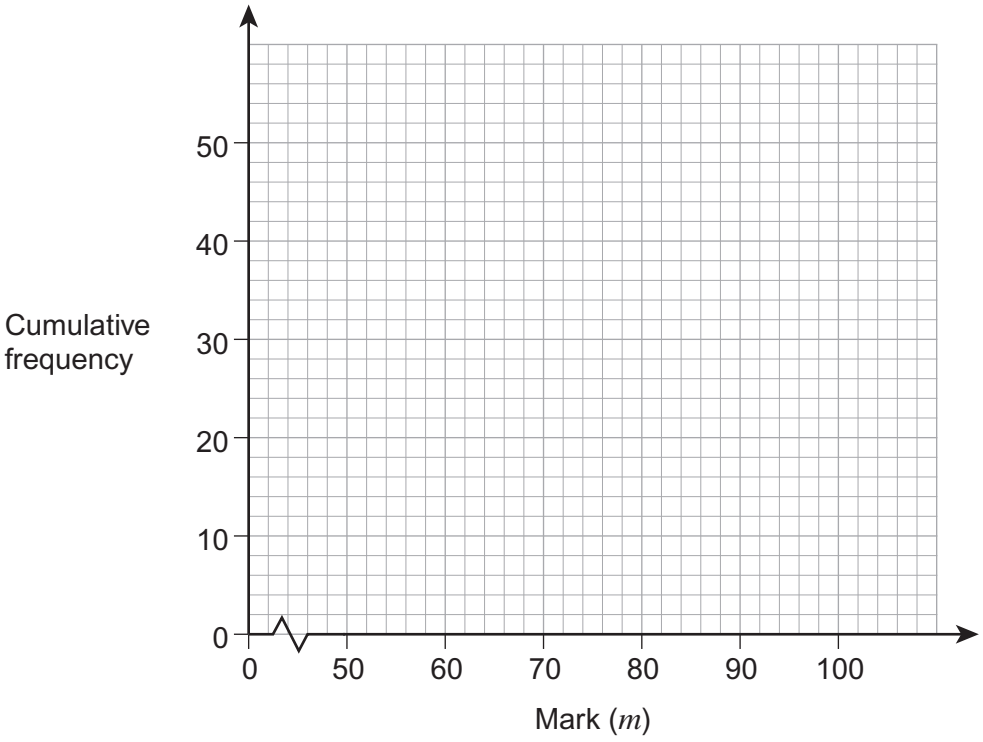
(5 marks)

12

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

Mark (m)	Number of students	
$50 < m \leqslant 60$	2	
$60 < m \leqslant 70$	3	
$70 < m \leqslant 80$	20	
$80 < m \leqslant 90$	16	
$90 < m \leqslant 100$	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
$0 < t \leqslant 10$	7
$10 < t \leqslant 30$	21
$30 < t \leqslant 40$	78
$40 < t \leqslant 50$	64
$50 < t \leqslant 100$	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
$0 < t \leqslant 10$	
$10 < t \leqslant 30$	
$30 < t \leqslant 40$	
$40 < t \leqslant 50$	
$50 < t \leqslant 100$	

(3 marks)

9

20 R is inversely proportional to A.

$R = 12.1$ 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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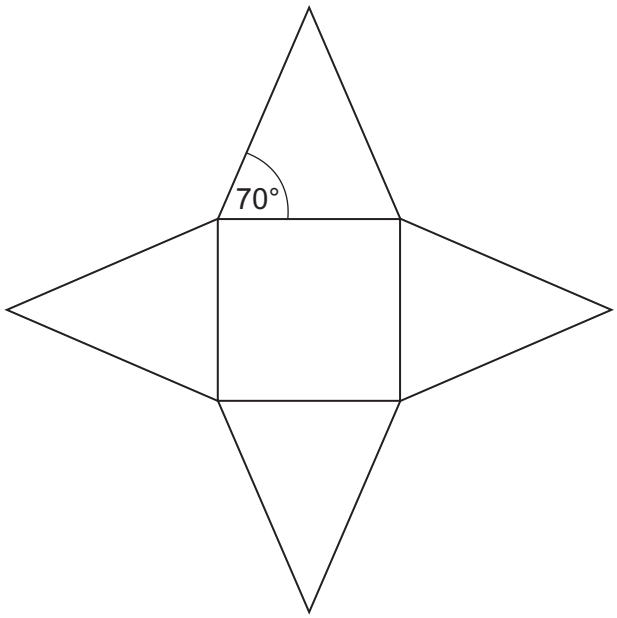
Answer ..... years *(4 marks)*

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



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The area of the square base is 36 cm^2.

Work out the area of one triangular face.

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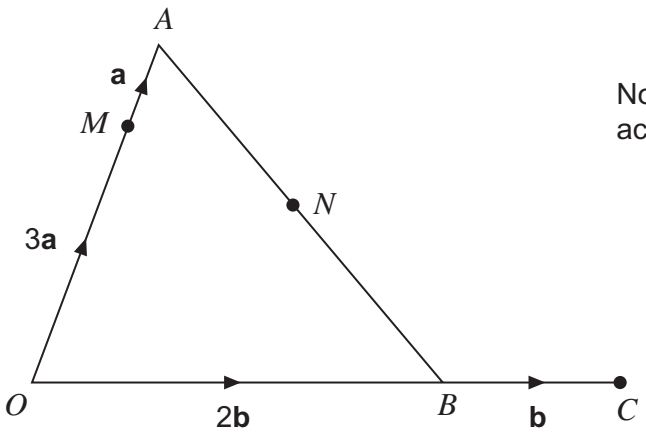
Answer ..... cm^2 *(5 marks)*

14

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



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$\overrightarrow{OA}$ = 4**a**

$\overrightarrow{OB}$ = 2**b**

$\overrightarrow{BC}$ = **b**

$\overrightarrow{OM}$ = 3**a**

N is the midpoint of AB.

23 (a) Work out $\overrightarrow{MN}$ in terms of **a** and **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

12

There are no questions printed on this page

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ANSWER IN THE SPACES PROVIDED