UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
International General Certificate of Secondary Education

CANDIDATE NAME

CENTRE NUMBER | | | | | |

CANDIDATE NUMBER | | | | |

MATHEMATICS **0580/41**

Paper 4 (Extended) **May/June 2010**

2 hours 30 minutes

Candidates answer on the Question Paper.

Additional Materials: Electronic calculator
Mathematical tables (optional)
Geometrical instruments
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.
You may use a pencil for any diagrams or graphs.
Do not use staples, paper clips, highlighters, glue or correction fluid.
DO **NOT** WRITE IN ANY BARCODES.

Answer **all** questions.
If working is needed for any question it must be shown below that question.
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.

At the end of the examination, fasten all your work securely together.
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 130.

This document consists of **19** printed pages and **1** blank page.

For Examiner's Use

1 A school has 220 boys and 280 girls.

(a) Find the ratio of boys to girls, in its simplest form.

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

(b) The ratio of students to teachers is 10 : 1.
Find the number of teachers.

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

(c) There are 21 students on the school's committee.
The ratio of boys to girls is 3 : 4.
Find the number of girls on the committee.

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

(d) The committee organises a disco and sells tickets.
35% of the school's students each buy a ticket. Each ticket costs $1.60.
Calculate the total amount received from selling the tickets.

Answer(d) $ ..... [3]

(e) The cost of running the disco is $264.
This is an increase of 10% on the cost of running last year's disco.
Calculate the cost of running last year's disco.

Answer(e) $ ..... [2]

For Examiner's Use

2 40 students are asked about the number of people in their families.

The table shows the results.

Number of people in family	2	3	4	5	6	7
Frequency	1	1	17	12	6	3

(a) Find

(i) the mode,

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

(ii) the median,

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

(iii) the mean.

Answer(a)(iii) ..... [3]

(b) Another n students are asked about the number of people in their families.

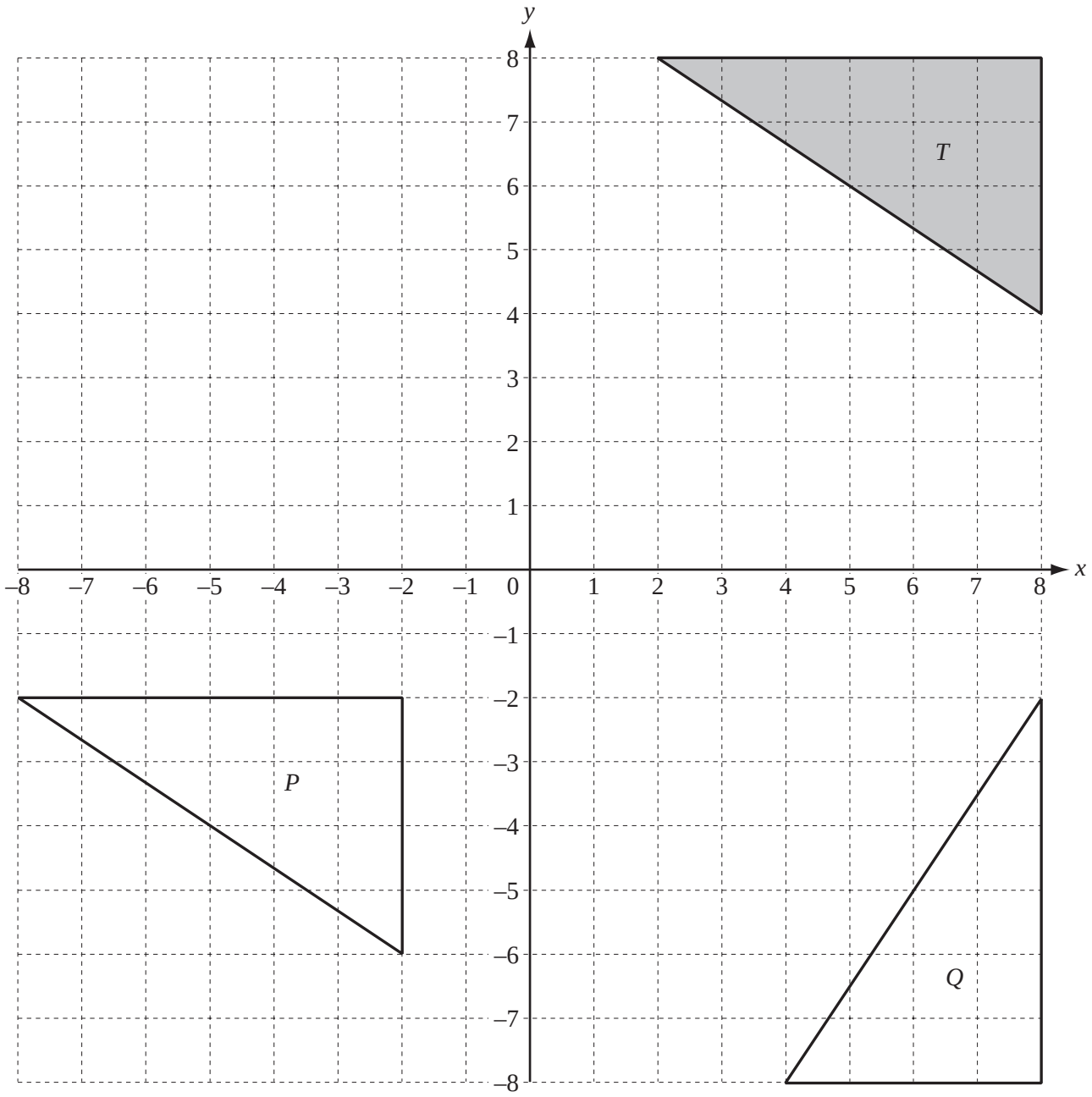
The mean for these n students is 3.

Find, in terms of n, an expression for the mean number for all $(40 + n)$ students.

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

For Examiner's Use

3



(a) On the grid, draw the enlargement of the triangle T, centre (0, 0), scale factor $\frac{1}{2}$. [2]

For Examiner's Use

(b) The matrix $\begin{pmatrix} 1 & 0 \\ 0 & 1 \end{pmatrix}$ represents a transformation.

(i) Calculate the matrix product $\begin{pmatrix} 1 & 0 \\ 0 & 1 \end{pmatrix}\begin{pmatrix} 8 & 8 & 2 \\ 4 & 8 & 8 \end{pmatrix}$.

Answer(b)(i) [2]

(ii) On the grid, draw the image of the triangle *T* under this transformation. [2]

(iii) Describe fully this **single** transformation.

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

(c) Describe fully the **single** transformation which maps

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

Answer(c)(i) ..... [2]

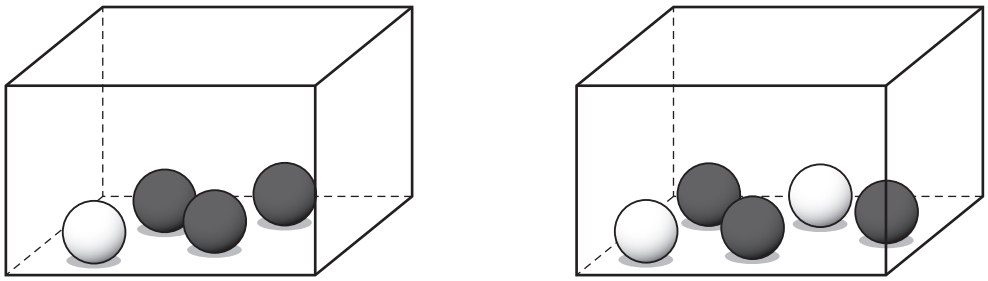
(ii) triangle *T* onto triangle *Q*.

Answer(c)(ii) ..... [3]

(d) Find the 2 by 2 matrix which represents the transformation in **part (c)(ii)**.

Answer(d) $\begin{pmatrix} & \\ & \end{pmatrix}$ [2]

4



A B

Box A contains 3 black balls and 1 white ball.
Box B contains 3 black balls and 2 white balls.

(a) A ball can be chosen at random from either box.
Complete the following statement.

There is a greater probability of choosing a white ball from Box ..... .

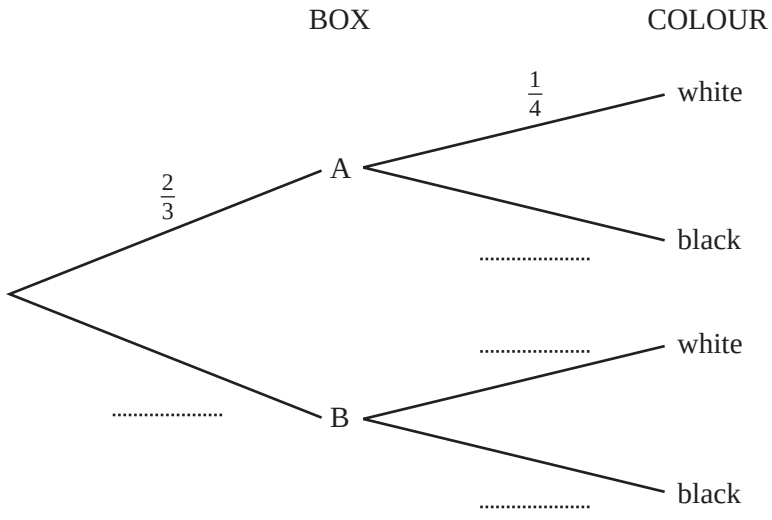
Explain your answer.

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

(b) Abdul chooses a box and then chooses a ball from this box at random.

The probability that he chooses box A is $\frac{2}{3}$.

(i) Complete the tree diagram by writing the four probabilities in the empty spaces.



[4]

For Examiner's Use

(ii) Find the probability that Abdul chooses box A and a black ball.

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

(iii) Find the probability that Abdul chooses a black ball.

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

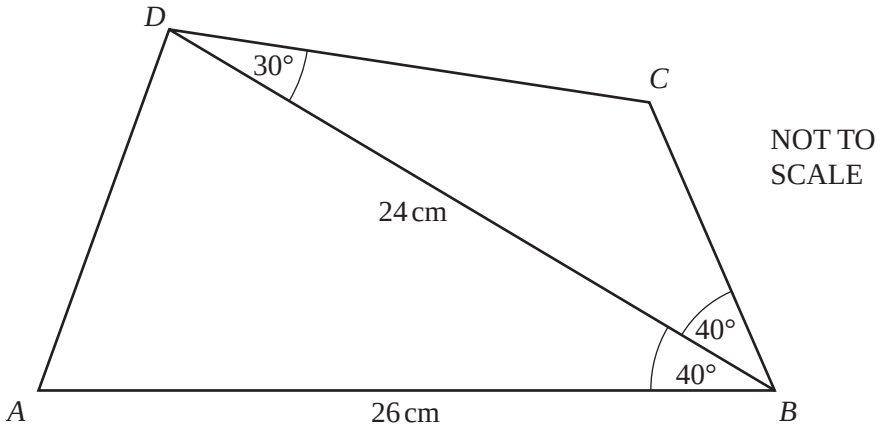
(c) Tatiana chooses a box and then chooses **two** balls from this box at random (without replacement).

The probability that she chooses box A is $\frac{2}{3}$.

Find the probability that Tatiana chooses two white balls.

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

5



ABCD is a quadrilateral and *BD* is a diagonal.
AB = 26 cm, *BD* = 24 cm, angle *ABD* = 40°, angle *CBD* = 40° and angle *CDB* = 30°.

(a) Calculate the area of triangle *ABD*.

Answer(a) ..... cm^2 [2]

(b) Calculate the length of *AD*.

Answer(b) ..... cm [4]

(c) Calculate the length of *BC*.

Answer(c) ..... cm [4]

(d) Calculate the shortest distance from the point *C* to the line *BD*.

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

For Examiner's Use

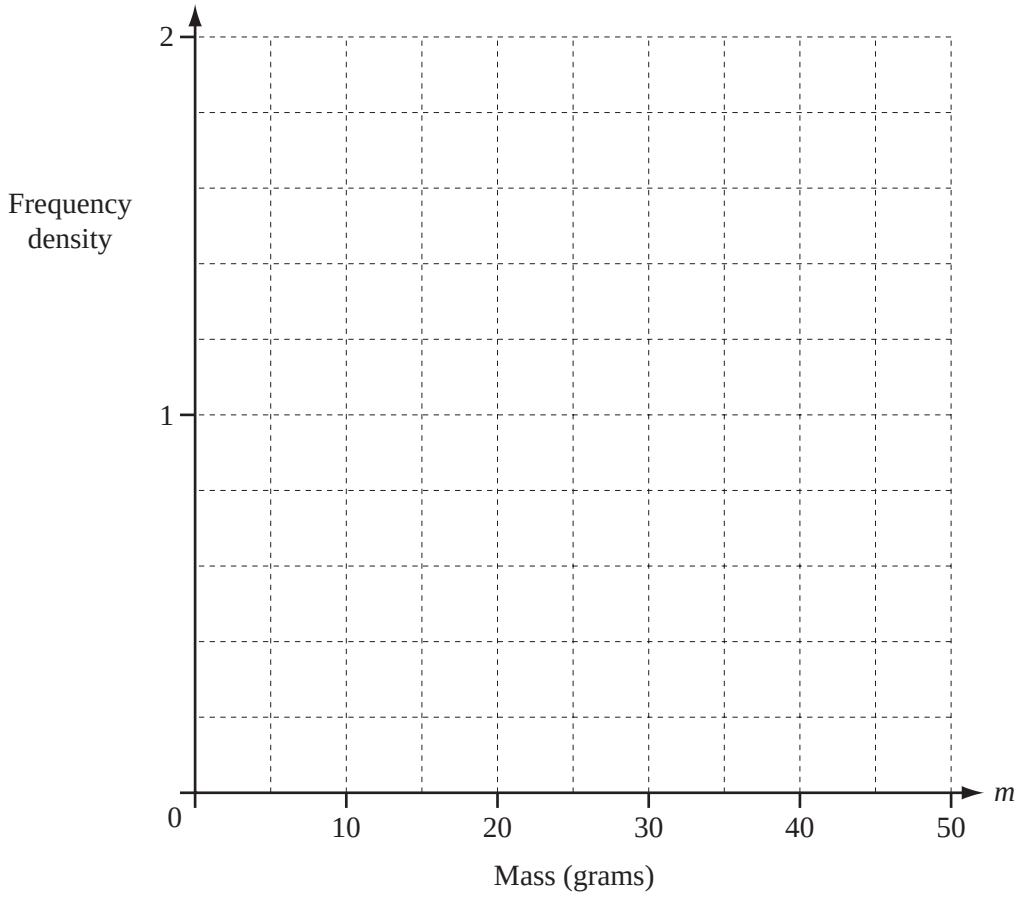
6 The masses of 60 potatoes are measured.
The table shows the results.

Mass (m grams)	$10 < m \leqslant 20$	$20 < m \leqslant 40$	$40 < m \leqslant 50$
Frequency	10	30	20

(a) Calculate an estimate of the mean.

Answer(a) ..... g [4]

(b) On the grid, draw an accurate histogram to show the information in the table.



[3]

For Examiner's Use

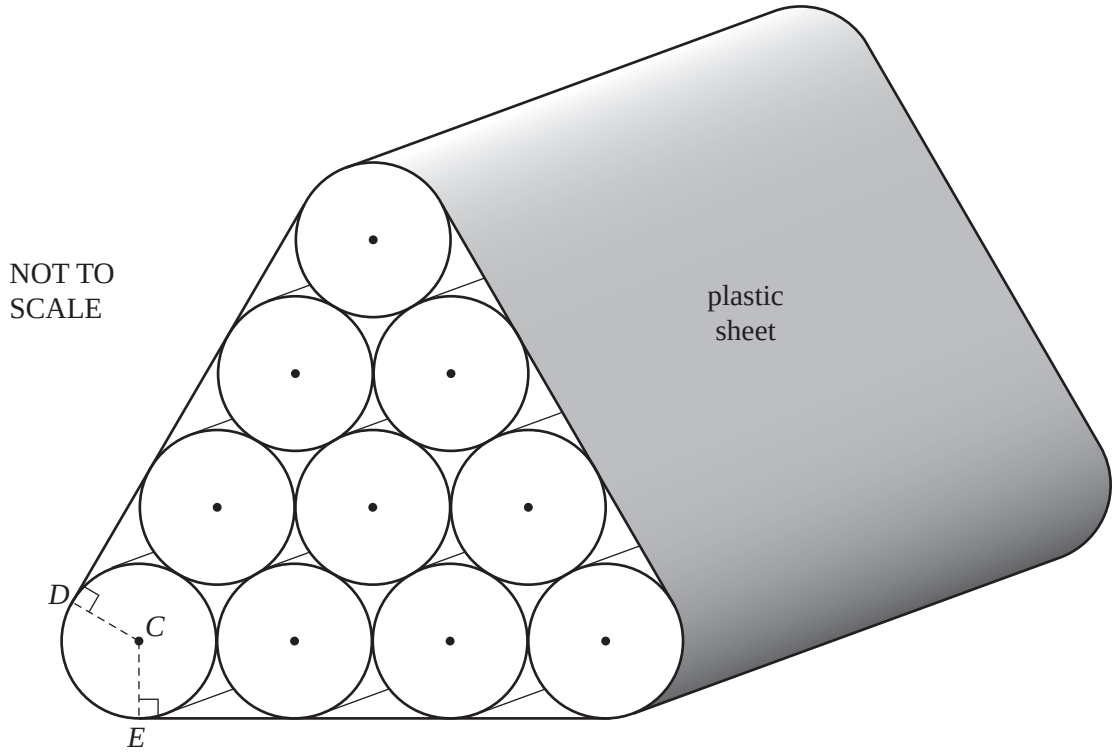
7 **(a)** Calculate the volume of a cylinder of radius 31 **centimetres** and length 15 **metres**.
Give your answer in cubic metres.

Answer(a) ..... m^3 [3]

(b) A tree trunk has a circular cross-section of radius 31 cm and length 15 m.
One cubic metre of the wood has a mass of 800 kg.
Calculate the mass of the tree trunk, giving your answer in tonnes.

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

(c)



The diagram shows a pile of 10 tree trunks.
Each tree trunk has a circular cross-section of radius 31 cm and length 15 m.
A plastic sheet is wrapped around the pile.

C is the centre of one of the circles.
CE and *CD* are perpendicular to the straight edges, as shown.

For Examiner's Use

(i) Show that angle $ECD = 120°$.

Answer(c)(i)

[2]

(ii) Calculate the length of the arc DE, giving your answer in metres.

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

(iii) The edge of the plastic sheet forms the perimeter of the cross-section of the pile.
The perimeter consists of three straight lines and three arcs.
Calculate this perimeter, giving your answer in metres.

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

(iv) The plastic sheet does not cover the two ends of the pile.
Calculate the area of the plastic sheet.

Answer(c)(iv) ..... m^2 [1]

8 **(a)** $f(x) = 2^x$

Complete the table.

x	–2	–1	0	1	2	3	4
$y = f(x)$		0.5	1	2	4		

[3]

(b) $g(x) = x(4 - x)$

Complete the table.

x	–1	0	1	2	3	4
$y = g(x)$		0	3		3	0

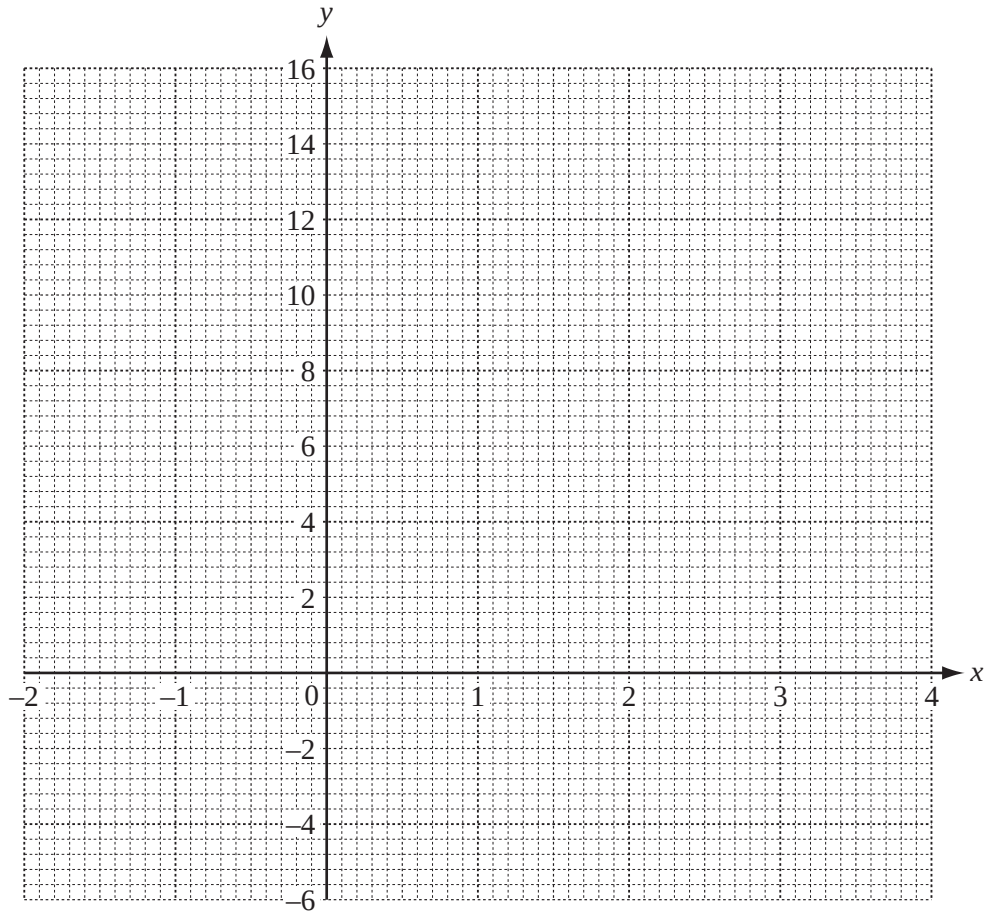
[2]

For Examiner's Use

(c) On the grid, draw the graphs of

(i) $y = f(x)$ for $2 \leqslant x \leqslant 4$, [3]

(ii) $y = g(x)$ for $1 \leqslant x \leqslant 4$. [3]



(d) Use your graphs to solve the following equations.

(i) $f(x) = 10$

Answer(d)(i) $x =$ ..... [1]

(ii) $f(x) = g(x)$

Answer(d)(ii) $x =$ ..... or $x =$ ..... [2]

(iii) $f^{1}(x) = 1.7$

Answer(d)(iii) $x =$ ..... [1]

[Turn over

For Examiner's Use

9 **(a)** Solve the following equations.

(i) $\frac{5}{w} \quad \frac{3}{w+1}$

Answer(a)(i) $w =$ ..... [2]

(ii) $(y+1)^2 \quad 4$

Answer(a)(ii) $y =$ ..... or $y =$ ..... [2]

(iii) $\frac{x+1}{3} \qquad \frac{x \quad 2}{5} \qquad 2$

Answer(a)(iii) $x =$ ..... [3]

(b) **(i)** Factorise $u^2 \quad 9u \quad 10$.

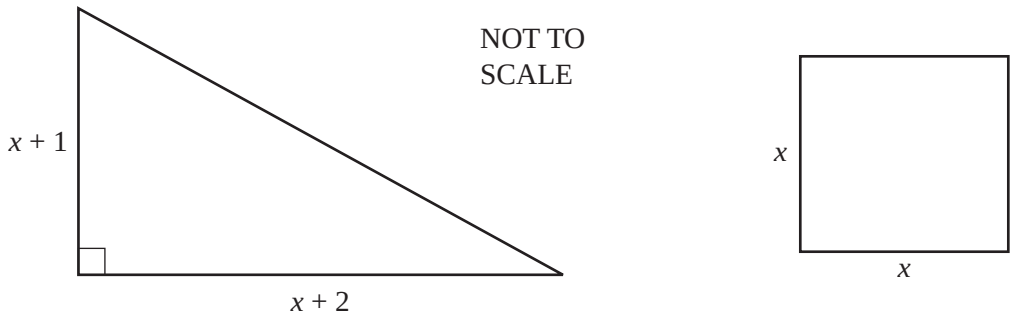
Answer(b)(i) ..... [2]

(ii) Solve the equation $u^2 \quad 9u \quad 10 = 0$.

Answer(b)(ii) $u =$ ..... or $u =$ ..... [1]

For Examiner's Use

(c)



The area of the triangle is equal to the area of the square.
All lengths are in centimetres.

(i) Show that $x^2 \quad 3x \quad 2 = 0$.

Answer(c)(i)

[3]

(ii) Solve the equation $x^2 - 3x - 2 = 0$, giving your answers correct to 2 decimal places. Show all your working.

Answer(c)(ii) $x =$ ..... or $x =$ ..... [4]

(iii) Calculate the area of one of the shapes.

Answer(c)(iii) ..... cm^2 [1]

For Examiner's Use

10 A company has a vehicle parking area of 1200 m^2 with space for x cars and y trucks.

Each car requires 20 m^2 of space and each truck requires 100 m^2 of space.

(a) Show that $x + 5y \leqslant 60$.

Answer(a)

[1]

(b) There must also be space for

(i) at least 40 vehicles,

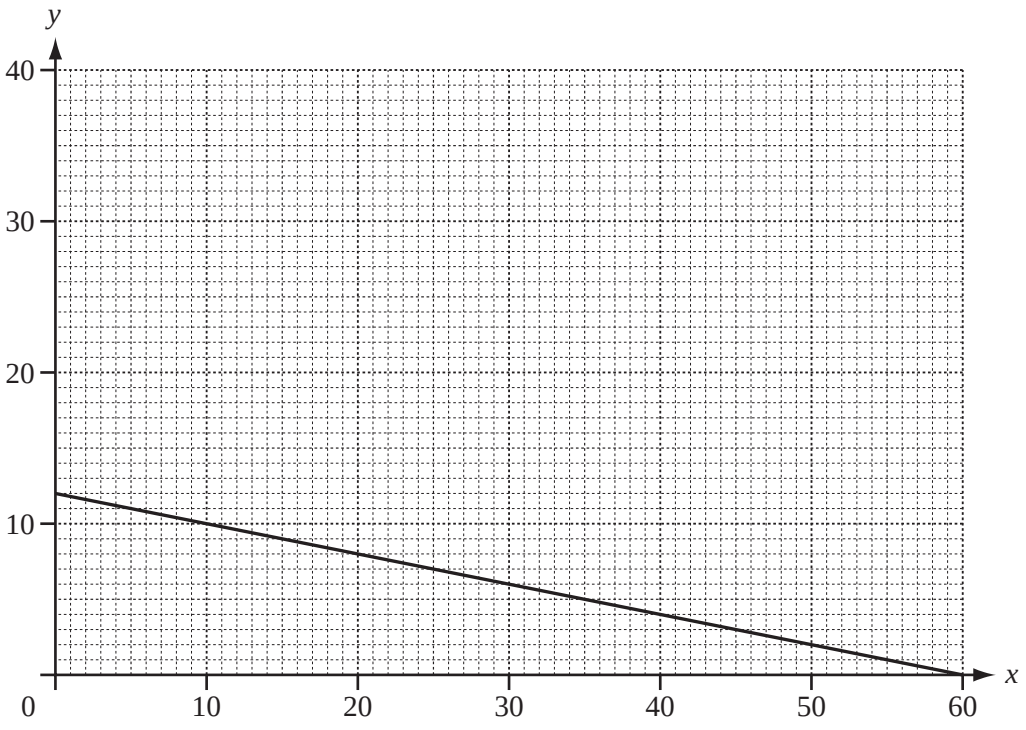
(ii) at least 2 trucks.

Write down two more inequalities to show this information.

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

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

(c) One line has been drawn for you.
On the grid, show the three inequalities by drawing the other two lines and shading the **unwanted** regions.



[4]

For Examiner's Use

(d) Use your graph to find the largest possible number of trucks.

Answer(d) ..... [1]

(e) The company charges \$5 for parking each car and \$10 for parking each truck.
Find the number of cars and the number of trucks which give the company the greatest possible income.

Calculate this income.

Answer(e) Number of cars = ...

Number of trucks = ...

Greatest possible income = \$ ..... [3]

For Examiner's Use

11

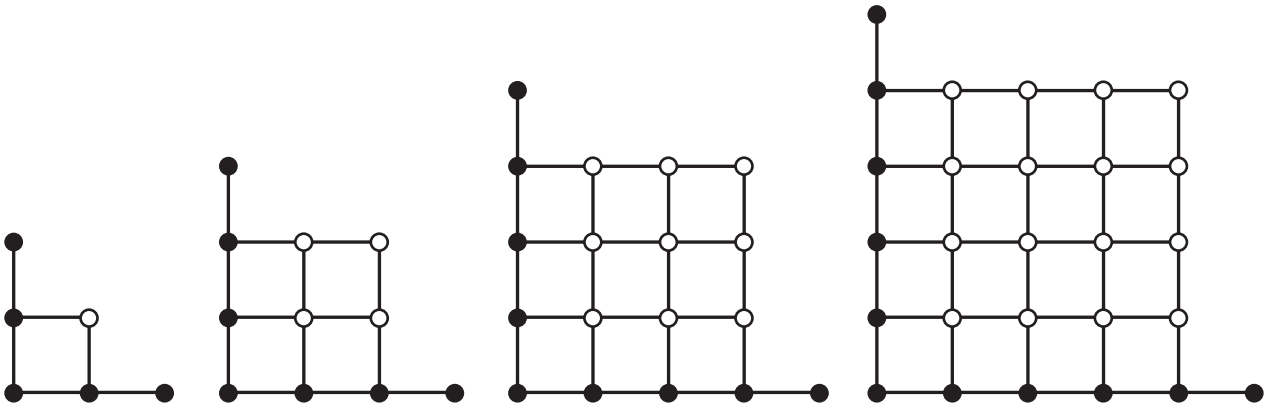


Diagram 1	**Diagram 2**	**Diagram 3**	**Diagram 4**
1 white dot	4 white dots	9 white dots	16 white dots
5 black dots	7 black dots	9 black dots	11 black dots
6 lines	14 lines	26 lines	42 lines

The four diagrams above are the first four of a pattern.

(a) Diagram 5 has been started below.
Complete this diagram and write down the information about the numbers of dots and lines.

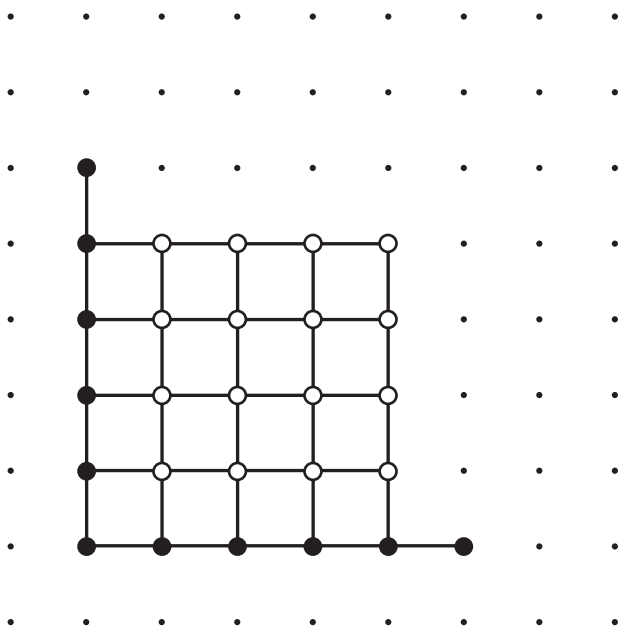


Diagram 5

..... white dots

..... black dots

..... lines

[4]

For Examiner's Use

(b) Complete the information about the number of dots and lines in Diagram 8.

Answer(b) ..... white dots

..... black dots

..... lines [3]

(c) Complete the information about the number of dots in Diagram *n*.
Give your answers in terms of *n*.

Answer(c) ..... white dots

..... black dots [2]

(d) The number of lines in diagram *n* is $k(n^2 + n + 1)$.

Find

(i) the value of *k*,

Answer(d)(i) $k =$ ..... [1]

(ii) the number of lines in Diagram 100.

Answer(d)(ii) ..... [1]

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