UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
General Certificate of Education Ordinary Level

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

MATHEMATICS (SYLLABUS D) **4024/21**

Paper 2 **October/November 2012**

2 hours 30 minutes

Candidates answer on the Question Paper.

Additional Materials: Geometrical instruments
Electronic calculator

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.

Section A
Answer **all** questions.

Section B
Answer any **four** questions.

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.
You are expected to use an electronic calculator to evaluate explicit numerical expressions.
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, unless the question requires the answer in terms of π.

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 100.

For Examiner's Use

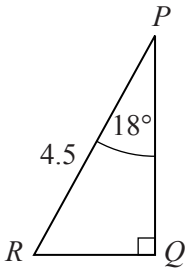
This document consists of **23** printed pages and **1** blank page.

Section A [52 marks]

Answer **all** questions in this section.

1 **(a)** In triangle PQR, $R\hat{P}Q = 18°$, $P\hat{Q}R = 90°$ and $PR = 4.5$ m.

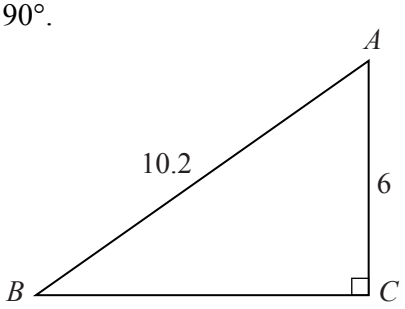
Find PQ.



Answer ..... m [2]

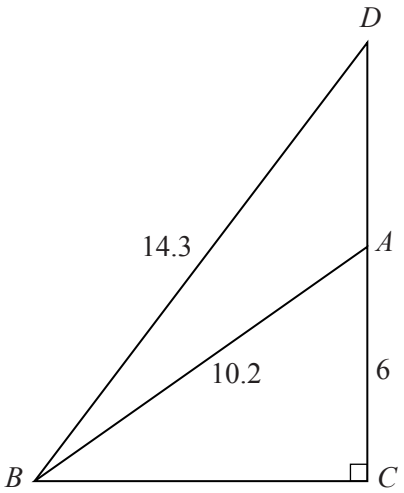
(b) In triangle ABC, $AB = 10.2$ m, $AC = 6$ m and $A\hat{C}B = 90°$.

(i) Find $A\hat{B}C$.



Answer ..... [2]

(ii)



D is the point on *CA* produced such that *BD* = 14.3 m.

Find *AD*.

Answer ..... m [4]

2 **(a)** **(i)** Simplify $5p - (1 - 5p) + 2$.

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Answer ..... [2]

(ii) Solve the inequality $3 - 2x > 5$.

Answer ..... [2]

(b) $y = \dfrac{A + 2x}{x}$.

(i) Find y when $x = A$.

Answer $y =$ ..... [1]

(ii) Rearrange the formula to make x the subject.

Answer $x =$ ..... [3]

(c) Ada is x years old and Bill is y years old.
Last year, Bill was 6 times as old as Ada.

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(i) Form an equation in x and y and show that it simplifies to $y = 6x - 5$.

[1]

(ii) In 19 years time, Bill will be twice as old as Ada.

Form another equation in x and y and show that it simplifies to $y = 2x + 19$.

[1]

(iii) Hence find the present ages of Ada and Bill.

Answer Ada's age ..... years

Bill's age ..... years [2]

3 Matthew makes pieces of furniture and sends them to a shop where they are sold.
When a piece is sold, the shopkeeper receives 15% of the selling price, and Matthew receives the rest.

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(a) A table is sold for $200.

(i) Calculate the amount the shopkeeper receives.

Answer $ ..... [1]

(ii) The cost of making this table was $131.80.

Calculate the percentage profit that Matthew makes when this table is sold.

Answer ..... % [3]

(b) Matthew made a bookcase.
The cost of making the bookcase was $647.50.
After the bookcase is sold and the shopkeeper has received 15% of the selling price, Matthew makes a profit of $160.

Calculate the selling price of the bookcase.

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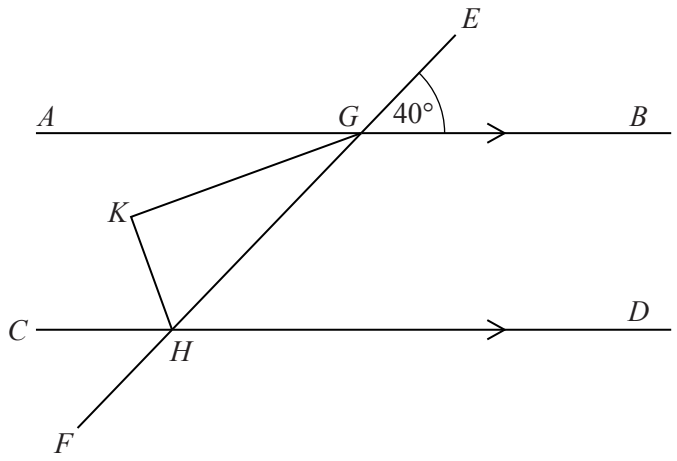
Answer $ ..... [3]

4 **(a)** AB and CD are parallel.
$EGHF$ is a straight line.
GK bisects $A\hat{G}H$ and
HK bisects $C\hat{H}G$.
$E\hat{G}B = 40°$.



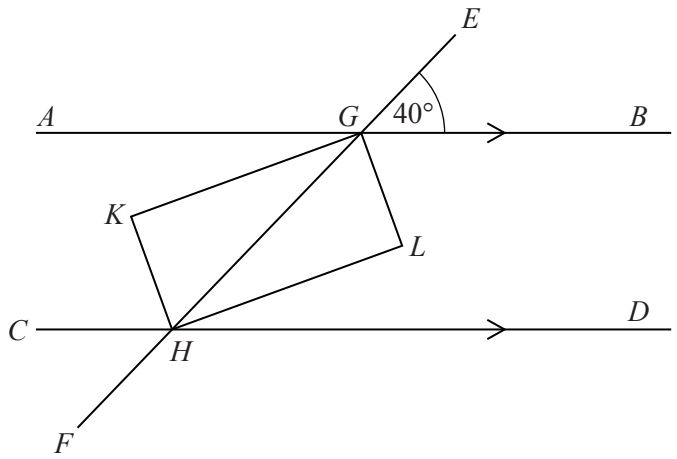
(i) Find $K\hat{G}H$.

Answer ..... [1]

(ii) Find $G\hat{H}K$.

Answer ..... [1]

(iii) The bisectors of $H\hat{G}B$ and $D\hat{H}G$ intersect at L.



State the name of the special quadrilateral $HKGL$ and give your reasons.

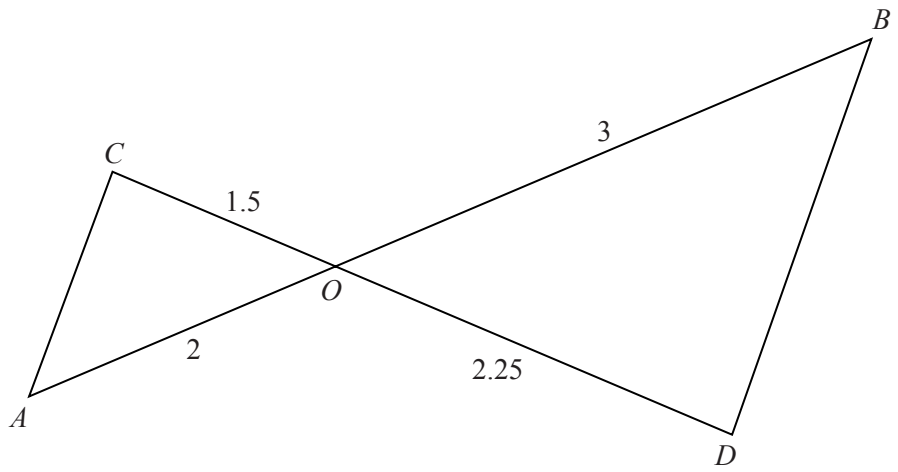
Answer $HKGL$ is a .....

because .....

.....

..... [3]

(b) AOB and COD are straight lines.



(i) Show that triangles OCA and ODB are similar.

Answer .....

.....

.....

..... [2]

(ii) Given that $BD = 2.7$ cm, find AC.

Answer ..... cm [1]

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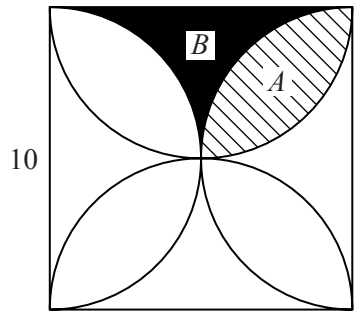
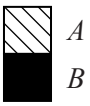


Diagram I



In **Diagram I**, four semicircles are drawn inside a square of side 10 cm.
Each semicircle has a side of the square as its diameter.
Two regions, *A* and *B*, are shown.

(a) Calculate the perimeter of region *A*.

Answer ..... cm [1]

(b) Calculate the perimeter of region *B*.

Answer ..... cm [1]

(c)

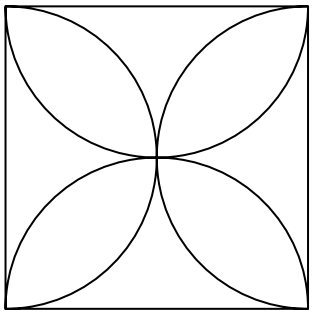


Diagram II

For **Diagram II**,

(i) draw all the lines of symmetry, [1]

(ii) state the order of rotational symmetry.

Answer ..... [1]

(d) **Diagram III** shows the combined regions *A* and *B* shaded.

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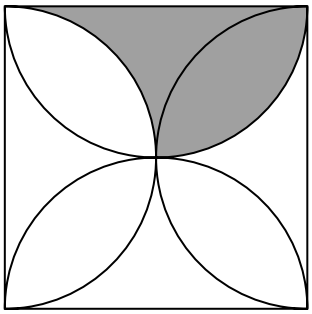

Diagram III

(i) Calculate the area of this shaded region.

Answer .....cm^2 [1]

(ii) Hence calculate the area of region *A* shown in **Diagram I**.

Answer .....cm^2 [3]

6 The journey times of 80 drivers are summarised in the table.

Time (t minutes)	$60 < t \leqslant 80$	$80 < t \leqslant 90$	$90 < t \leqslant 95$	$95 < t \leqslant 100$	$100 < t \leqslant 110$	$110 < t \leqslant 130$
Number of drivers	4	10	14	20	24	8

(a) Calculate an estimate of the mean journey time.

Answer ..... minutes [3]

(b) **(i)** A driver is chosen at random.

Find the probability that the journey time for this driver is 95 minutes or less.

Answer .....[1]

(ii) Two drivers are chosen at random without replacement.

Calculate the probability that both their journey times are more than 100 minutes.

Answer .....[2]

(c) Complete the histogram to represent the information in the table.

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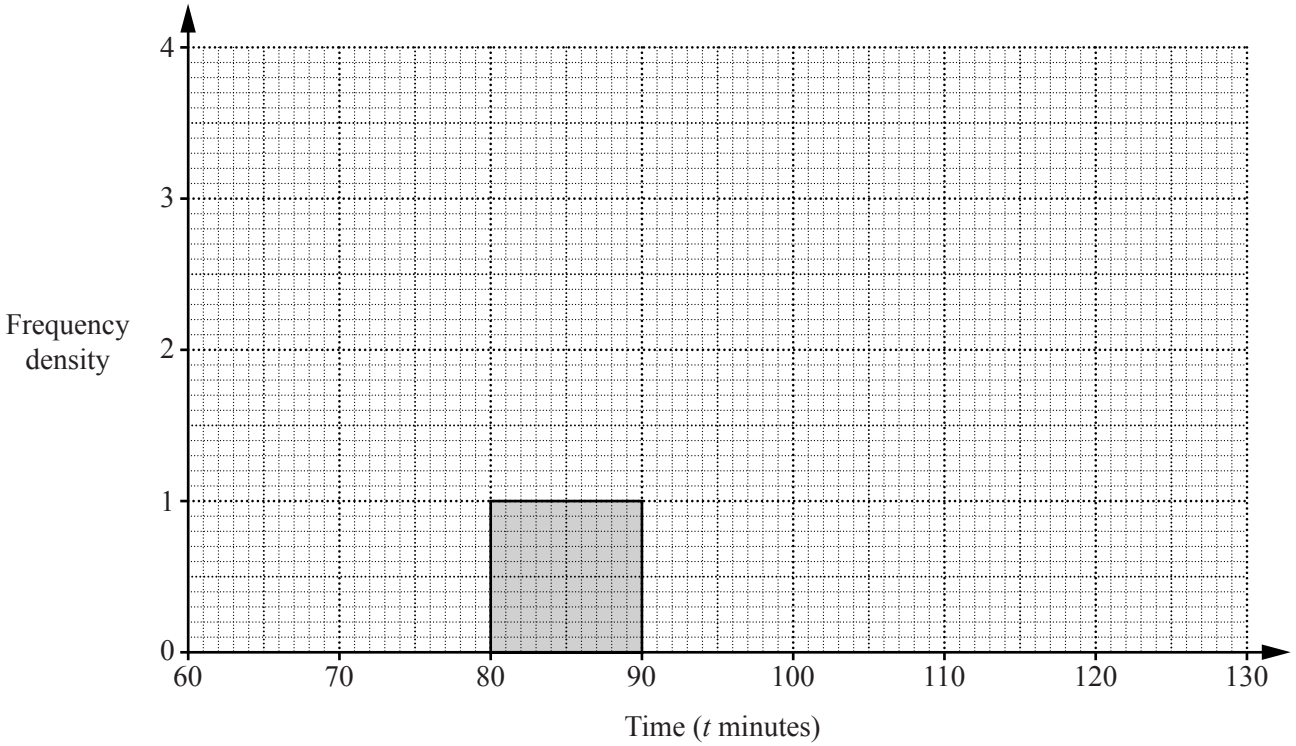

[3]

Section B [48 marks]

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Answer **four** questions in this section.

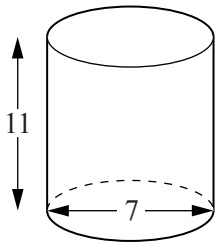
Each question in this section carries 12 marks.

7 **(a)** Tuna chunks are sold in cylindrical tins.
The 130 g tin costs \$1.00 and the 185 g tin costs \$1.50.

Which one is the better value for money?
Show all your working.

Answer ..... [2]

(b) A closed cylindrical tin is 11 cm high and the base has a diameter of 7 cm.



(i) Calculate the volume of this tin.

Answer ..... cm^3 [2]

(ii) Calculate the total external surface area of this tin.

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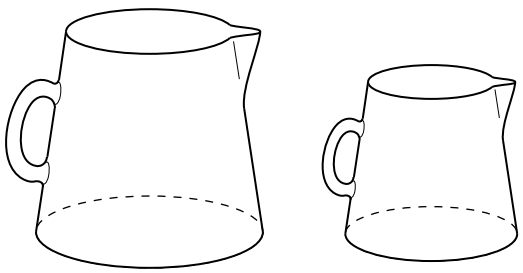
Answer ..... cm^2 [3]

(iii) In addition to the surface area, a closed tin requires an extra $30\,cm^2$ of metal to allow the top, bottom and side to be joined together.

Calculate the area of metal required for 30 000 closed tins.
Give your answer in square metres.

Answer ..... m^2 [2]

(c) Two geometrically similar jugs have volumes of $1000\,cm^3$ and $512\,cm^3$.
They have circular bases.
The diameter of the base of the larger jug is 9 cm.



Calculate the diameter of the base of the smaller jug.

Answer ..... cm [3]

8 The variables x and y are connected by the equation

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

The table below shows some values of x and the corresponding values of y, correct to 1 decimal place where appropriate.

x	–1	–0.5	0	0.5	1	1.5	2	2.5
y	–2	0.4	1	0.6	0	–0.1	1	p

(a) Calculate p. Give your answer correct to 1 decimal place.

Answer $p =$ .....[1]

(b) On the graph paper opposite, using a scale of 2 cm to represent 1 unit on both axes,
draw a horizontal x-axis for $-2 \leqslant x \leqslant 3$ and
draw a vertical y-axis for $-3 \leqslant y \leqslant 5$.
On your axes, plot the points given in the table and join them with a smooth curve. [3]

(c) Use your graph to find all the solutions of $x^3 - 2x^2 + 1 = 0$.

Answer $x =$ .....[2]

(d) By drawing a tangent, find the gradient of the curve at the point where $x = -0.3$.

Answer .....[2]

(e) The equation $x^3 - 2x^2 - x + 2 = 0$ can be solved by finding the intersection of the graphs of $y = x^3 - 2x^2 + 1$ and the straight line $y = x + a$.

(i) Find the value of a.

Answer $a =$ .....[1]

(ii) Hence solve the equation $x^3 - 2x^2 - x + 2 = 0$.

Answer $x =$ .....[3]

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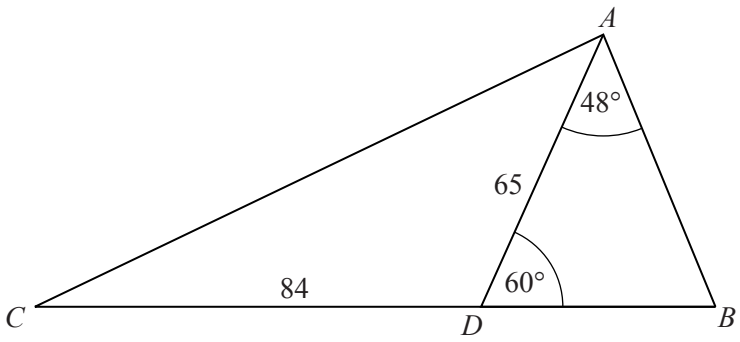

A, B, C and *D* are four points on horizontal ground.
CDB is a straight line.
$AD = 65$ m and $CD = 84$ m.
$D\hat{A}B = 48°$ and $A\hat{D}B = 60°$.

(a) Calculate *AB*.

Answer .....m [3]

(b) Calculate the area of triangle *ACD*.

Answer ..... m^2 [2]

(c) Calculate AC.

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Answer .....m [4]

(d) A vertical tree of height 35 m stands at A.

P is the point on the line BC such that the angle of elevation from the line BC to the top of the tree is greatest.

Calculate this angle of elevation.

Answer ..... [3]

10 London is 320 km from York.
A train travels from York to London at an average speed of x kilometres per hour.

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(a) Write down an expression, in terms of x, for the time taken, in hours, for this train to travel from York to London.

Answer ..... h [1]

(b) A car travels from York to London.
The average speed of the car is 80 km/h slower than the average speed of the train.

Write down an expression, in terms of x, for the time taken, in hours, for the car to travel from York to London.

Answer .....h [2]

(c) The car took $2\frac{1}{2}$ hours longer than the train.

Form an equation in x and show that it simplifies to $x^2 - 80x - 10\,240 = 0$.

[3]

(d) Solve this equation, giving each solution correct to 1 decimal place.

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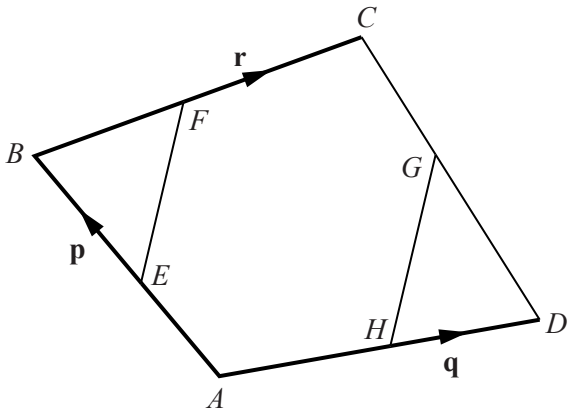
Answer $x =$ ..... or ..... [4]

(e) Hence find the time taken by the **train** to travel from York to London.
Give your answer in hours and minutes, correct to the nearest minute.

Answer ..... hours ..... minutes [2]

11 **(a)** E, F, G and H are the midpoints of AB, BC, CD and DA respectively. $\overrightarrow{AB} = \mathbf{p}$, $\overrightarrow{AD} = \mathbf{q}$ and $\overrightarrow{BC} = \mathbf{r}$.



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(i) Find, in terms of **p**, **q** and **r** as appropriate

(a) $\overrightarrow{EF}$,

Answer .....[1]

(b) $\overrightarrow{DC}$,

Answer .....[1]

(c) $\overrightarrow{HG}$, expressing the vector as simply as possible.

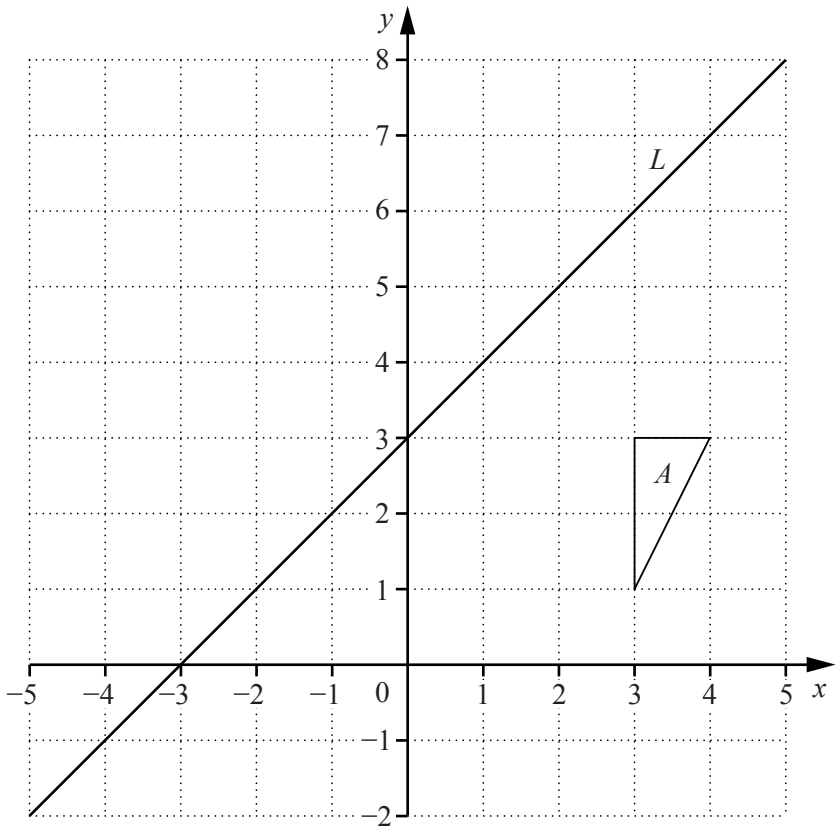
Answer .....[2]

(ii) What conclusions can be drawn about the lines EF and HG?

Answer .....

.....[1]

(b)



The grid shows triangle A and line L.

(i) Triangle A is mapped onto triangle B by a reflection in line L.

Draw and label triangle B. [2]

(ii) Triangle A is mapped onto triangle C by a clockwise rotation of 90°, centre $(0, 3)$.

Draw and label triangle C. [2]

(iii) Triangle C is mapped onto triangle D by a reflection in line L.

Describe the single transformation that maps triangle B onto triangle D.

Answer .....

..... [3]

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