Centre Number	Candidate Number	Name

UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
General Certificate of Education Ordinary Level

MATHEMATICS (SYLLABUS D)   **4024/01**

Paper 1

October/November 2004

2 hours

Candidates answer on the Question Paper.
Additional materials: Geometrical instruments

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 in the spaces provided on the Question Paper.
You may use a pencil for any diagrams or graphs.
Do not use staples, paper clips, highlighters, glue or correction fluid.

Answer **all** questions.
The number of marks is given in brackets [ ] at the end of each question or part question.

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.
The total of the marks for this paper is 80.

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

For Examiner's Use

If you have been given a label, look at the details. If any details are incorrect or missing, please fill in your correct details in the space given at the top of this page.

Stick your personal label here, if provided.

This document consists of **16** printed pages.

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[Turn over

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

1   Evaluate

   (a) 0.4×0.06 ,

   (b) $\sqrt[3]{0.008}$.

Answer (a) .... [1]

(b) .... [1]

2
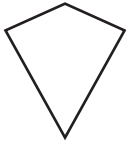
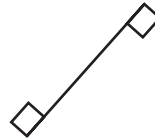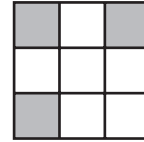Shape *A*   *B*   *C*   *D*   *E*   *F*

In the answer space, write down the letters of all the shapes which have

   (a) exactly 1 line of symmetry,

   (b) rotational symmetry of order 2.

Answer (a) .... [1]

(b) .... [1]

3   Evaluate

   (a) $1\frac{2}{3} \div 5$,

   (b) $4\frac{1}{4} - 1.43$, giving your answer as a decimal.

Answer (a) .... [1]

(b) .... [1]

4 **(a)** Write down the next two terms in the sequence 20, $16\frac{1}{2}$, 13, $9\frac{1}{2}$, 6, …….

(b) Write down an expression, in terms of n, for the nth term of the sequence

$$1,\ 4,\ 7,\ 10,\ 13,\ \ldots\ldots\ldots.$$

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

(b) .... [1]

5 **(a)** Add together 181 centimetres and 14.85 metres.
Give your answer in metres.

(b) Express 40 000 square metres in square kilometres.

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

(b) ....km² [1]

6 **(a)** Express $\dfrac{17}{40}$ as a percentage.

(b) Evaluate $\left(\dfrac{1}{3}\right)^{-2}$.

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

(b) .... [1]

[Turn over

7 A block of wood is a cuboid, 10 cm by 6 cm by 2 cm.

Find

(a) its volume,

(b) its surface area.
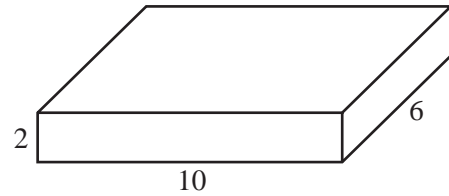
Answer (a) .... [1]

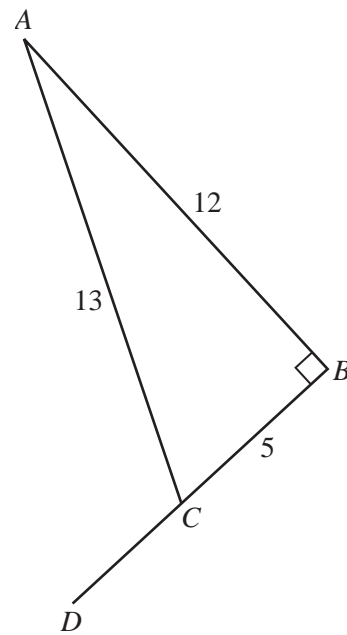*(b)* .... [1]

8 In the diagram, *BCD* is a straight line,

$BC = 5$ cm, $AB = 12$ cm, $AC = 13$ cm and $A\hat{B}C = 90°$.
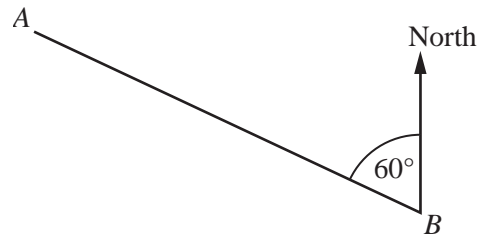
Find

(a) $\tan B\hat{A}C$,

(b) $\cos A\hat{C}D$.

Give both answers as fractions.

Answer (a) $\tan B\hat{A}C$ = ... [1]

(b) $\cos A\hat{C}D$ = ...[1]

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9 The diagram shows the positions of *A* and *B*.

Find the bearing of

(a) *A* from *B*,

(b) *B* from *A*.

Answer (a) .... [1]

(b) .... [1]

10 (a) During one week the temperatures at midnight were

$3\,°C$, $4.5\,°C$, $1\,°C$, $–2\,°C$, $0\,°C$, $–6.5\,°C$, $–3.5\,°C$.

Find the difference between the highest and lowest temperatures.

(b) Find all the integers which satisfy both

$$2x + 7 < 3 \text{ and } x \geqslant -4 .$$

Answer (a) ....°C [1]

(b) .... [1]

11 The diagram shows the graph of $y = x^2 + x - 12$.

(a) The graph cuts the *y*-axis at *K* (0, *k*).

Write down the value of *k*.

(b) The graph cuts the *x*-axis at *L* (*l*, 0) and *M* (*m*, 0).

Find the value of

(i) *l*,

(ii) *m*.
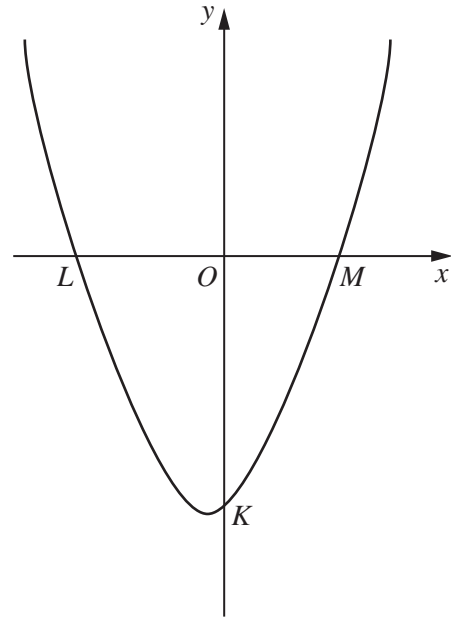
Answer (a) k = ... [1]

(b) (i) *l =* .... [1]

(ii) *m =* .... [1]

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12 An atom of helium has a mass of 6.8×10^{-27} kilograms.

(a) Express this mass in grams.
Give your answer in standard form.

(b) A room contains 9×10^{22} atoms of helium.

Find the mass of helium in the room.
Give your answer in grams as a normal decimal number.

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

(b) ....g [2]

13 $\overrightarrow{AB} = \begin{pmatrix} 8 \\ -4 \end{pmatrix}$, $\overrightarrow{BC} = \begin{pmatrix} 6 \\ 4 \end{pmatrix}$.

(a) Express $\overrightarrow{AC}$ as a column vector.

Answer (a) $\overrightarrow{AC} =$ $\begin{pmatrix} \\ \end{pmatrix}$ [1]

(b) It is given that $\overrightarrow{CD} = \begin{pmatrix} -11 \\ h \end{pmatrix}$.

Find the two possible values of h which will make *ABCD* a trapezium.

You may use the grid below to help you with your investigation.

A

Answer (b) h = ... and ....[2]

14 The cost of a chair, x, is $70 correct to the nearest $10.
The cost of a desk, y, is $900 correct to the nearest $50.

(a) Complete the table in the answer space.

(b) Find the lower bound of the total cost of a desk and 4 chairs.

Answer (a)

	Lower Bound	Upper Bound
x		
y		

[2]

(b) $.. [1]

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15 **(a)** The determinant of the matrix $\begin{pmatrix} k & 5 \\ -1 & 2 \end{pmatrix}$ is 14.

Find k.

(b) Find the inverse of the matrix $\begin{pmatrix} 3 & -1 \\ -4 & 2 \end{pmatrix}$.

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

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

16 The unshaded region **R** is defined by 3 inequalities.
One of these is $x \geqslant 1$.
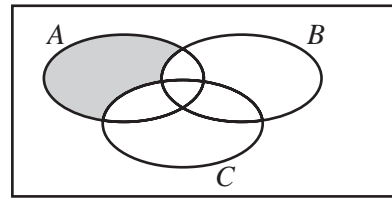Write down the other two inequalities.
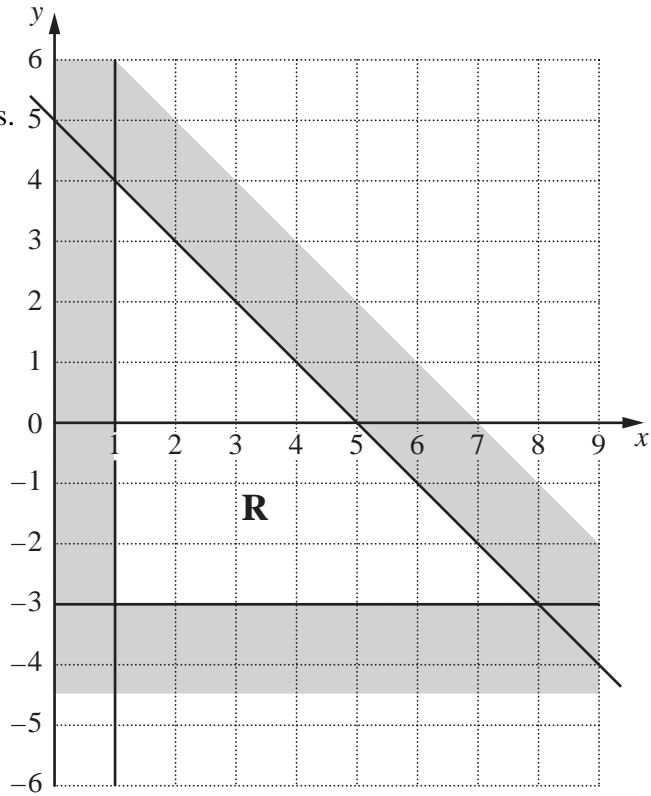
Answer ....

.... [3]

17 (a) Given that f(x) = $3x + 5$, find f(3).

(b) The function g is defined by g(x) = ($2x - 3$) ($x + k$).

Given that g(0) = –15, find

(i) k,

(ii) x such that g(x) = 0.

Answer (a) f(3) = ... [1]

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

(ii) x = ... [2]

18 **(a)** Express in set notation, as simply as possible, the subset shaded in the Venn diagram.

Answer (a) .... [1]

(b) $\mathscr{E}$ = {all polygons},
   T = {all triangles},
   R = {all regular polygons},
   Q = {all quadrilaterals}.

Add the set Q to the Venn diagram in the answer space.

Answer (b) $\mathscr{E}$
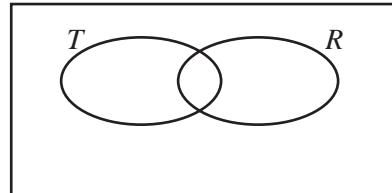
[1]

(c) $\mathscr{E}$ = { $x : x$ is an integer and $3 \leqslant x \leqslant 11$},
   F = { $x : x$ is a factor of 12},
   O = { $x : x$ is an odd number}.

List the elements of the set $(F \cup O)'$.

Answer (c) .... [1]

(d) It is given that n($\mathscr{E}$) = 20.
   P and S are sets such that n(P) = 7 and n(S) = 16.
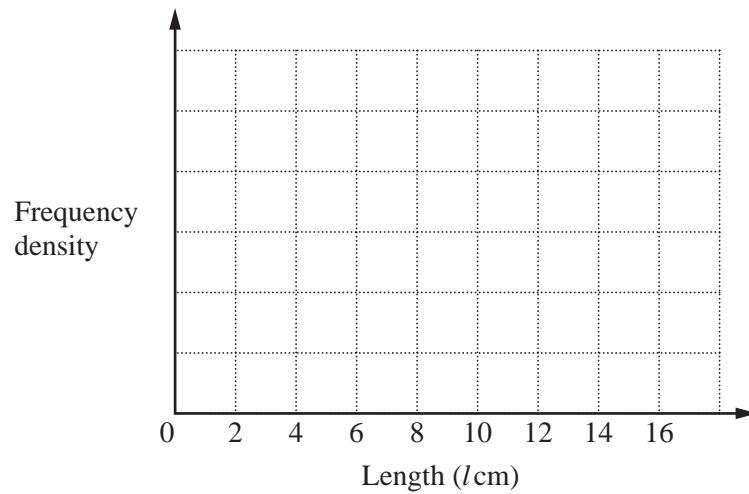
Find the smallest possible value of n($P \cap S$).

Answer (d) .... [1]

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19 The lengths of 40 nails were measured.
Their lengths, in centimetres, are summarised in the table below.

Length (l cm)	Frequency
$0 < l \leqslant 4$	14
$4 < l \leqslant 8$	18
$8 < l \leqslant 16$	8

(a) On the axes in the answer space, draw the histogram which represents this information.

Answer (a)

Frequency density

Length (l cm)

[2]

(b) Calculate an estimate of the mean length of the nails.

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

 [Turn over

20 **(a)** The interior angle of a regular polygon is $160°$.

How many sides does it have?

Answer (a) .... [2]

(b) *ABCDE......* is part of a regular polygon which has interior angles of $160°$.
CDLM is a square.
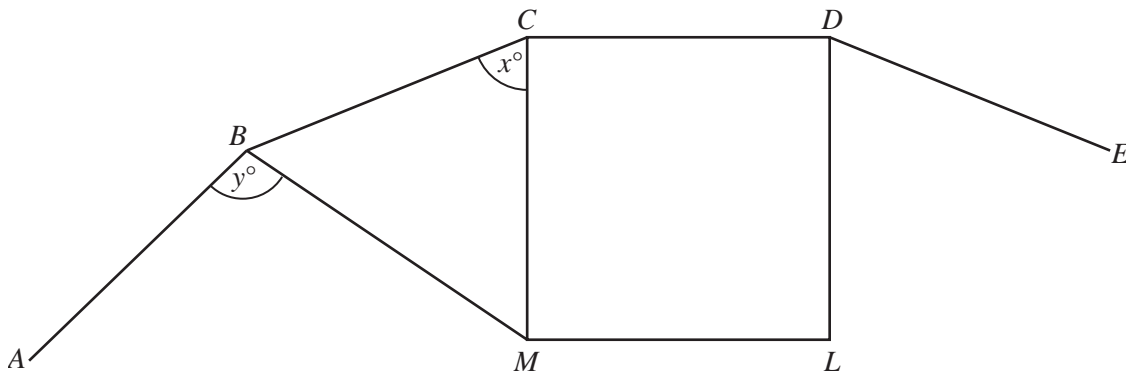
Find
(i) the value of *x*,

(ii) the value of *y*.

Answer (b) (i) *x* = ... [1]

(ii) *y* = ... [1]

21 The diagram shows the distance – time graphs of the journeys of Ali and Bala from home to school.
They leave home together and follow the same route.
Ali runs to school and Bala cycles.
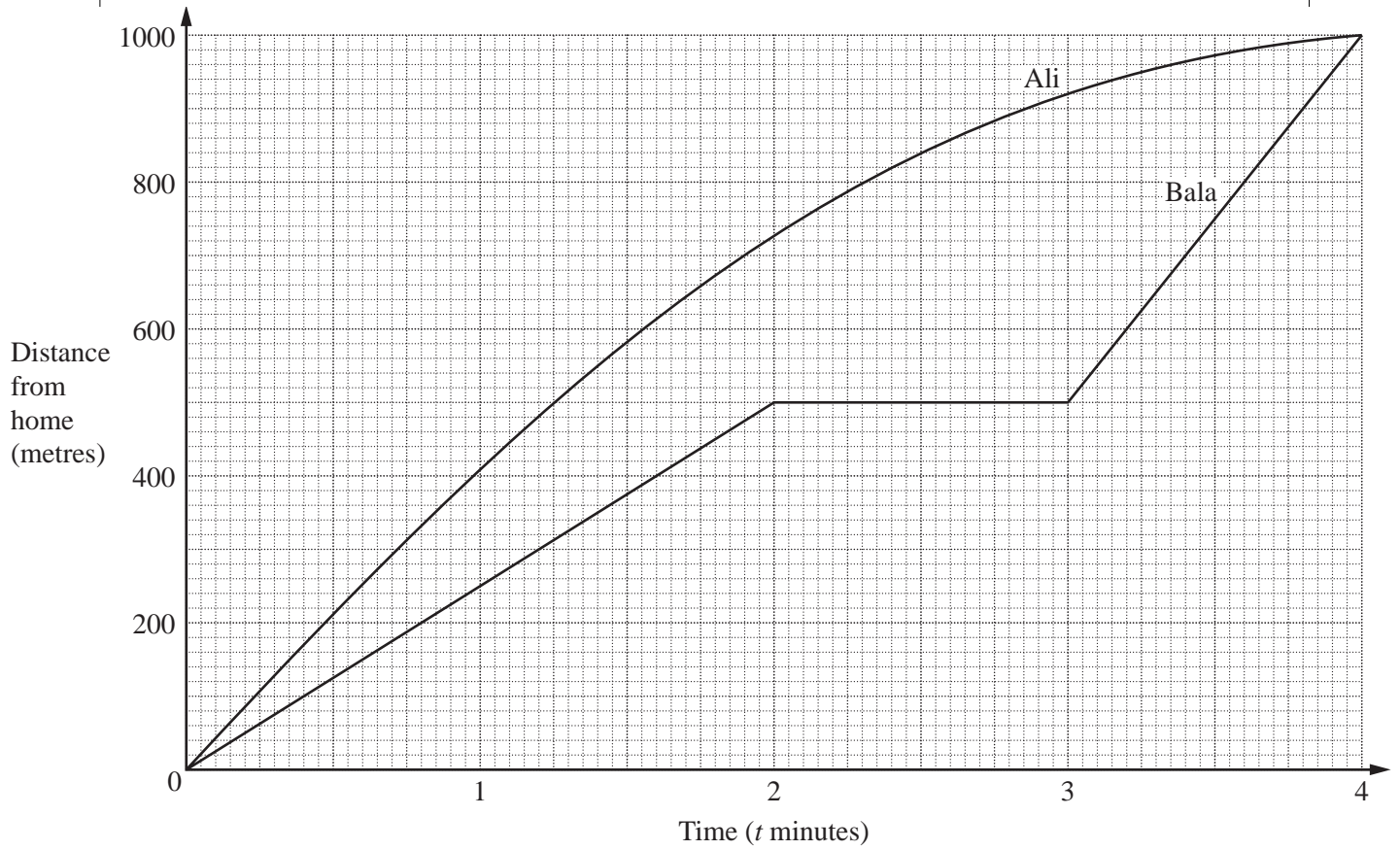
(a) How long does it take Ali to run the first 700 m?

(b) Estimate the distance between Ali and Bala when $t = 3$.

(c) Find Bala's speed when $t = 2.6$.

(d) Find Bala's speed when $t = 3.5$.

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

(b) ....m [1]

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

(d) ....m/minute [1]

22 **(a)** Factorise $(a - 2b) - 3c\,(a - 2b)$.

(b) Simplify $5t\,(t + 3) - 3\,(5t - 2)$.

(c) Solve the simultaneous equations

$$2x - 3y = 15 \, ,$$
$$3x - 7y = 27\tfrac{1}{2} \, .$$

Answer (a) ....[1]

(b) .... [1]

(c) x = ...

y =..................................... [3]

23 **(a)** A coach left London at 20 45 and arrived in Edinburgh the next day at 05 05.
How long did the journey take?

(b) The distance between London and Edinburgh is 660 km.

(i) A train took 5 hours 30 minutes to complete the journey.

Calculate its average speed.

(ii) The average speed of another train was 150 km/h.

How long did this train take for the journey?
Give your answer in hours and minutes.

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

(b) (i) ....km/h [2]

(ii) ....h ....minutes [2]

24 In triangle *ABC*, *AB* = 15 cm, *BC* = 8 cm and *AC* = 11 cm.
The side *AB* is drawn in the answer space.

(a) Using ruler and compasses only, complete the triangle.

(b) Measure the largest angle of the triangle.

(c) Draw the locus of **all** points **within the triangle** that are

(i) 5 cm from *C*,

(ii) equidistant from *BA* and *BC*.

(d) The point *P*, within the triangle, is such that *PC* = 5 cm and
P is equidistant from *BA* and *BC*.

Label the point *P* and measure the distance *PA*.

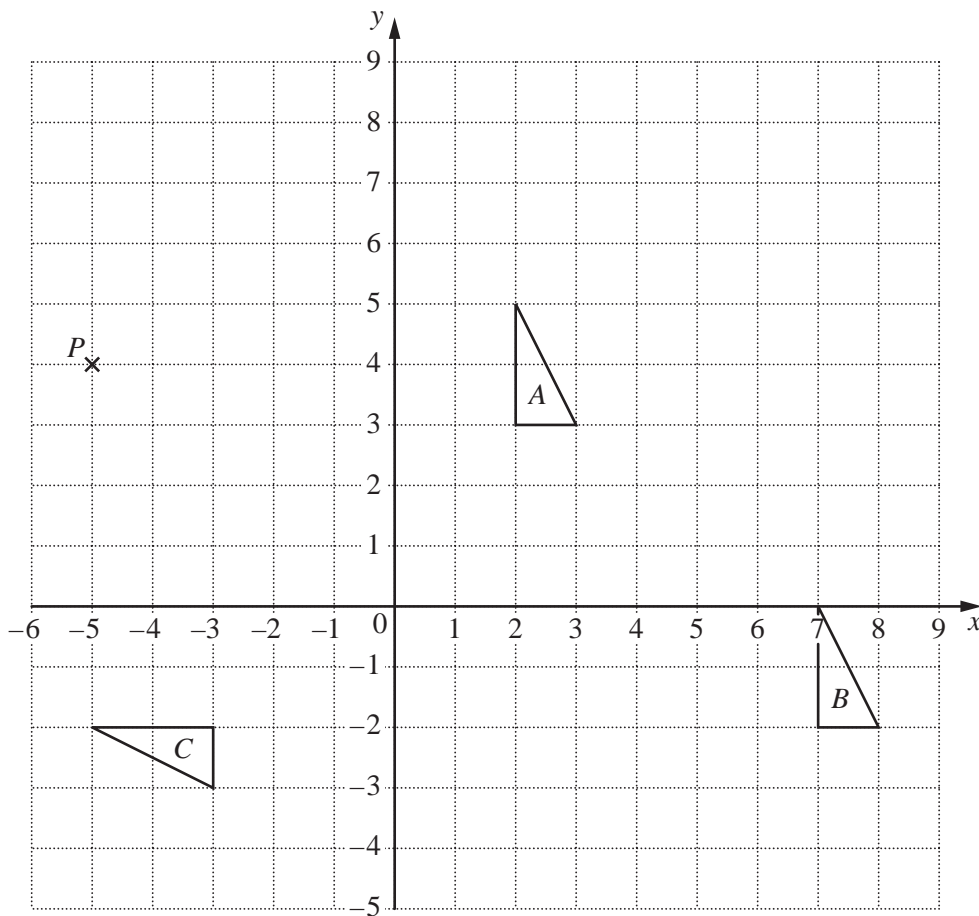*Answer (a)* and *(c)*

A _____ B

[3]

Answer (b)... [1]

(d) PA = ...cm [1]

25 The diagram below shows the point *P* and triangles *A*, *B*, and *C*.

[4]

(a) The translation T maps Δ*A* onto Δ*B*.
Given that T(*P*) = *Q*, write down the coordinates of *Q*.

(b) Describe fully the single transformation which maps Δ*A* onto Δ*C*.

(c) The matrix $\begin{pmatrix} 1 & 0 \\ -2 & 1 \end{pmatrix}$ represents the shear S.
Given that S(*A*) = *D*, draw and label Δ*D* on the diagram above.

(d) Δ*A* is mapped onto Δ*E* by a rotation of 90° clockwise about the point (4, 2).
Draw and label Δ*E* on the diagram above.

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

Answer (b) ....[2]