Cambridge IGCSE

Cambridge International Examinations
Cambridge International General Certificate of Secondary Education

CANDIDATE NAME									
CENTRE NUMBER						CANDIDATE NUMBER				

3415255704

MATHEMATICS **0580/41**

Paper 4 (Extended) **May/June 2014**

2 hours 30 minutes

Candidates answer on the Question Paper.

Additional Materials: Electronic calculator
Tracing paper (optional)
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.
You may use an HB pencil for any diagrams or graphs.
Do not use staples, paper clips, 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.

The syllabus is approved for use in England, Wales and Northern Ireland as a Cambridge International Level 1/Level 2 Certificate.

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

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1 $\mathbf{A} = \begin{pmatrix} 3 & 2 \\ -1 & 1 \end{pmatrix}$ $\mathbf{B} = \begin{pmatrix} -2 & 5 \end{pmatrix}$ $\mathbf{C} = \begin{pmatrix} -2 \\ 5 \end{pmatrix}$ $\mathbf{D} = \begin{pmatrix} 2 & 0 \\ 0 & 2 \end{pmatrix}$

(a) Work out, when possible, each of the following.
If it is not possible, write 'not possible' in the answer space.

(i) $2\mathbf{A}$

Answer(a)(i) [1]

(ii) $\mathbf{B} + \mathbf{C}$

Answer(a)(ii) [1]

(iii) $\mathbf{AD}$

Answer(a)(iii) [2]

(iv) $\mathbf{A}^{-1}$, the inverse of $\mathbf{A}$.

Answer(a)(iv) [2]

(b) Explain why it is not possible to work out $\mathbf{CD}$.

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

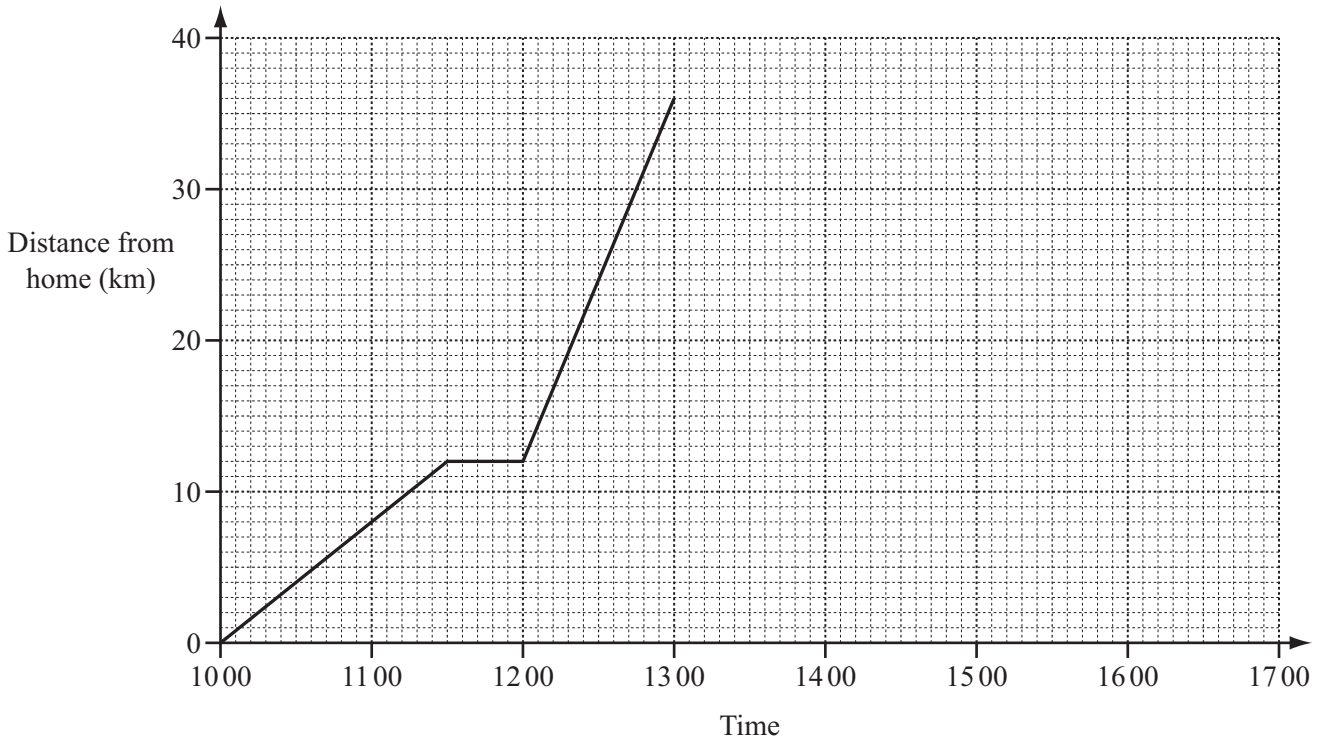
(c) Describe fully the **single** transformation represented by the matrix $\mathbf{D}$.

Answer(c) .....

..... [3]

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2 Ali leaves home at 10 00 to cycle to his grandmother's house. He arrives at 13 00.
The distance-time graph represents his journey.



(a) Calculate Ali's speed between 10 00 and 11 30.
Give your answer in kilometres per hour.

Answer(a) ..... km/h [2]

(b) Show that Ali's average speed for the whole journey to his grandmother's house is 12 km/h.

Answer(b)

[2]

(c) Change 12 kilometres per hour into metres per minute.

Answer(c) ..... m/min [2]

(d) Ali stays for 45 minutes at his grandmother's house and then returns home.
He arrives home at 16 42.

Complete the distance-time graph. [2]

3 **(a)** The running costs for a papermill are \$75 246.
This amount is divided in the ratio labour costs : materials = 5 : 1.

Calculate the labour costs.

Answer(a) \$ ..... [2]

(b) In 2012 the company made a profit of \$135 890.
In 2013 the profit was \$150 675.

Calculate the percentage increase in the profit from 2012 to 2013.

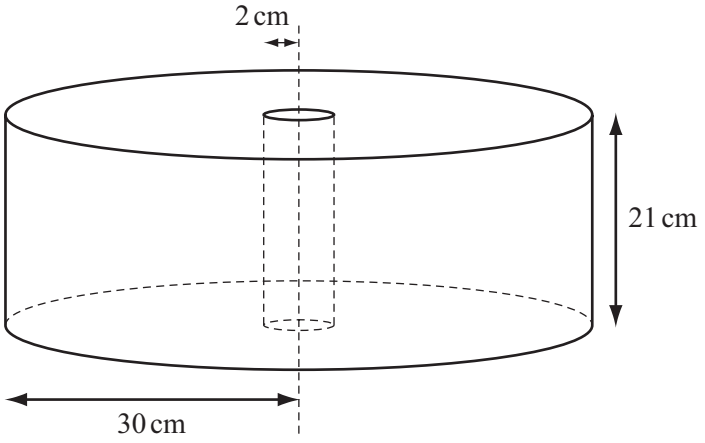
Answer(b) ..... % [3]

(c) The profit of \$135 890 in 2012 was an increase of 7% on the profit in 2011.

Calculate the profit in 2011.

Answer(c) \$ ..... [3]

(d)



Paper is sold in cylindrical rolls.
There is a wooden cylinder of radius 2 cm and height 21 cm in the centre of each roll.
The outer radius of a roll of paper is 30 cm.

(i) Calculate the volume of paper in a roll.

Answer(d)(i) ..... cm^3 [3]

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(ii) The paper is cut into sheets which measure 21 cm by 29.7 cm.
The thickness of each sheet is 0.125 mm.

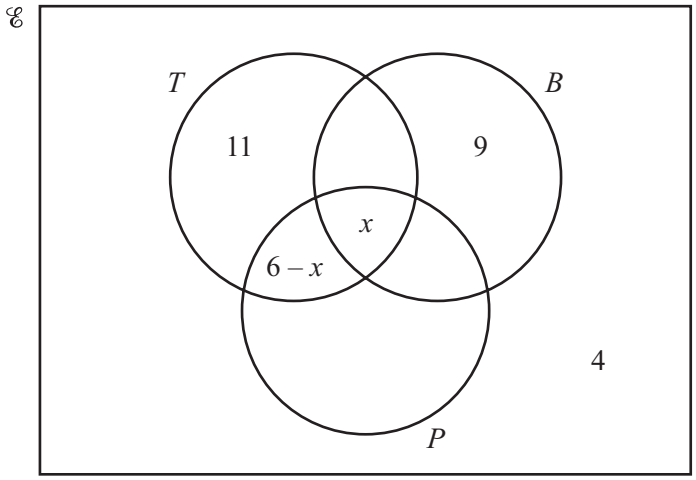
(a) Change 0.125 millimetres into centimetres.

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

(b) Work out how many whole sheets of paper can be cut from a roll.

Answer(d)(ii)(b) ..... [4]

4



In the Venn diagram, $\mathscr{E}$ = {children in a nursery}

B = {children who received a book for their birthday}
T = {children who received a toy for their birthday}
P = {children who received a puzzle for their birthday}

x children received a book and a toy and a puzzle.
6 children received a toy and a puzzle.

(a) 4 children received a book and a toy.
5 children received a book and a puzzle.
7 children received a puzzle but not a book and not a toy.

Complete the Venn diagram above. [3]

(b) There are 40 children in the nursery.

Using the Venn diagram, write down and solve an equation in x.

Answer(b)

[3]

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(c) Work out

(i) the probability that a child, chosen at random, received a book but not a toy and not a puzzle,

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

(ii) the number of children who received a book and a puzzle but not a toy,

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

(iii) n(B),

Answer(c)(iii) ..... [1]

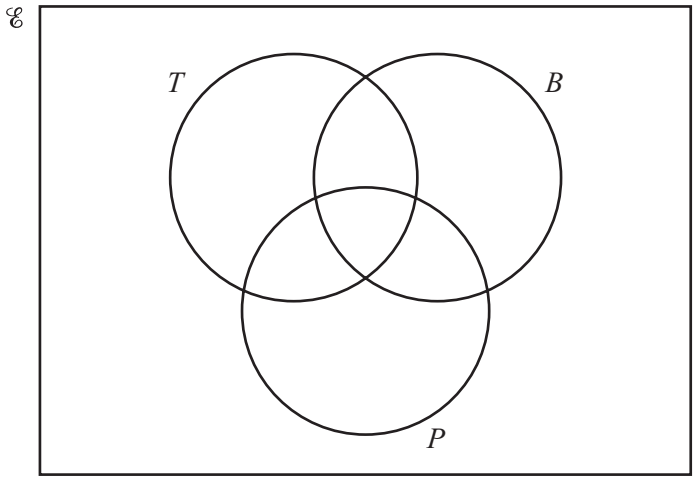
(iv) n($B \cup P$),

Answer(c)(iv) ..... [1]

(v) n($B \cup T \cup P$)'.

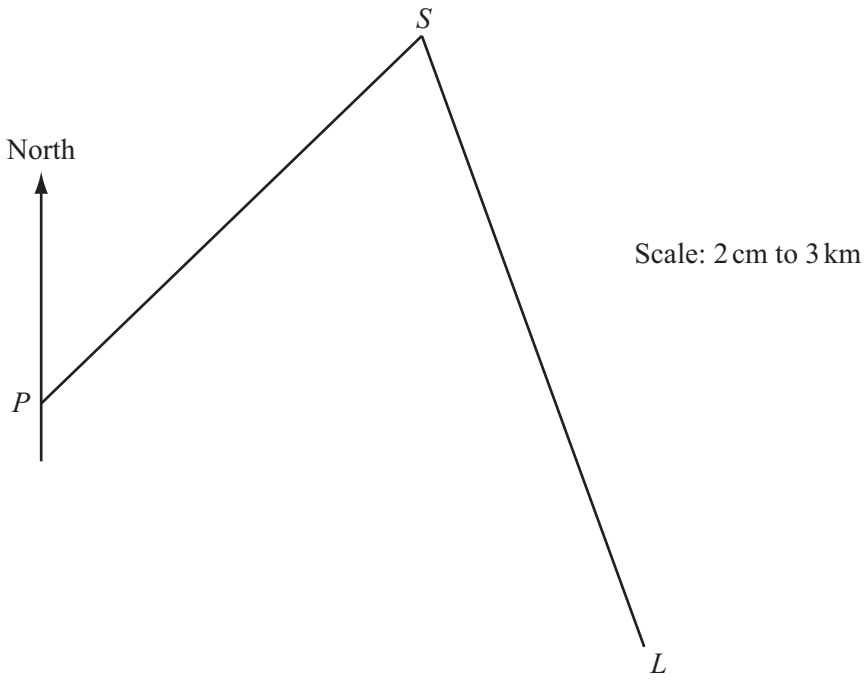
Answer(c)(v) ..... [1]

(d)



Shade the region $B \cap (T \cup P)'$. [1]

5



In the scale drawing, P is a port, L is a lighthouse and S is a ship.
The scale is 2 centimetres represents 3 kilometres.

(a) Measure the bearing of S from P.

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

(b) Find the actual distance of S from L.

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

(c) The bearing of L from S is 160°.

Calculate the bearing of S from L.

Answer(c) ..... [1]

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(d) Work out the scale of the map in the form $1 : n$.

Answer(d) 1 : ..... [2]

(e) A boat B is

- equidistant from S and L

and

- equidistant from the lines PS and SL.

On the diagram, **using a straight edge and compasses only**, construct the position of B. [5]

(f) The lighthouse stands on an island of area $1.5\,cm^2$ on the scale drawing.

Work out the actual area of the island.

Answer(f) ..... km^2 [2]

6 **(a)** A square spinner is biased.
The probabilities of obtaining the scores 1, 2, 3 and 4 when it is spun are given in the table.

Score	1	2	3	4
Probability	0.1	0.2	0.4	0.3

(i) Work out the probability that on one spin the score is 2 or 3.

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

(ii) In 5000 spins, how many times would you expect to score 4 with this spinner?

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

(iii) Work out the probability of scoring 1 on the first spin and 4 on the second spin.

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

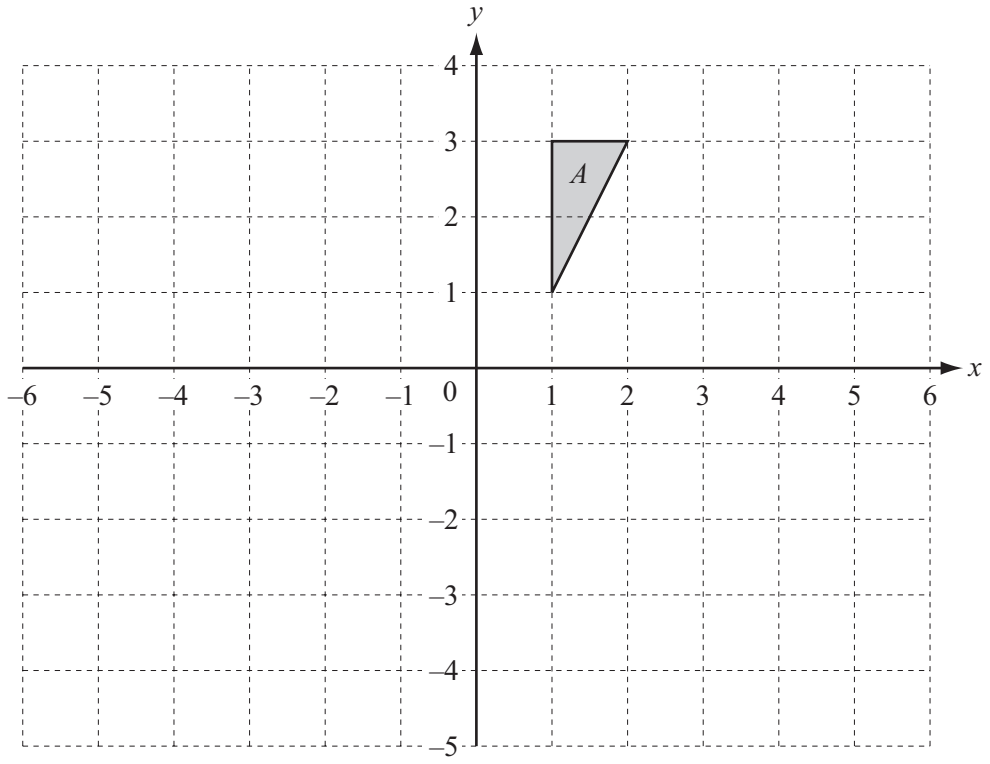
(b) In a bag there are 7 red discs and 5 blue discs.
From the bag a disc is chosen at random and not replaced.
A second disc is then chosen at random.

Work out the probability that at least one of the discs is red.
Give your answer as a fraction.

Answer(b) ..... [3]

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7



(a) On the grid,

(i) draw the image of shape A after a translation by the vector $\begin{pmatrix} -5 \\ -4 \end{pmatrix}$, [2]

(ii) draw the image of shape A after a rotation through 90° clockwise about the origin. [2]

(b) (i) On the grid, draw the image of shape A after the transformation represented by the matrix $\begin{pmatrix} 2 & 0 \\ 0 & 1 \end{pmatrix}$.

[3]

(ii) Describe fully the **single** transformation represented by the matrix $\begin{pmatrix} 2 & 0 \\ 0 & 1 \end{pmatrix}$.

Answer(b)(ii) .....

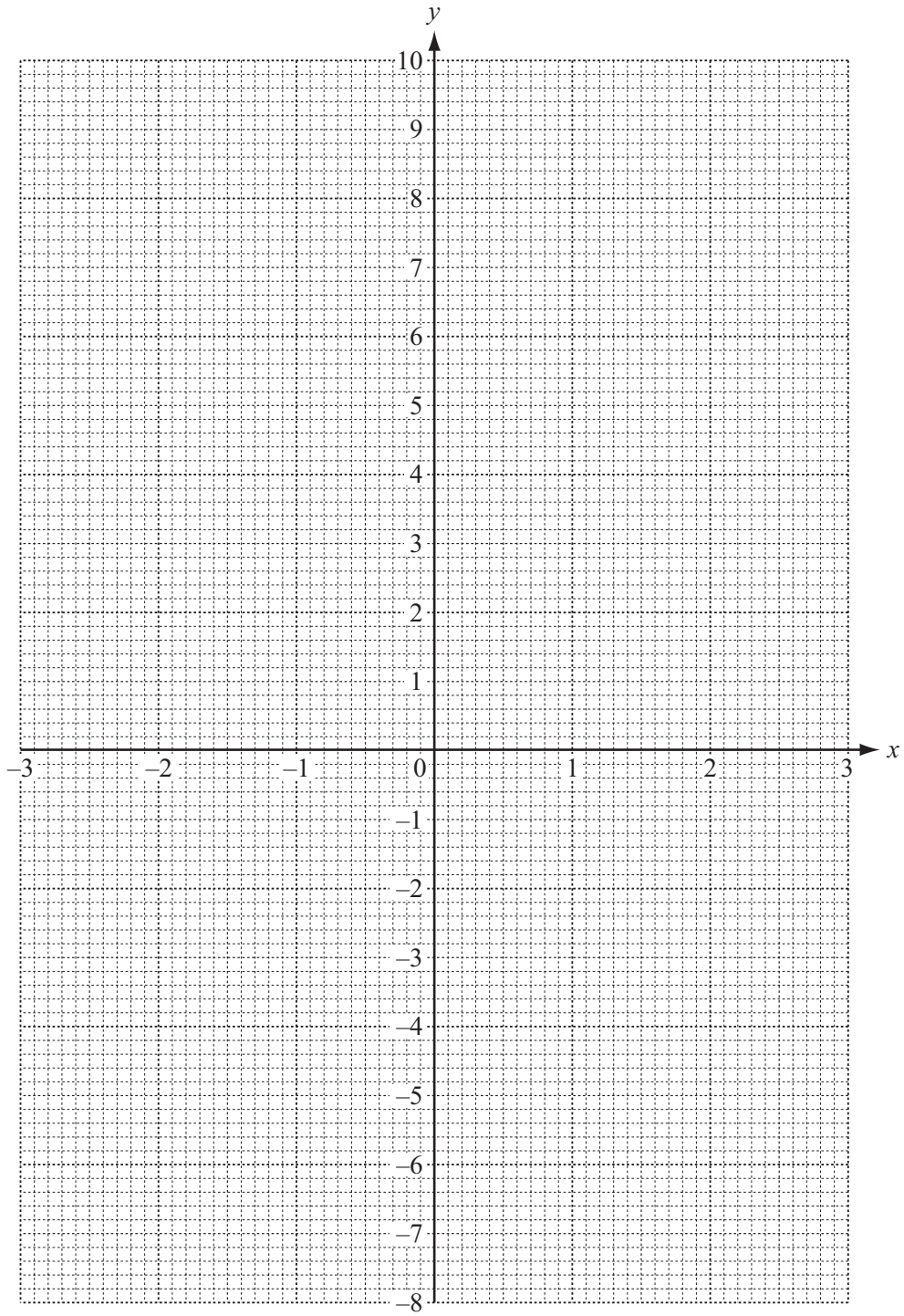
..... [3]

8 **(a)** Complete the table of values for $y = x^3 - 3x + 1$.

x	–2.5	–2	–1.5	–1	–0.5	0	0.5	1	1.5	2	2.5
y	–7.125	–1		3		1	–0.375	–1	–0.125	3	9.125

[2]

(b) Draw the graph of $y = x^3 - 3x + 1$ for $-2.5 \leqslant x \leqslant 2.5$.



[4]

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(c) By drawing a suitable tangent, estimate the gradient of the curve at the point where $x = 2$.

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

(d) Use your graph to solve the equation $x^3 - 3x + 1 = 1$.

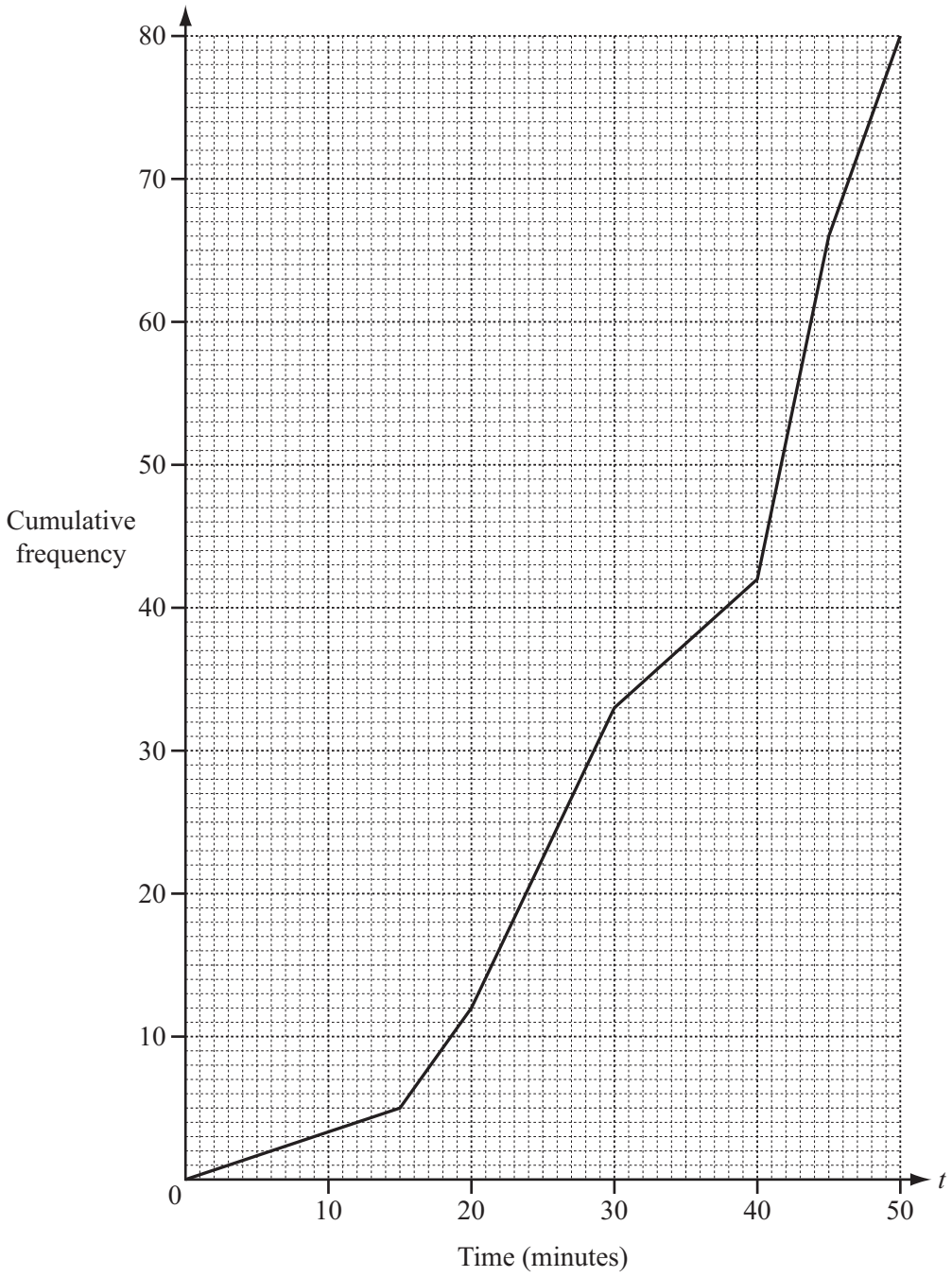
Answer(d) $x =$ ..... or $x =$ ..... or $x =$ ..... [2]

(e) Use your graph to complete the inequality in k for which the equation

$x^3 - 3x + 1 = k$ has three different solutions.

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

9



The times (t minutes) taken by 80 people to complete a charity swim were recorded.
The results are shown in the cumulative frequency diagram above.

(a) Find

(i) the median,

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

(ii) the inter-quartile range,

Answer(a)(ii) ..... min [2]

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(iii) the 70th percentile.

Answer(a)(iii) ..... min [2]

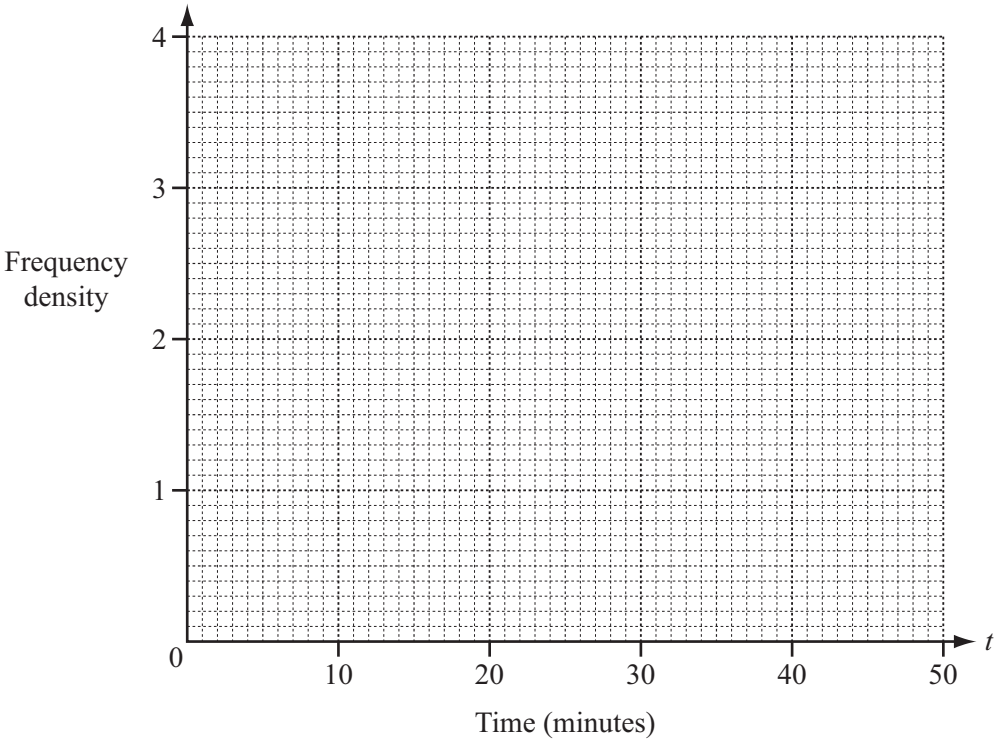
(b) The times taken by the 80 people are shown in this grouped frequency table.

Time (t minutes)	$0 < t \leqslant 20$	$20 < t \leqslant 30$	$30 < t \leqslant 45$	$45 < t \leqslant 50$
Frequency	12	21	33	14

(i) Calculate an estimate of the mean time.

Answer(b)(i) ..... min [4]

(ii) Draw a histogram to represent the grouped frequency table.



[4]

10 (a) $f(x) = 2x - 3$ $\quad g(x) = \dfrac{1}{x+1} + 2$ $\quad h(x) = 3^x$

(i) Work out f(4).

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

(ii) Work out fh(–1).

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

(iii) Find $f^{-1}(x)$, the inverse of $f(x)$.

Answer(a)(iii) $f^{-1}(x)$ = ... [2]

(iv) Find $ff(x)$ in its simplest form.

Answer(a)(iv) $ff(x)$ = ... [2]

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(v) Show that the equation $f(x) = g(x)$ simplifies to $2x^2 - 3x - 6 = 0$.

Answer(a)(v)

[3]

(vi) Solve the equation $2x^2 - 3x - 6 = 0$.

Give your answers correct to 2 decimal places.
Show all your working.

Answer(a)(vi) $x =$ ..... or $x =$ ..... [4]

(b) Simplify $\dfrac{x^2 - 3x + 2}{x^2 + 3x - 10}$.

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

11 **(a)** $\overrightarrow{PQ} = \begin{pmatrix} -3 \\ 4 \end{pmatrix}$

(i) P is the point (–2, 3).

Work out the co-ordinates of Q.

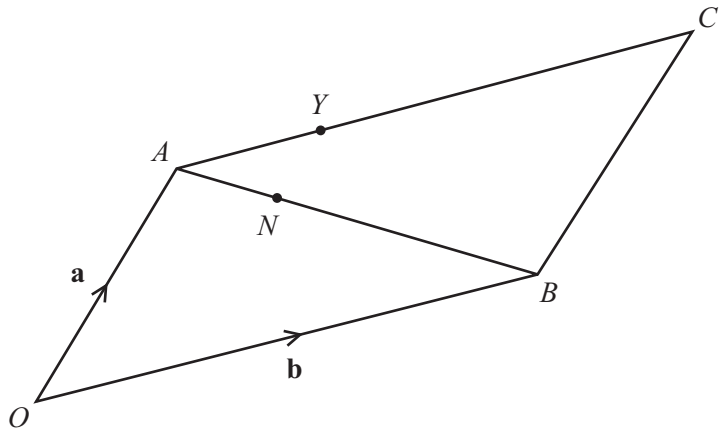
Answer(a)(i) (..... , ...) [1]

(ii) Work out $|\overrightarrow{PQ}|$, the magnitude of $\overrightarrow{PQ}$.

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

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(b)



NOT TO SCALE

$OACB$ is a parallelogram.
$\overrightarrow{OA} = \mathbf{a}$ and $\overrightarrow{OB} = \mathbf{b}$.
$AN : NB = 2 : 3$ and $AY = \frac{2}{5}AC$.

(i) Write each of the following in terms of **a** and/or **b**.
Give your answers in their simplest form.

(a) $\overrightarrow{ON}$

Answer(b)(i)(a) $\overrightarrow{ON}$ = ... [2]

(b) $\overrightarrow{NY}$

Answer(b)(i)(b) $\overrightarrow{NY}$ = ... [2]

(ii) Write down two conclusions you can make about the line segments NY and BC.

Answer(b)(ii) .....

..... [2]

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