UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
International General Certificate of Secondary Education

CANDIDATE NAME									
CENTRE NUMBER						CANDIDATE NUMBER			

8044943715

MATHEMATICS **0580/43**

Paper 4 (Extended) **May/June 2011**

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.

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1 Lucy works in a clothes shop.

(a) In one week she earned \$277.20.

(i) She spent $\frac{1}{8}$ of this on food.
Calculate how much she spent on food.

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

(ii) She paid 15% of the \$277.20 in taxes.
Calculate how much she paid in taxes.

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

(iii) The \$277.20 was 5% more than Lucy earned in the previous week.
Calculate how much Lucy earned in the previous week.

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

(b) The shop sells clothes for men, women and children.

(i) In one day Lucy sold clothes with a total value of \$2200 in the ratio

men : women : children = 2 : 5 : 4.

Calculate the value of the women's clothes she sold.

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

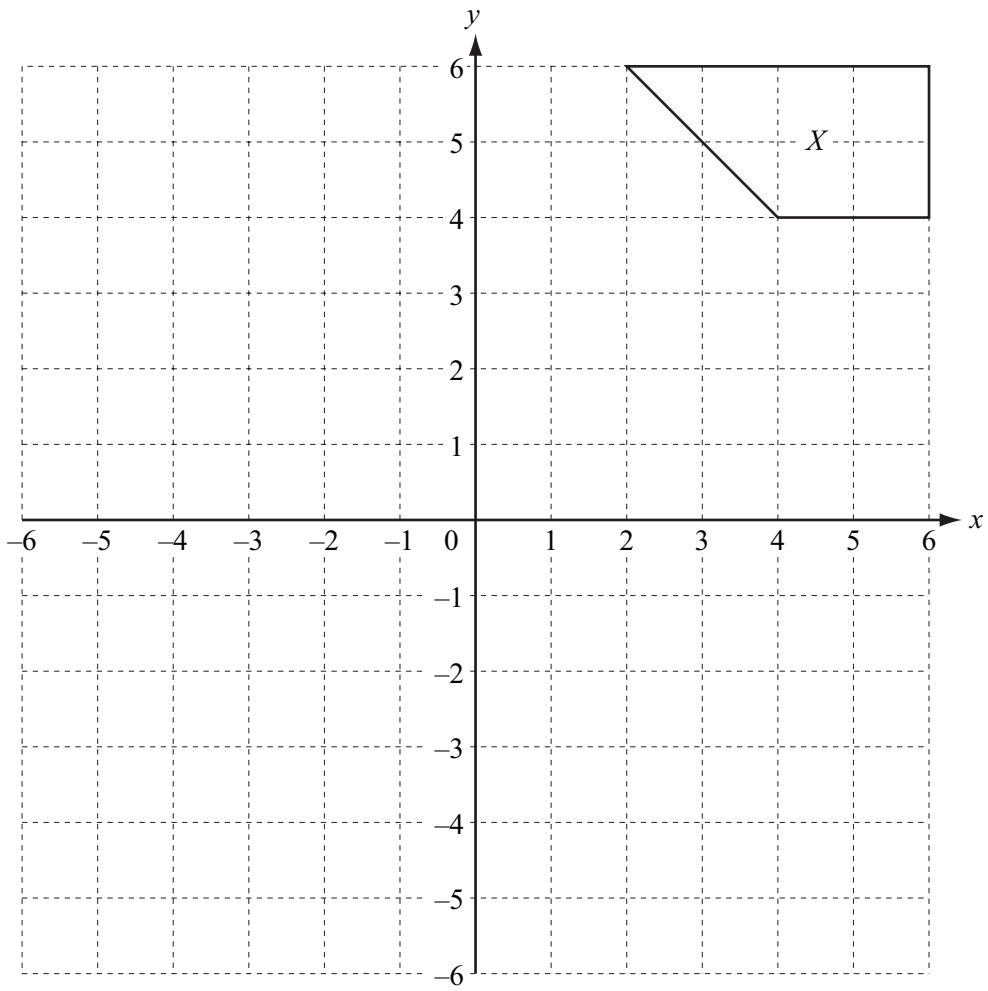
(ii) The \$2200 was $\frac{44}{73}$ of the total value of the clothes sold in the shop on this day.
Calculate the total value of the clothes sold in the shop on this day.

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

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2

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(a) (i) Draw the reflection of shape *X* in the *x*-axis. Label the image *Y*. [2]

(ii) Draw the rotation of **shape *Y***, 90° clockwise about (0, 0). Label the image *Z*. [2]

(iii) Describe fully the **single** transformation that maps shape *Z* onto shape *X*.

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

(b) (i) Draw the enlargement of shape *X*, centre (0, 0), scale factor $\frac{1}{2}$. [2]

(ii) Find the matrix which represents an enlargement, centre (0, 0), scale factor $\frac{1}{2}$.

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

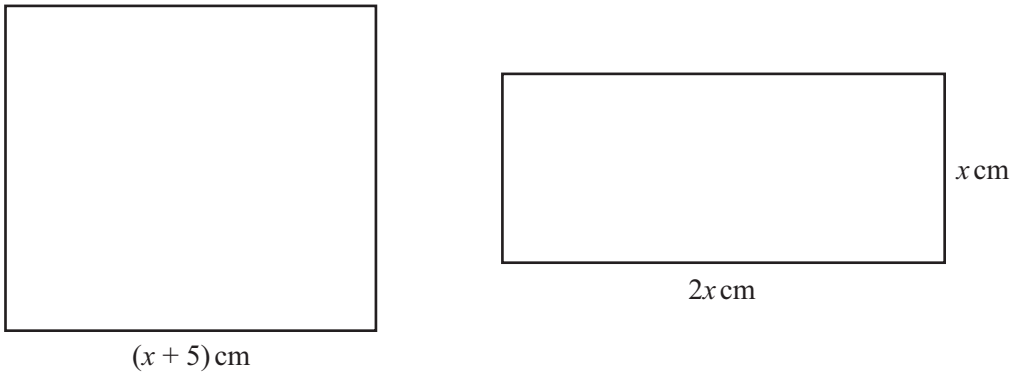
(c) (i) Draw the shear of **shape *X*** with the *x*-axis invariant and shear factor –1. [2]

(ii) Find the matrix which represents a shear with the *x*-axis invariant and shear factor –1.

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

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3



The diagram shows a square of side $(x + 5)$ cm and a rectangle which measures $2x$ cm by x cm.

The area of the square is 1 cm^2 more than the area of the rectangle.

(a) Show that $x^2 - 10x - 24 = 0$.

Answer(a)

[3]

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(b) Find the value of x.

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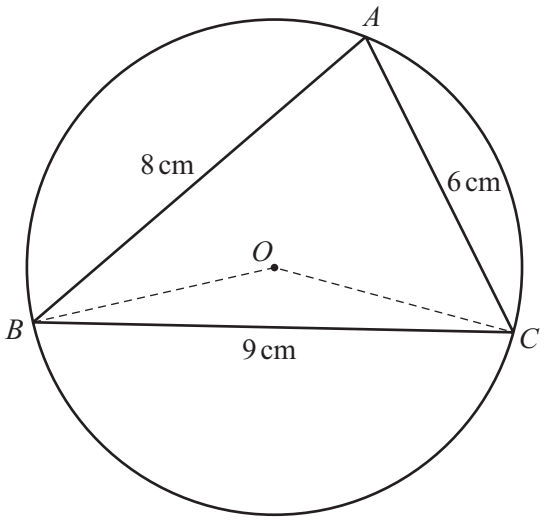
Answer(b) $x =$ ..... [3]

(c) Calculate the acute angle between the diagonals of the rectangle.

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

4

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NOT TO SCALE

The circle, centre O, passes through the points A, B and C.

In the triangle ABC, $AB = 8$ cm, $BC = 9$ cm and $CA = 6$ cm.

(a) Calculate angle BAC and show that it rounds to 78.6°, correct to 1 decimal place.

Answer(a)

[4]

(b) M is the midpoint of BC.

(i) Find angle BOM.

Answer(b)(i) Angle BOM = ... [1]

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(ii) Calculate the radius of the circle and show that it rounds to 4.59 cm, correct to 3 significant figures.

Answer(b)(ii)

[3]

(c) Calculate the area of the triangle *ABC* as a percentage of the area of the circle.

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

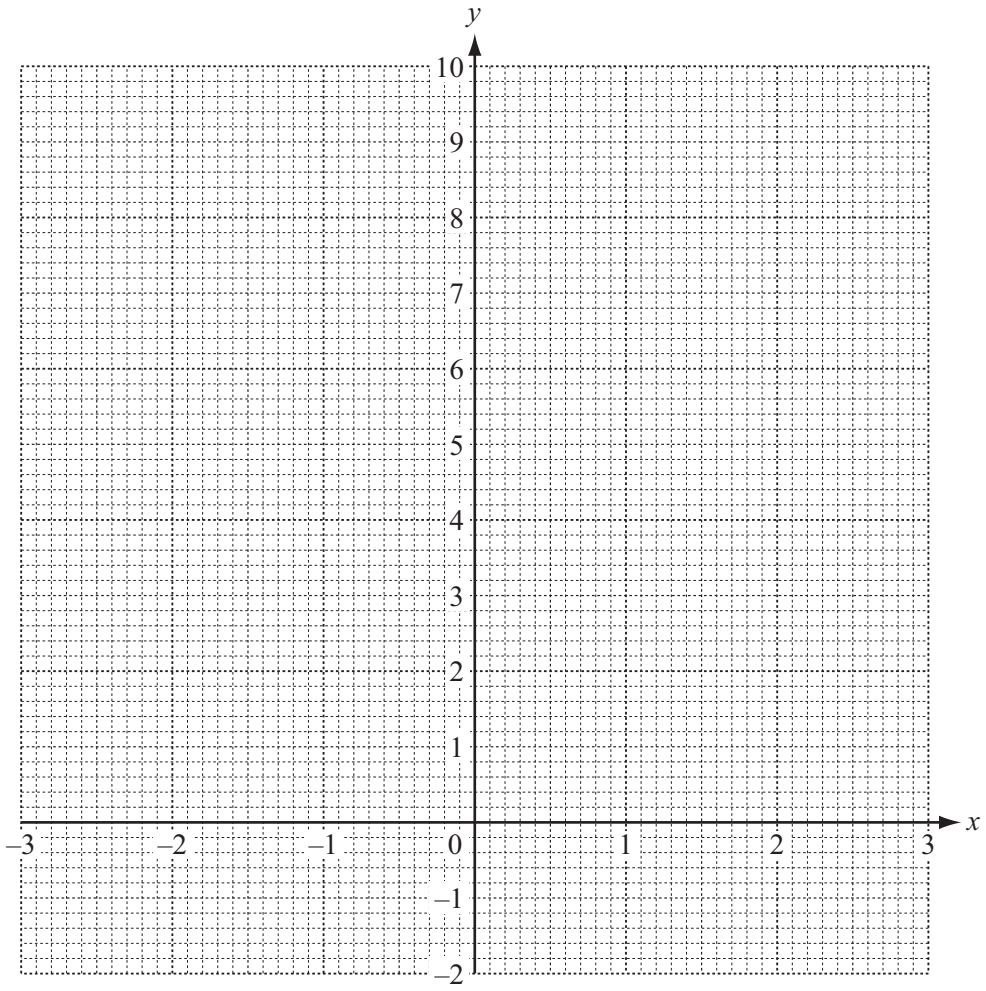
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5 **(a)** Complete the table of values for the function f(x), where $f(x) = x^2 + \frac{1}{x^2}$, $x \neq 0$.

x	-3	-2.5	-2	-1.5	-1	-0.5		0.5	1	1.5	2	2.5	3
f(x)		6.41		2.69		4.25		4.25		2.69		6.41	

[3]

(b) On the grid, draw the graph of $y = f(x)$ for $-3 \leqslant x \leqslant -0.5$ and $0.5 \leqslant x \leqslant 3$.



[5]

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(c) (i) Write down the equation of the line of symmetry of the graph.

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

(ii) Draw the tangent to the graph of $y = f(x)$ where $x = -1.5$.
Use the tangent to estimate the gradient of the graph of $y = f(x)$ where $x = -1.5$.

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

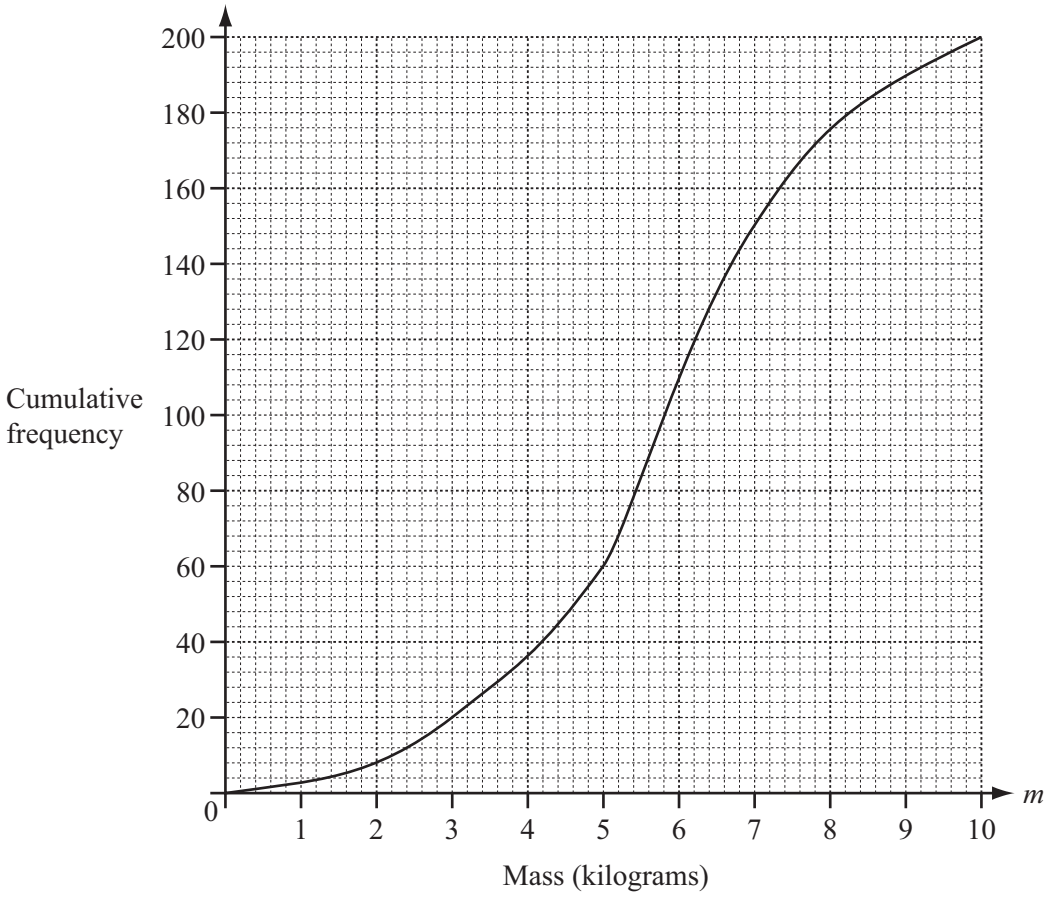
(iii) Use your graph to solve the equation $x^2 + \frac{1}{x^2} = 3$.

Answer(c)(iii) $x =$ ..... or $x =$ ..... or $x =$ ..... or $x =$ ..... [2]

(iv) Draw a suitable line on the grid and use your graphs to solve the equation $x^2 + \frac{1}{x^2} = 2x$.

Answer(c)(iv) $x =$ ..... or $x =$ ..... [3]

6



The masses of 200 parcels are recorded.

The results are shown in the cumulative frequency diagram above.

(a) Find

(i) the median,

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

(ii) the lower quartile,

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

(iii) the inter-quartile range,

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

(iv) the number of parcels with a mass greater than 3.5 kg.

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

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(b) (i) Use the information from the cumulative frequency diagram to complete the grouped frequency table.

Mass (m) kg	$0 < m \leqslant 4$	$4 < m \leqslant 6$	$6 < m \leqslant 7$	$7 < m \leqslant 10$
Frequency	36			50

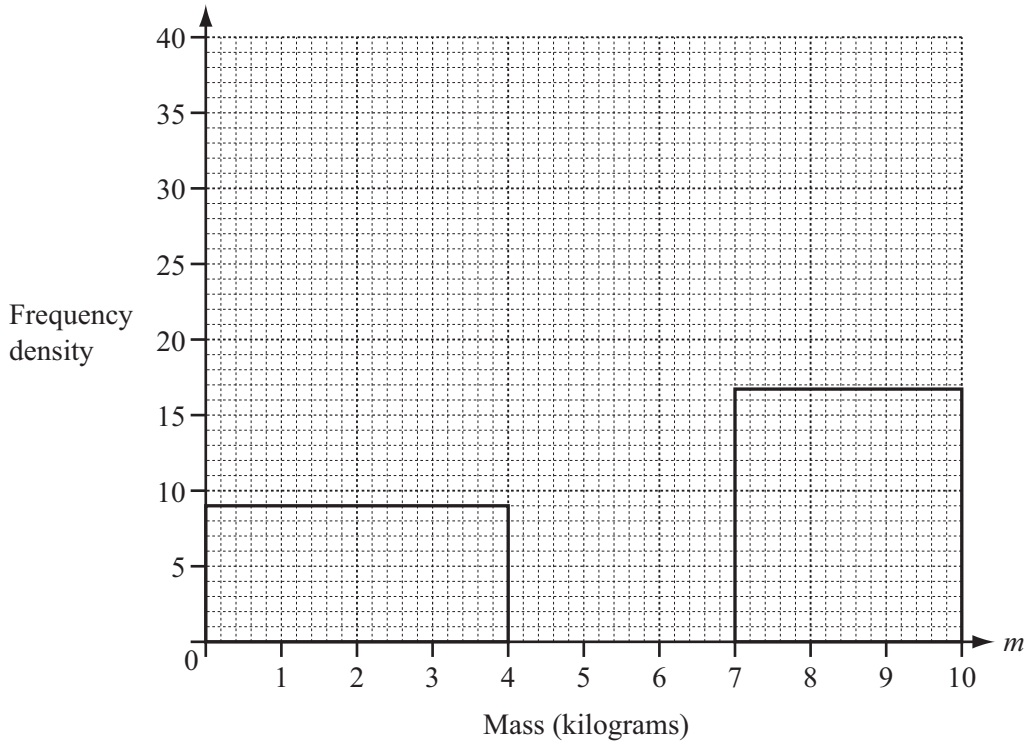
[2]

(ii) Use the grouped frequency table to calculate an estimate of the mean.

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

(iii) Complete the frequency density table and use it to complete the histogram.

Mass (m) kg	$0 < m \leqslant 4$	$4 < m \leqslant 6$	$6 < m \leqslant 7$	$7 < m \leqslant 10$
Frequency density	9			16.7



[4]

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7 Katrina puts some plants in her garden.

The probability that a plant will produce a flower is $\frac{7}{10}$.

If there is a flower, it can only be red, yellow or orange.

When there is a flower, the probability it is red is $\frac{2}{3}$ and the probability it is yellow is $\frac{1}{4}$.

(a) Draw a tree diagram to show **all** this information.

Label the diagram and write the probabilities on each branch.

Answer(a)

[5]

(b) A plant is chosen at random.

Find the probability that it will **not** produce a yellow flower.

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

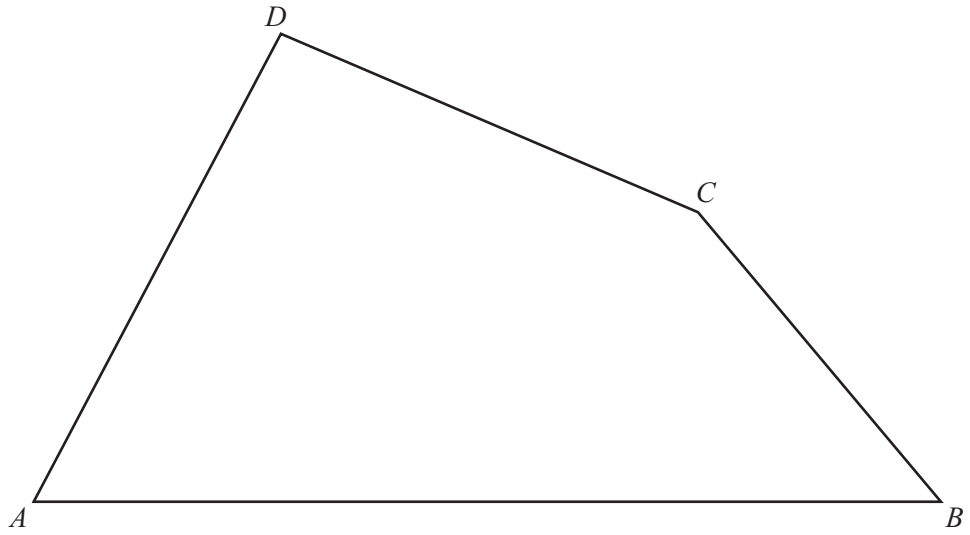
(c) If Katrina puts 120 plants in her garden, how many orange flowers would she expect?

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

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(a) Draw accurately the locus of points, inside the quadrilateral $ABCD$, which are 6 cm from the point D. [1]

(b) **Using a straight edge and compasses only,** construct

(i) the perpendicular bisector of AB, [2]

(ii) the locus of points, inside the quadrilateral, which are equidistant from AB and from BC. [2]

(c) The point Q is equidistant from A and from B **and** equidistant from AB and from BC.

(i) Label the point Q on the diagram. [1]

(ii) Measure the distance of Q from the line AB.

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

(d) On the diagram, shade the region inside the quadrilateral which is

- less than 6 cm from D
  and
- nearer to A than to B
  and
- nearer to AB than to BC. [1]

9 $f(x) = 3x + 1$ $g(x) = (x + 2)^2$

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(a) Find the values of

(i) gf(2),

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

(ii) ff(0.5).

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

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

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

(c) Find $fg(x)$.

Give your answer in its simplest form.

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

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(d) Solve the equation $x^2 + f(x) = 0$.

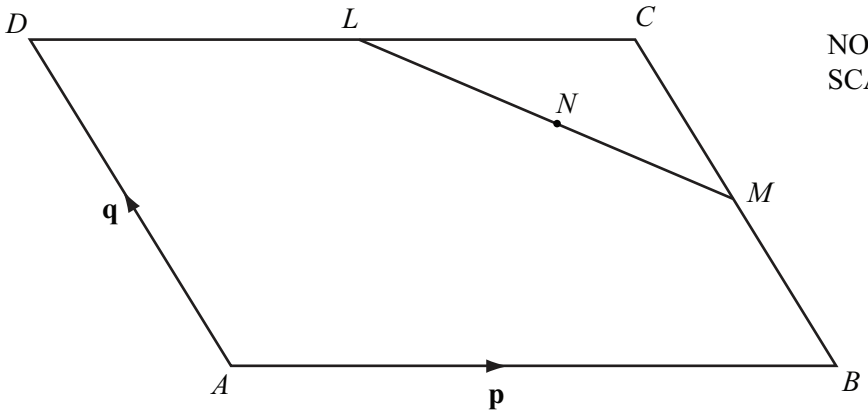
Show all your working and give your answers correct to 2 decimal places.

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Answer(d) $x =$ ..... or $x =$ ..... [4]

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10 (a)



ABCD is a parallelogram.
L is the midpoint of *DC*, *M* is the midpoint of *BC* and *N* is the midpoint of *LM*.
$\overrightarrow{AB}$ = **p** and $\overrightarrow{AD}$ = **q**.

(i) Find the following in terms of **p** and **q**, in their simplest form.

(a) $\overrightarrow{AC}$

Answer(a)(i)(a) $\overrightarrow{AC}$ = ... [1]

(b) $\overrightarrow{LM}$

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

(c) $\overrightarrow{AN}$

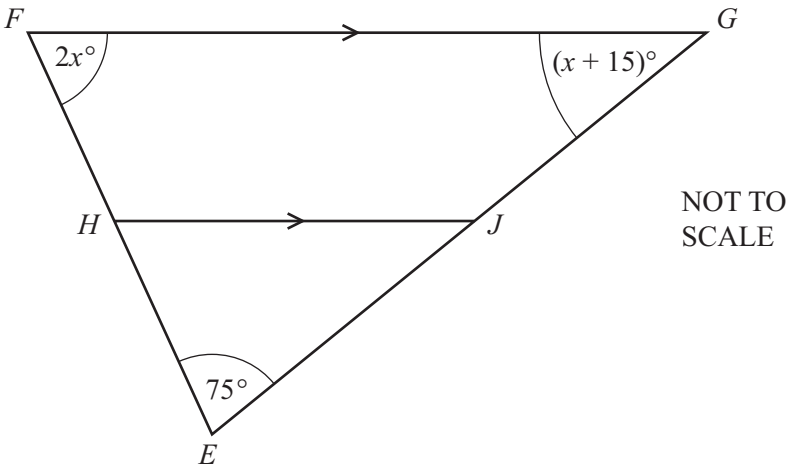
Answer(a)(i)(c) $\overrightarrow{AN}$= ..... [2]

(ii) Explain why your answer for $\overrightarrow{AN}$ shows that the point *N* lies on the line *AC*.

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

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(b)



EFG is a triangle.
HJ is parallel to *FG*.
Angle *FEG* = 75°.
Angle *EFG* = 2*x*° and angle *FGE* = (*x* + 15)°.

(i) Find the value of *x*.

Answer(b)(i) *x* = ... [2]

(ii) Find angle *HJG*.

Answer(b)(ii) Angle *HJG* = ... [1]

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11 (a) (i) The first three positive integers 1, 2 and 3 have a sum of 6.

Write down the sum of the first 4 positive integers.

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

(ii) The formula for the sum of the first n integers is $\frac{n(n+1)}{2}$.

Show the formula is correct when $n = 3$.

Answer(a)(ii)

[1]

(iii) Find the sum of the first 120 positive integers.

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

(iv) Find the sum of the integers

121 + 122 + 123 + 124 + …… + 199 + 200.

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

(v) Find the sum of the even numbers

2 + 4 + 6 + …… + 800.

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

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(b) (i) Complete the following statements about the sums of cubes and the sums of integers.

$1^3 = 1$	$1 = 1$
$1^3 + 2^3 = 9$	$1 + 2 = 3$
$1^3 + 2^3 + 3^3 =$	$1 + 2 + 3 =$ .....
$1^3 + 2^3 + 3^3 + 4^3 =$	$1 + 2 + 3 + 4 =$ .....

[2]

(ii) The sum of the first 14 integers is 105.

Find the sum of the first 14 cubes.

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

(iii) Use the formula in **part(a)(ii)** to write down a formula for the sum of the first n cubes.

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

(iv) Find the sum of the first 60 cubes.

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

(v) Find n when the sum of the first n cubes is 278 784.

Answer(b)(v) $n =$ ..... [2]

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