Cambridge International Examinations
Cambridge International General Certificate of Secondary Education

CANDIDATE NAME	
CENTRE NUMBER	
CANDIDATE NUMBER	

9468931136

MATHEMATICS **0580/43**

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

2 hours 30 minutes

Candidates answer on the Question Paper.

Additional Materials: Electronic calculator, 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 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 **16** printed pages.

IB14 06_0580_43/2RP

1 In July, a supermarket sold 45 981 bottles of fruit juice.

(a) The cost of a bottle of fruit juice was \$1.35 .

Calculate the amount received from the sale of the 45 981 bottles.
Give your answer correct to the nearest hundred dollars.

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

(b) The number of bottles sold in July was 17% more than the number sold in January.

Calculate the number of bottles sold in January.

Answer(b) .... [3]

(c) There were 3 different flavours of fruit juice.
The number of bottles sold in each flavour was in the ratio apple : orange : cherry = 3 : 4 : 2.
The total number of bottles sold was 45 981.

Calculate the number of bottles of orange juice sold.

Answer(c) .... [2]

(d) One bottle contains 1.5 litres of fruit juice.

Calculate the number of 330 ml glasses that can be filled completely from one bottle.

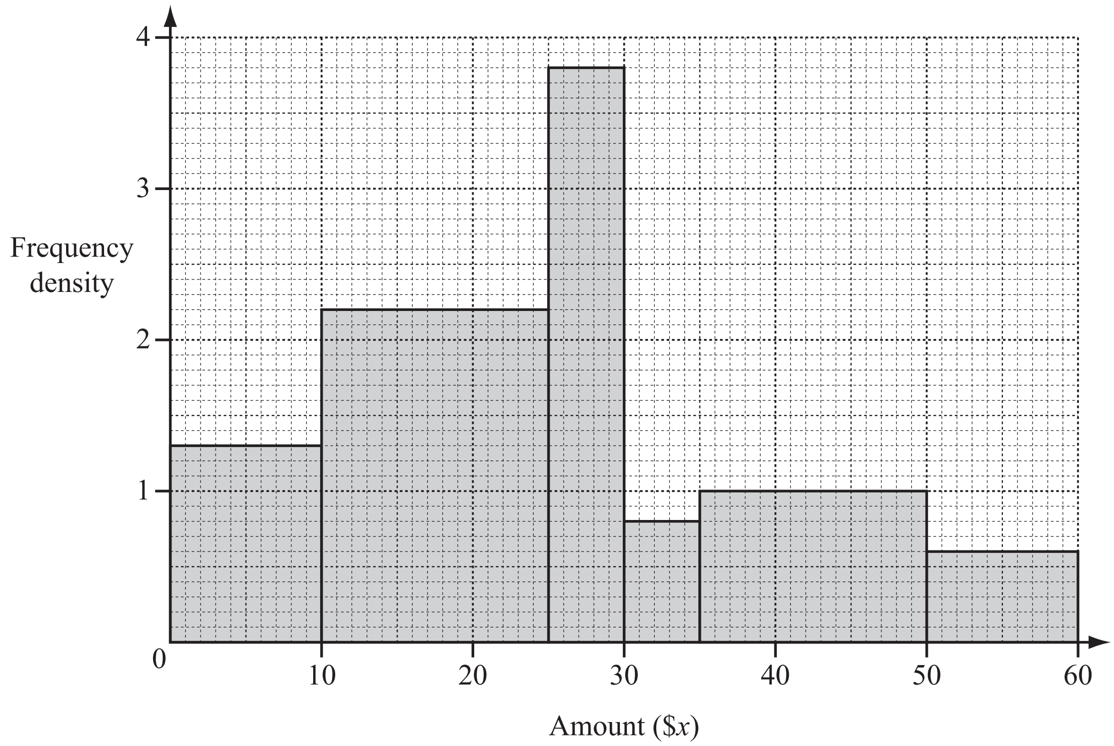
Answer(d) .... [3]

(e) $\frac{5}{9}$ of the 45 981 bottles are recycled.

Calculate the number of bottles that are recycled.

Answer(e) .... [2]

2



A survey asked 90 people how much money they gave to charity in one month.
The histogram shows the results of the survey.

(a) Complete the frequency table for the six columns in the histogram.

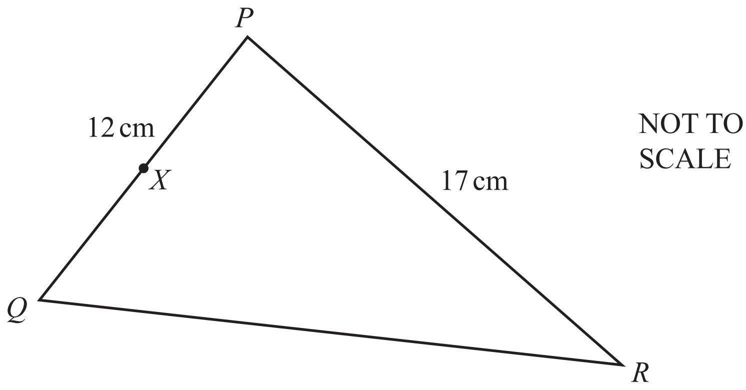
Amount ($x)	$0 < x \leqslant 10$					
Frequency				4		

[5]

(b) Use your frequency table to calculate an estimate of the mean amount these 90 people gave to charity.

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

3 **(a)**



The diagram shows triangle PQR with $PQ = 12$ cm and $PR = 17$ cm.
The area of triangle PQR is 97 cm^2 and angle QPR is acute.

(i) Calculate angle QPR.

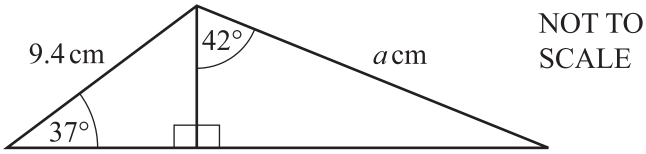
Answer(a)(i) Angle QPR = ... [3]

(ii) The midpoint of PQ is X.

Use the cosine rule to calculate the length of XR.

Answer(a)(ii) XR = ... cm [4]

(b)



Calculate the value of a.

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

(c) $\sin x = \cos 40°, \quad 0° \leqslant x \leqslant 180°$

Find the two values of x.

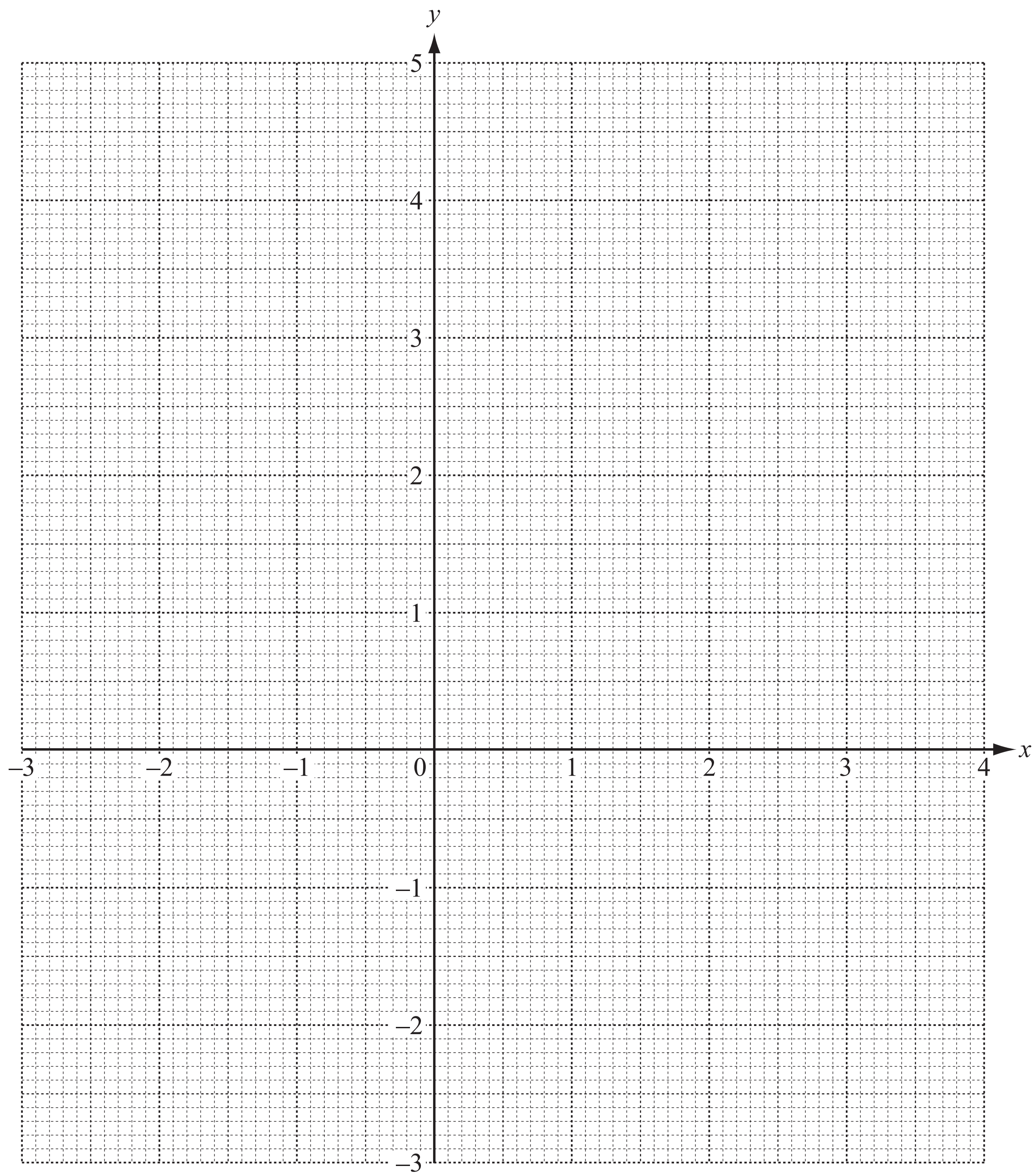
Answer(c) x = ... or x = ... [2]

4 The table shows some values for the function $y = \frac{1}{x^2} + x$, $x \neq 0$.

x	–3	–2	–1	–0.5		0.5	1	2	3	4
y	–2.89	–1.75		3.5			2	2.25		4.06

(a) Complete the table of values. [3]

(b) On the grid, draw the graph of $y = \frac{1}{x^2} + x$ for $-3 \leqslant x \leqslant -0.5$ and $0.5 \leqslant x \leqslant 4$.



[5]

(c) Use your graph to solve the equation $\frac{1}{x^2} + x - 3 = 0$.

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

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

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

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

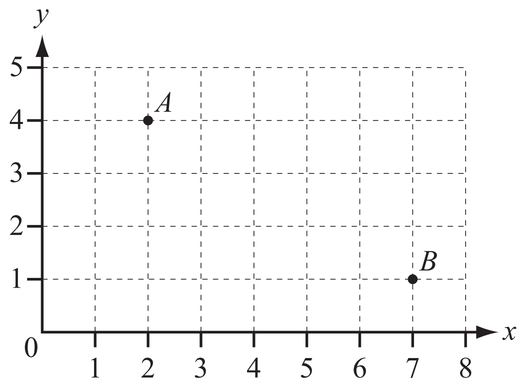
Answer(e) .... [3]

(f) Using algebra, show that you can use the graph at $y = 0$ to find $\sqrt[3]{-1}$.

Answer(f)

[3]

5 **(a)**



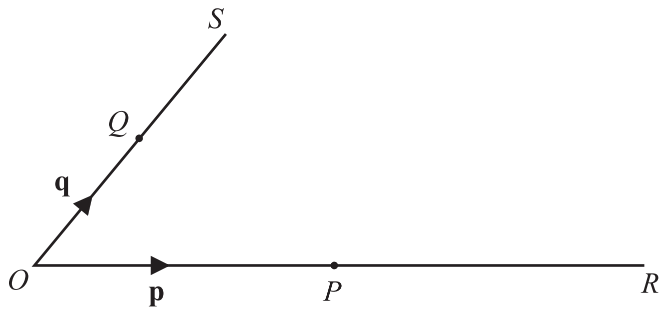
(i) Write down the position vector of *A*.

Answer(a)(i) $\begin{pmatrix} \quad \\ \quad \end{pmatrix}$ [1]

(ii) Find $|\overrightarrow{AB}|$, the magnitude of $\overrightarrow{AB}$.

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

(b)



NOT TO SCALE

O is the origin, $\overrightarrow{OP} = \mathbf{p}$ and $\overrightarrow{OQ} = \mathbf{q}$.
OP is extended to *R* so that *OP* = *PR*.
OQ is extended to *S* so that *OQ* = *QS*.

(i) Write down $\overrightarrow{RQ}$ in terms of **p** and **q**.

Answer(b)(i) $\overrightarrow{RQ}$ = ... [1]

(ii) *PS* and *RQ* intersect at *M* and *RM* = 2*MQ*.

Use vectors to find the ratio *PM* : *PS*, showing all your working.

Answer(b)(ii) *PM* : *PS* = ... : .... [4]

6 In this question, give all your answers as fractions.

N	A	T	I	O	N

The letters of the word **NATION** are printed on 6 cards.

(a) A card is chosen at random.

Write down the probability that

(i) it has the letter **T** printed on it,

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

(ii) it does not have the letter **N** printed on it,

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

(iii) the letter printed on it has no lines of symmetry.

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

(b) Lara chooses a card at random, replaces it, then chooses a card again.

Calculate the probability that only **one** of the cards she chooses has the letter **N** printed on it.

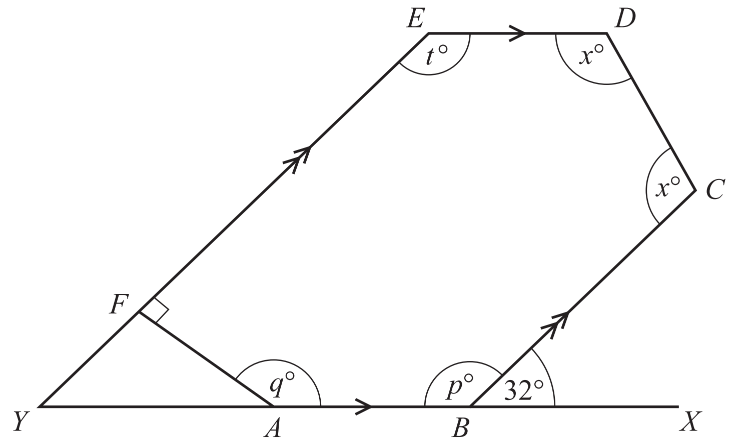
Answer(b) .... [3]

(c) Jacob chooses a card at random and does not replace it.
He continues until he chooses a card with the letter **N** printed on it.

Find the probability that this happens when he chooses the 4th card.

Answer(c) .... [3]

7 (a)



NOT TO SCALE

ABCDEF is a hexagon.
AB is parallel to *ED* and *BC* is parallel to *FE*.
YFE and *YABX* are straight lines.
Angle *CBX* = 32° and angle *EFA* = 90°.

Calculate the value of

(i) *p*,

Answer(a)(i) *p* = ... [1]

(ii) *q*,

Answer(a)(ii) *q* = ... [2]

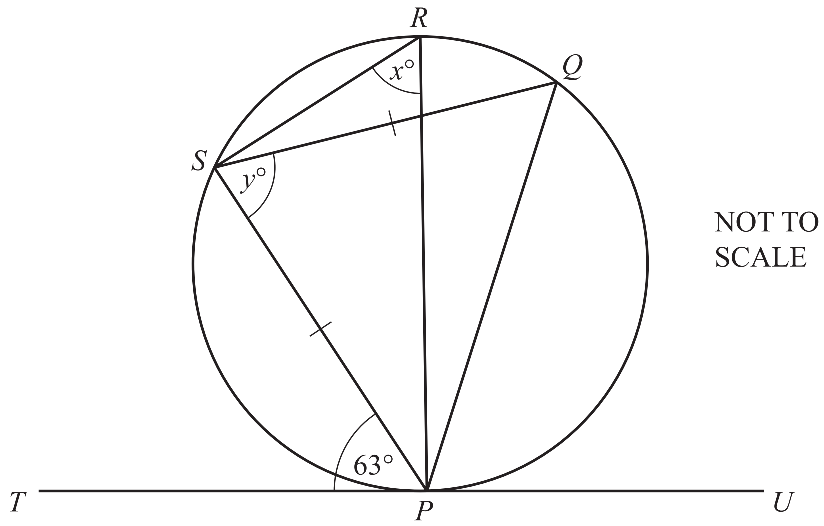
(iii) *t*,

Answer(a)(iii) *t* = ... [1]

(iv) *x*.

Answer(a)(iv) *x* = ... [3]

(b)



P, *Q*, *R* and *S* are points on a circle and *PS* = *SQ*.
PR is a diameter and *TPU* is the tangent to the circle at *P*.
Angle *SPT* = 63°.

Find the value of

(i) *x*,

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

(ii) *y*.

Answer(b)(ii) *y* = ... [2]

8 **(a)** **(i)** Show that the equation $\frac{7}{x+4} + \frac{2x-3}{2} = 1$ can be simplified to $2x^2 + 3x - 6 = 0$.

Answer(a)(i)

[3]

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

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

Answer(a)(ii) x = ... or x = ... [4]

(b) The **total** surface area of a cone with radius x and slant height $3x$ is equal to the area of a circle with radius r.

Show that $r = 2x$.
[The curved surface area, A, of a cone with radius r and slant height l is $A = \pi rl$.]

Answer(b)

[4]

9 $f(x) = 4 - 3x$ $g(x) = 3^{-x}$

(a) Find $f(2x)$ in terms of x.

Answer(a) $f(2x) =$ .... [1]

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

Answer(b) $ff(x) =$ .... [2]

(c) Work out $gg(-1)$.
Give your answer as a fraction.

Answer(c) .... [3]

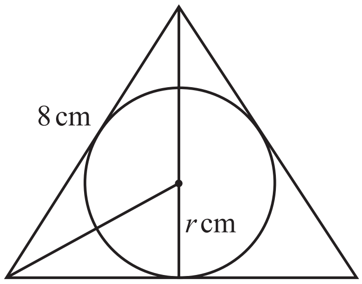
(d) Find $f^{-1}(x)$, the inverse of $f(x)$.

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

(e) Solve the equation $gf(x) = 1$.

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

10 **(a)**



NOT TO SCALE

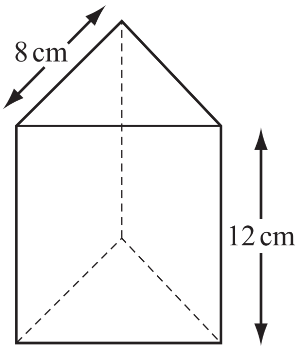
The three sides of an equilateral triangle are tangents to a circle of radius *r* cm.
The sides of the triangle are 8 cm long.

Calculate the value of *r*.
Show that it rounds to 2.3, correct to 1 decimal place.

Answer(a)

[3]

(b)



NOT TO SCALE

The diagram shows a box in the shape of a triangular prism of height 12 cm.
The cross section is an equilateral triangle of side 8 cm.

Calculate the volume of the box.

Answer(b) .... cm^3 [4]

(c) The box contains biscuits.
Each biscuit is a cylinder of radius 2.3 centimetres and height 4 millimetres.

Calculate

(i) the largest number of biscuits that can be placed in the box,

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

(ii) the volume of one biscuit in cubic centimetres,

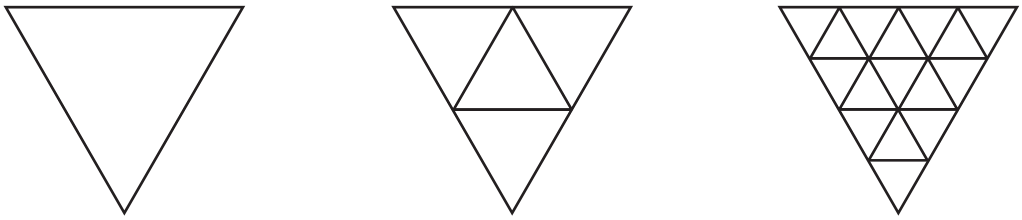
Answer(c)(ii) .... cm^3 [2]

(iii) the percentage of the volume of the box **not** filled with biscuits.

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

Question 11 is printed on the next page.

11



The first three diagrams in a sequence are shown above.
Diagram 1 shows an equilateral triangle with sides of length 1 unit.

In Diagram 2, there are 4 triangles with sides of length $\frac{1}{2}$ unit.

In Diagram 3, there are 16 triangles with sides of length $\frac{1}{4}$ unit.

(a) Complete this table for Diagrams 4, 5, 6 and *n*.

	Diagram 1	Diagram 2	Diagram 3	Diagram 4	Diagram 5	Diagram 6		Diagram *n*
Length of side	1	$\frac{1}{2}$	$\frac{1}{4}$					
Length of side as a power of 2	2^0	2^{-1}	2^{-2}					

[6]

(b) **(i)** Complete this table for the number of the smallest triangles in Diagrams 4, 5 and 6.

	Diagram 1	Diagram 2	Diagram 3	Diagram 4	Diagram 5	Diagram 6
Number of smallest triangles	1	4	16			
Number of smallest triangles as a power of 2	2^0	2^2	2^4			

[2]

(ii) Find the number of the smallest triangles in Diagram *n*, giving your answer as a power of 2.

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

(c) Calculate the number of the smallest triangles in the diagram where the smallest triangles have sides of length $\frac{1}{128}$ unit.

Answer(c) .... [2]