

## UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS International General Certificate of Secondary Education

| CANDIDATE<br>NAME |  |  |                     |  |  |
|-------------------|--|--|---------------------|--|--|
| CENTRE<br>NUMBER  |  |  | CANDIDATE<br>NUMBER |  |  |

MATHEMATICS 0580/41

Paper 4 (Extended) May/June 2012

2 hours 30 minutes

Candidates answer on the Question Paper.

Additional Materials: Electronic calculator Geometrical instruments

Mathematical tables (optional) 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.

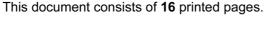
If the degree of accuracy is not specified in the question, and if the answer is not exact, give the answer to three significant figures. Give answers in degrees to one decimal place.

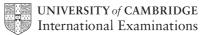
For  $\pi$  use either your calculator value or 3.142.

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.



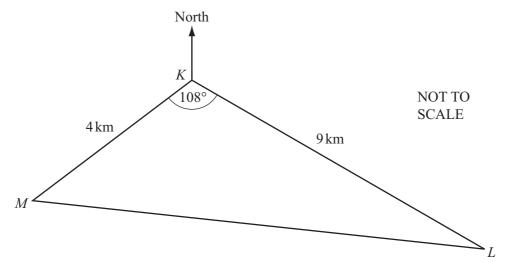


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1

| The | e | y sha      | obby and Carl receive a sum of money. are it in the ratio 12:7:8. ceives \$504.  |                     |     |     | For<br>Examiner's<br>Use |
|-----|---|------------|--|---------------------|-----|-----|--------------------------|
|     |   |            | culate the <b>total</b> amount.  | Answer(a) \$        |     | [3] |                          |
| (b) | ) | <b>(i)</b> | Anna uses 7% of her \$504 to pay a bill. Calculate how much she has left.  | <i>Answer(b)</i> (i | )\$ | [3] |                          |
|     |   | (ii)       | She buys a coat in a sale for \$64.68. This was 23% less than the original price. Calculate the original price of the coat.  |                     |     |     |                          |
| (c) |   | Thi<br>Cal | bby uses \$250 of his share to open a bank accoust account pays compound interest at a rate of 1. culate the amount in the bank account after 3 years your answer correct to 2 decimal places. | 6% per year.        |     | [3] |                          |
| (d) | ) |            | l buys a computer for \$288 and sells it for \$324 culate his percentage profit.   |                     |     | [3] |                          |
|     |   |            |  | Answer(d)           | %   | [3] |                          |

For Examiner's Use



Three buoys K, L and M show the course of a boat race. MK = 4 km, KL = 9 km and angle  $MKL = 108^{\circ}$ .

(a) Calculate the distance ML.

- **(b)** The bearing of L from K is 125°.
  - (i) Calculate how far L is south of K.

 $Answer(b)(i) \qquad \qquad km [3]$ 

(ii) Find the three figure bearing of K from M.

*Answer(b)*(ii) \_\_\_\_\_ [2]

3 The table shows some values for the equation  $y = x^3 - 2x$  for  $-2 \le x \le 2$ .

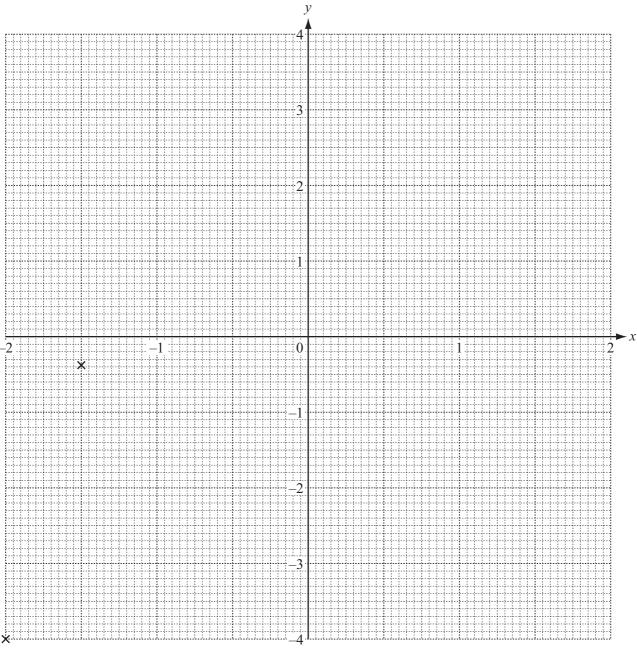
| х | -2 | -1.5  | -1 | -0.6 | -0.3 | 0 | 0.3   | 0.6 | 1 | 1.5  | 2 |
|---|----|-------|----|------|------|---|-------|-----|---|------|---|
| y | -4 | -0.38 |    |      | 0.57 |   | -0.57 |     |   | 0.38 | 4 |

For Examiner's Use

(a) Complete the table of values.

[3]

(b) On the grid below, draw the graph of  $y = x^3 - 2x$  for  $-2 \le x \le 2$ . The first two points have been plotted for you.



[4]

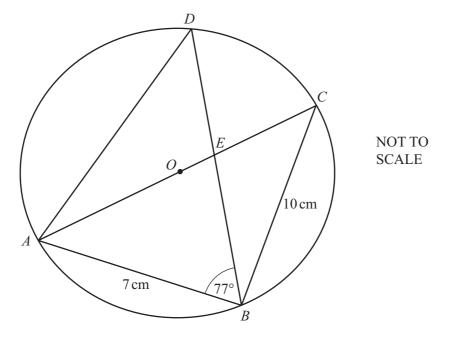
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For Examiner's

Use

| (c) | (i)  | On the grid, draw the line $y = 0.8$ for $-2 \le x \le 2$ .   | ] |
|-----|------|---|---|
|     | (ii) | Use your graph to solve the equation $x^3 - 2x = 0.8$ .   |   |
|     |      |   |   |
|     |      |   |   |
|     |      |   |   |
|     |      | Answer(c)(ii) x =   | ] |
| (d) |      | drawing a suitable tangent, work out an estimate for the gradient of the graph of $y = x^3 - 2x$ ere $x = -1.5$ . | ĸ |
|     | You  | u must show your working.   |   |
|     |      |   |   |
|     |      |   |   |
|     |      |   |   |
|     |      |   | _ |
|     |      | $Answer(d) \qquad \qquad [3$  | ] |

For Examiner's Use



A, B, C and D lie on a circle, centre O. AB = 7 cm, BC = 10 cm and angle  $ABD = 77^{\circ}$ . AOC is a diameter of the circle.

(a) Find angle ABC.

Answer(a) Angle 
$$ABC =$$
 [1]

**(b)** Calculate angle ACB and show that it rounds to 35° correct to the nearest degree. Answer(b)

[2]

(c) Explain why angle ADB = angle ACB.

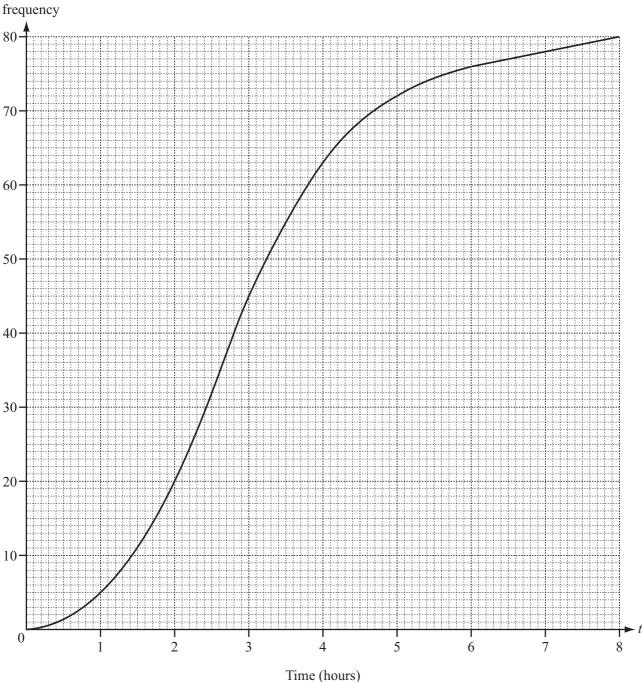
Answer(c) [1]

| (d) | (i)  | Calculate the length of $AD$ .   | For<br>Examiner's<br>Use |
|-----|------|--|--------------------------|
|     |      |  |                          |
|     |      |  |                          |
|     |      |  |                          |
|     |      |  |                          |
|     |      | $Answer(d)(i) AD = \dots cm [3]$   |                          |
|     | (ii) | Calculate the area of triangle ABD.  |                          |
|     |      |  |                          |
|     |      |  |                          |
|     |      |  |                          |
|     |      |  |                          |
|     |      | Answer(d)(ii) cm <sup>2</sup> [2]  |                          |
| (e) | The  | e area of triangle $AED = 12.3 \text{ cm}^2$ , correct to 3 significant figures. |                          |
|     | Use  | similar triangles to calculate the area of triangle BEC.                         |                          |
|     |      |  |                          |
|     |      |  |                          |
|     |      |  |                          |
|     |      |  |                          |
|     |      | Answer(e) cm <sup>2</sup> [3]  |                          |
|     |      |  |                          |

5 Felix asked 80 motorists how many hours their journey took that day. He used the results to draw a cumulative frequency diagram.

For Examiner's Use

Cumulative



(a) Find

| 1 | (i) | ۱ +۱ | 20 | med  | 101   |
|---|-----|------|----|------|-------|
|   |     |      |    | 1115 | 11411 |
|   |     |      |    |      |       |

(ii) the upper quartile,

(iii) the inter-quartile range.

| Answer(a)(i) | <br>h | [1 |
|--------------|-------|----|
| Answer(a)(1) | <br>h | l  |

Answer(a)(iii) h [1]

[5]

| <b>(b)</b> Find the number o | f motorists wh  | nose journey   | took more tha    | an 5 hours bu      | t no more tha          | in / nours.      |
|------------------------------|-----------------|----------------|------------------|--------------------|------------------------|------------------|
|                              |                 |                | Answ             | er(b)              |                        | [1]              |
| (c) The frequency tab        | le shows some   | e of the infor | mation about     | the 80 journe      | eys.                   |                  |
| Time in hours (t)            | $0 < t \le 2$   | 2 < t ≤ 3      | 3 < <i>t</i> ≤ 4 | 4 < <i>t</i> ≤ 5   | 5 < <i>t</i> ≤ 6       | 6 < <i>t</i> ≤ 8 |
| Frequency                    | 20              | 25             | 18               |                    |                        |                  |
| (i) Use the cumu             | lative frequen  | ncy diagram t  | o complete th    | ne table above     | <b>).</b>              | [2]              |
| (ii) Calculate an e          | estimate of the | e mean numb    | er of hours th   | e 80 journeys      | s took.                |                  |
|                              |                 |                |                  |                    |                        |                  |
|                              |                 |                |                  |                    |                        |                  |
|                              |                 |                |                  |                    |                        |                  |
|                              |                 |                |                  |                    |                        |                  |
|                              |                 |                |                  |                    |                        |                  |
|                              |                 |                |                  |                    |                        |                  |
|                              |                 |                |                  |                    |                        |                  |
|                              |                 |                |                  |                    |                        |                  |
|                              |                 |                |                  |                    |                        |                  |
|                              |                 |                |                  | <i>ver(c)</i> (ii) |                        | h [4]            |
| (d) On the grid, draw        | a histogram to  | o represent th |                  |                    | e in <b>part (c)</b> . | h [4]            |
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| (d) On the grid, draw        | a histogram to  | o represent th |                  |                    | e in part (c).         | h [4]            |
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| (d) On the grid, draw        | a histogram to  | o represent th |                  |                    | e in part (c).         | h [4]            |

| 6 | (a) | A p   | arallelogram has base $(2x - 1)$ metres and height $(4x - 7)$ metres.<br>area of the parallelogram is $1 \text{ m}^2$ . |      |
|---|-----|-------|---|------|
|   |     | (i)   | Show that $4x^2 - 9x + 3 = 0$ .   |      |
|   |     |       | Answer (a)(i)   |      |
|   |     |       |   |      |
|   |     |       |   |      |
|   |     |       |   |      |
|   |     |       |   |      |
|   |     |       |   |      |
|   |     |       |   |      |
|   |     |       |   | [3]  |
|   |     | (ii)  | Solve the equation $4x^2 - 9x + 3 = 0$ .  |      |
|   |     |       | Show all your working and give your answers correct to 2 decimal places.  |      |
|   |     |       |   |      |
|   |     |       |   |      |
|   |     |       |   |      |
|   |     |       |   |      |
|   |     |       |   |      |
|   |     |       |   |      |
|   |     |       |   |      |
|   |     |       |   |      |
|   |     |       | Answer(a)(ii) x =   | [4]  |
|   |     | (iii) | Calculate the height of the parallelogram.  |      |
|   |     |       |   |      |
|   |     |       |   |      |
|   |     |       |   |      |
|   |     |       |   |      |
|   |     |       | Answer(a)(iii)  | m[1] |

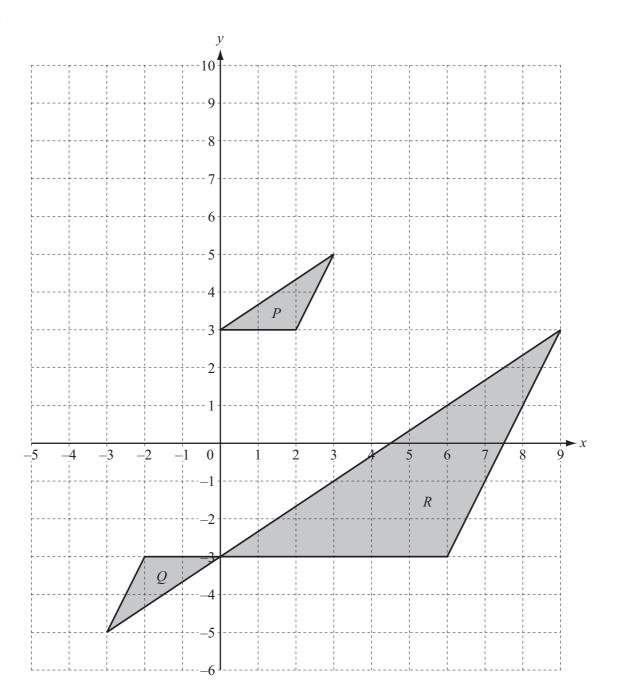
|            |     |           | 2       |     |
|------------|-----|-----------|---------|-----|
| <b>(b)</b> | (i) | Factorise | $x^2$ — | 16. |

Answer(b)(i) [1]

(ii) Solve the equation 
$$\frac{2x+3}{x-4} + \frac{x+40}{x^2-16} = 2$$
.

$$Answer(b)(ii) x =$$
 [4]

For Examiner's Use



- (a) Describe fully
  - (i) the **single** transformation which maps **triangle** P onto triangle Q,

Answer(a)(i) [3]

(ii) the **single** transformation which maps **triangle** Q onto triangle R,

Answer(a)(ii) [3]

(iii) the **single** transformation which maps **triangle** R onto triangle P.

Answer(a)(iii) [3]

| <b>(b)</b> | On the | grid, | draw | the | image | of |
|------------|--------|-------|------|-----|-------|----|
|------------|--------|-------|------|-----|-------|----|

(i) triangle 
$$P$$
 after translation by  $\begin{pmatrix} -4 \\ -5 \end{pmatrix}$ , [2]

- (ii) triangle P after reflection in the line x = -1. [2]
- (c) (i) On the grid, draw the image of **triangle** *P* after a stretch, scale factor 2 and the *y*-axis as the invariant line.
  - (ii) Find the matrix which represents this stretch.

$$Answer(c)$$
(ii) [2]

$$\mathscr{E} = \{1, 2, 3, 4, 5, 6, 7, 8, 9\}$$

 $E = \{x : x \text{ is an even number}\}$ 

$$F = \{2, 5, 7\}$$

$$G = \{x : x^2 - 13x + 36 = 0\}$$

(a) List the elements of set E.

$$Answer(a) E = \{ \} [1]$$

**(b)** Write down n(F).

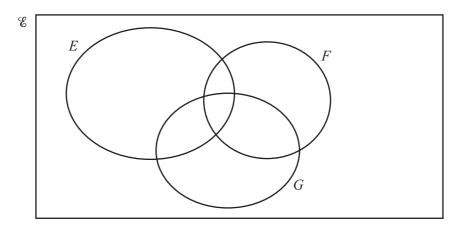
$$Answer(b) \ n(F) =$$
 [1]

(c) (i) Factorise  $x^2 - 13x + 36$ .

$$Answer(c)(i)$$
 [2]

(ii) Using your answer to part (c)(i), solve  $x^2 - 13x + 36 = 0$  to find the two elements of G.

(d) Write all the elements of  $\mathscr{C}$  in their correct place in the Venn diagram.



[2]

(e) Use set notation to complete the following statements.

(i) 
$$F \cap G =$$
 [1]

(iii) 
$$n(E | F) = 6$$
 [1]

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| )            |                 | f(x) = 3x + 5                 | g(x) = 7 - 2x     | $h(x) = x^2 - 8$              |     | For<br>Examiner |
|--------------|-----------------|-------------------------------|-------------------|-------------------------------|-----|-----------------|
| <b>(a)</b> F | ind             |                               |                   |                               |     | Use             |
| <b>(</b> i   | <b>i)</b> f(3), |                               |                   |                               |     |                 |
|              |                 |                               |                   | Answer(a)(i)                  | [1] |                 |
| (ii          | <b>i)</b> g(x – | -3) in terms of $x$ in its s  | simplest form,    |                               |     |                 |
|              |                 |                               |                   |                               | [0] |                 |
| (iii         | i) h(5x)        | in terms of $x$ in its sim    | plest form.       | Answer(a)(ii)                 | [2] |                 |
| (            | <i>-</i> ,(e)   |                               | <b>P</b> 200 2022 |                               |     |                 |
|              |                 |                               |                   | Answer(a)(iii)                | [1] |                 |
| <b>(b)</b> F | ind the ir      | overse function $g^{-1}(x)$ . |                   |                               |     |                 |
|              |                 |                               |                   |                               |     |                 |
|              |                 |                               |                   | $Answer(b) g^{-1}(x) = \dots$ | [2] |                 |
| (c) F        | find $hf(x)$    | in the form $ax^2 + bx +$     | c.                |                               |     |                 |
|              |                 |                               |                   |                               |     |                 |
|              |                 |                               | Ansv              | wer(c) hf(x) =                | [3] |                 |
|              |                 | 200                           |                   | () ()                         |     |                 |
| (d) S        | olve the        | equation $ff(x) = 83$ .       |                   |                               |     |                 |
|              |                 |                               |                   |                               |     |                 |
|              |                 |                               |                   | Answer(d) x =                 | [3] |                 |
| (e) S        | solve the       | inequality $2f(x) < g(x)$     | ).                |                               |     |                 |
|              |                 |                               |                   |                               |     |                 |
|              |                 |                               |                   |                               | [2] |                 |
|              |                 |                               |                   | Answer(e)                     | [3] |                 |
|              |                 | Questi                        | on 10 is printed  | on the next page.             |     |                 |

24 cm NOT TO SCALE

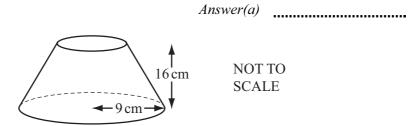
For Examiner's Use

A solid metal cone has base radius 9 cm and vertical height 24 cm.

(a) Calculate the volume of the cone.

[The volume, V, of a cone with radius r and height h is  $V = \frac{1}{3} \pi r^2 h$ .]

(b)



A cone of height 8 cm is removed by cutting parallel to the base, leaving the solid shown above. Show that the volume of this solid rounds to 1960 cm<sup>3</sup>, correct to 3 significant figures.

Answer (b)

[4]

(c) The 1960 cm<sup>3</sup> of metal in the solid in **part** (b) is melted and made into 5 identical cylinders, each of length 15 cm.

Show that the radius of each cylinder rounds to 2.9 cm, correct to 1 decimal place.

Answer (c)

[4]

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