UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
International General Certificate of Secondary Education

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|---|---|---|---|---|---|---|---|---|---|
| CANDIDATE NAME | | | | | | | | | |
| CENTRE NUMBER | | | | | | CANDIDATE NUMBER | | | |

*5830631420*

**MATHEMATICS** **0580/41**

Paper 4 (Extended) **October/November 2012**

**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**

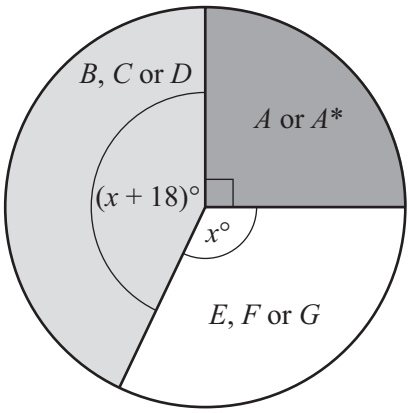
Write your Centre number, candidate number and name on all the work you hand in.
Write in dark blue or black pen.
You may use a pencil for any diagrams or graphs.
Do not use staples, paper clips, highlighters, glue or correction fluid.
DO **NOT** WRITE IN ANY BARCODES.

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

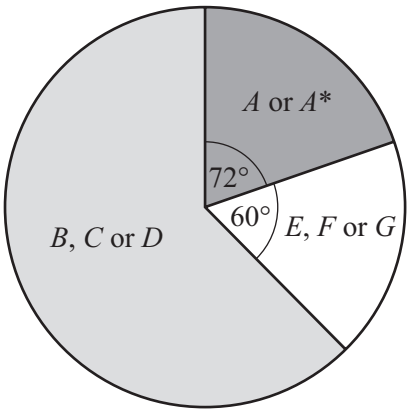
At the end of the examination, fasten all your work securely together.
The number of marks is given in brackets [ ] at the end of each question or part question.
The total of the marks for this paper is 130.

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

**1**




Girls




Boys

NOT TO SCALE

*For Examiner's Use*

The pie charts show information on the grades achieved in mathematics by the girls and boys at a school.

**(a)** For the **Girls'** pie chart, calculate

**(i)** $x$,

*Answer(a)*(i) $x$ = ..... [2]

**(ii)** the angle for grades $B$, $C$ or $D$.

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

**(b)** Calculate the percentage of the **Boys** who achieved grades $E$, $F$ or $G$.

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

**(c)** There were 140 girls and 180 boys.

**(i)** Calculate the percentage of students (girls and boys) who achieved grades $A$ or $A^*$.

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

**(ii)** How many more boys than girls achieved grades *B*, *C* or *D*?

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

**(d)** The table shows information about the times, $t$ minutes, taken by 80 of the girls to complete their mathematics examination.

| Time taken ($t$ minutes) | $40 < t \leqslant 60$ | $60 < t \leqslant 80$ | $80 < t \leqslant 120$ | $120 < t \leqslant 150$ |
|---|---|---|---|---|
| Frequency | 5 | 14 | 29 | 32 |

**(i)** Calculate an estimate of the mean time taken by these 80 girls to complete the examination.

*Answer(d)*(i) ..... min [4]

**(ii)** On a histogram, the height of the column for the interval $60 < t \leqslant 80$ is 2.8 cm.

Calculate the heights of the other three columns.
**Do not draw the histogram.**

*Answer(d)*(ii) $40 < t \leqslant 60$ column height = ..... cm

$80 < t \leqslant 120$ column height = ..... cm

$120 < t \leqslant 150$ column height = ..... cm [4]





**[Turn over**

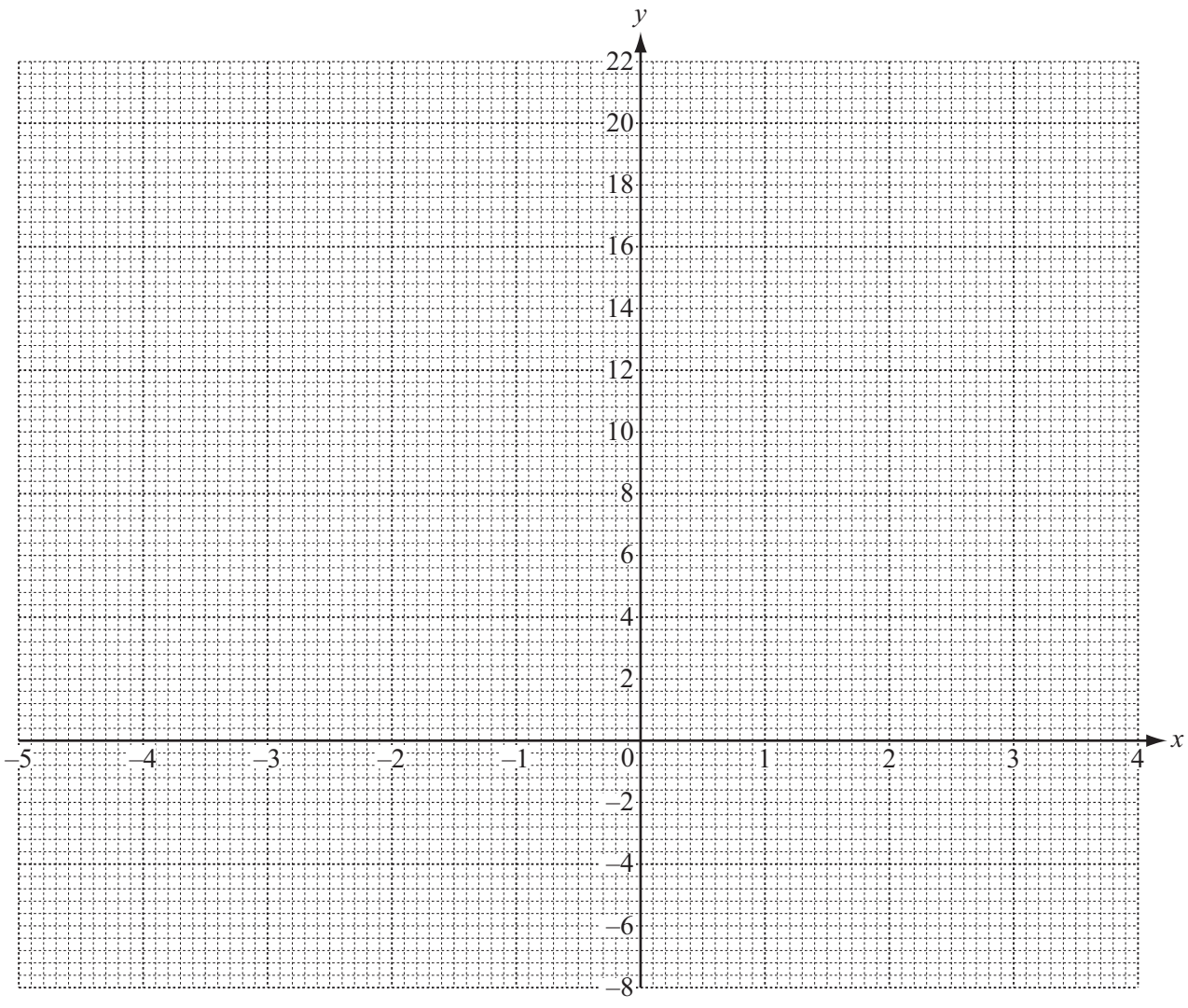
*For Examiner's Use*

**2** **(a)** **(i)** Complete the table of values for $y = \frac{1}{2}x^3 + x^2 - 7x$.

| $x$ | –5 | –4 | –3 | –2 | –1 | 0 | 1 | 2 | 3 | 4 |
|---|---|---|---|---|---|---|---|---|---|---|
| $y$ | –2.5 | 12 | 16.5 | | 7.5 | 0 | | –6 | 1.5 | |

[3]

**(ii)** On the grid, draw the graph of $y = \frac{1}{2}x^3 + x^2 - 7x$ for $-5 \leqslant x \leqslant 4$.




[4]

**(b)** Use your graph to solve the equation $\frac{1}{2}x^3 + x^2 - 7x = 2$.

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

*For Examiner's Use*

**(c)** By drawing a suitable tangent, calculate an estimate of the gradient of the graph where $x = -4$.

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

**(d) (i)** On the grid draw the line $y = 10 - 5x$ for $-2 \leqslant x \leqslant 3$. [3]

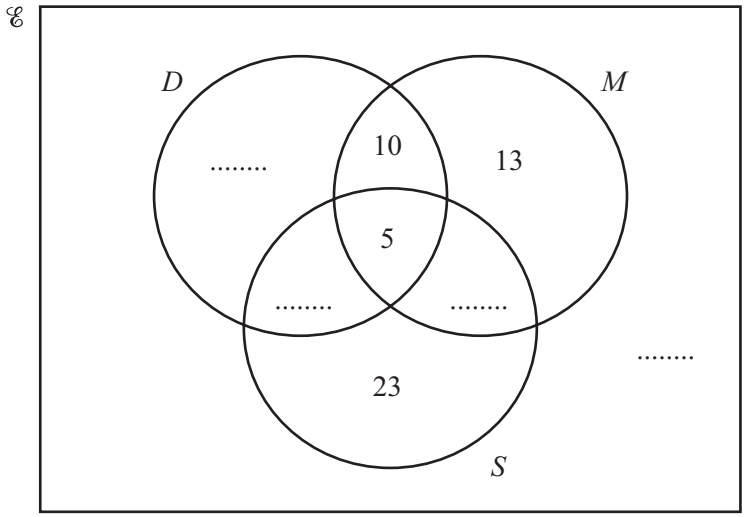
**(ii)** Use your graphs to solve the equation $\frac{1}{2}x^3 + x^2 - 7x = 10 - 5x$.

*Answer(d)*(ii) $x =$ ..... [1]

**3** 90 students are asked which school clubs they attend.

$D$ = {students who attend drama club}
$M$ = {students who attend music club}
$S$ = { students who attend sports club}

39 students attend music club.
26 students attend **exactly two** clubs.
35 students attend drama club.




**(a)** Write the four missing values in the Venn diagram. [4]

**(b)** How many students attend

**(i)** all three clubs,

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

**(ii)** one club only?

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

**(c)** Find

**(i)** $n(D \cap M)$,

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

**(ii)** $n((D \cap M) \cap S')$.

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

*For Examiner's Use*

**(d)** One of the 90 students is chosen at random.

Find the probability that the student

**(i)** **only** attends music club,

*Answer(d)*(i) ..... [1]

**(ii)** attends **both** music and drama clubs.

*Answer(d)*(ii) ..... [1]

**(e)** Two of the 90 students are chosen at random without replacement.

Find the probability that

**(i)** they **both** attend all three clubs,

*Answer(e)*(i) ..... [2]

**(ii)** one of them attends sports club only and the other attends music club only.

*Answer(e)*(ii) ..... [3]

*For Examiner's Use*

**4** **(a)** Solve the equations.

**(i)** $4x - 7 = 8 - 2x$

*Answer(a)*(i) $x =$ ..... [2]

**(ii)** $\frac{x-7}{3} = 2$

*Answer(a)*(ii) $x =$ ..... [2]

**(b)** Simplify the expressions.

**(i)** $(3xy^4)^3$

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

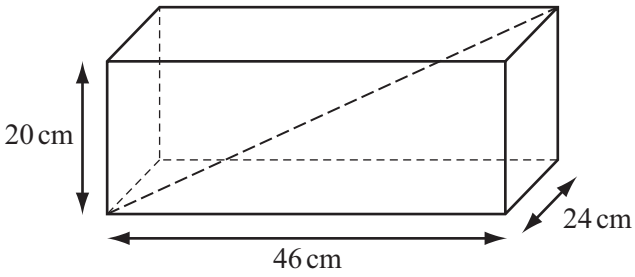
**(ii)** $(16a^6b^2)^{\frac{1}{2}}$

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

**(iii)** $\frac{x^2 - 7x - 8}{x^2 - 64}$

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

**5** **(a)**




NOT TO SCALE

Jose has a fish tank in the shape of a cuboid measuring 46 cm by 24 cm by 20 cm.

Calculate the length of the diagonal shown in the diagram.

*Answer(a)* ..... cm [3]

**(b)** Maria has a fish tank with a volume of 20 000 $cm^3$.

Write the volume of Maria's fish tank as a percentage of the volume of Jose's fish tank.

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

**(c)** Lorenzo's fish tank is mathematically similar to Jose's and double the volume.

Calculate the dimensions of Lorenzo's fish tank.

*Answer(c)* ..... cm by ..... cm by ..... cm [3]

**(d)** A sphere has a volume of 20 000 $cm^3$. Calculate its radius.

[The volume, $V$, of a sphere with radius $r$ is $V = \frac{4}{3}\pi r^3$.]

*Answer(d)* ..... cm [3]

*For Examiner's Use*

**6** **(a)** $\mathbf{a} = \begin{pmatrix} -2 \\ 3 \end{pmatrix}$ $\mathbf{b} = \begin{pmatrix} 2 \\ -7 \end{pmatrix}$ $\mathbf{c} = \begin{pmatrix} -10 \\ 21 \end{pmatrix}$

**(i)** Find $2\mathbf{a} + \mathbf{b}$.

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

**(ii)** Find $|\mathbf{b}|$.

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

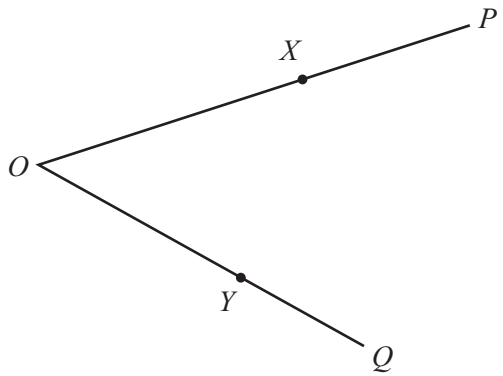
**(iii)** $m\mathbf{a} + n\mathbf{b} = \mathbf{c}$

Find the values of $m$ and $n$.
Show all your working.

*Answer(a)*(iii) $m =$ .....

$n =$ ..... [6]

**(b)**




NOT TO SCALE

In the diagram, $OX : XP = 3 : 2$ and $OY : YQ = 3 : 2$.
$\overrightarrow{OP} = \mathbf{p}$ and $\overrightarrow{OQ} = \mathbf{q}$.

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

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

**(ii)** Write $\overrightarrow{XY}$ in terms of **p** and **q**.

*Answer(b)*(ii) $\overrightarrow{XY}$ = ..... [1]

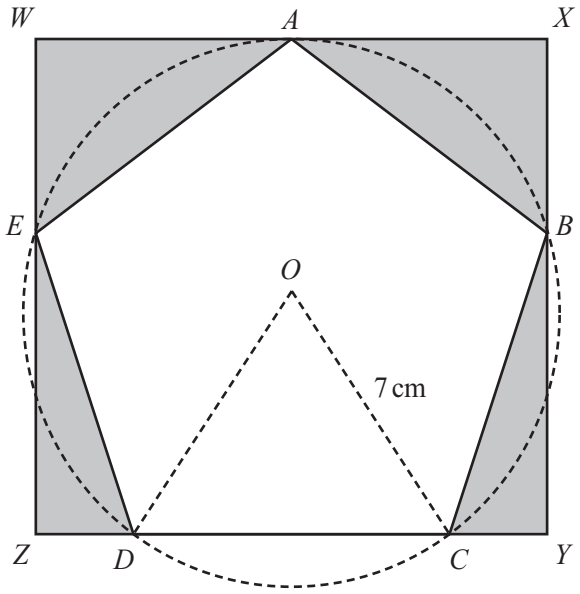
**(iii)** Complete the following sentences.

The lines $XY$ and $PQ$ are .....

The triangles $OXY$ and $OPQ$ are .....

The ratio of the area of triangle $OXY$ to the area of triangle $OPQ$ is ..... : ..... [3]

**7**




NOT TO SCALE

*For Examiner's Use*

The vertices *A*, *B*, *C*, *D* and *E* of a regular pentagon lie on the circumference of a circle, centre *O*, radius 7 cm.
They also lie on the sides of a rectangle *WXYZ*.

**(a)** Show that

**(i)** angle $DOC = 72°$,

*Answer(a)*(i)

[1]

**(ii)** angle $DCB = 108°$,

*Answer(a)*(ii)

[2]

**(iii)** angle $CBY = 18°$.

*Answer(a)*(iii)

[1]

**(b)** Show that the length $CD$ of one side of the pentagon is 8.23 cm correct to three significant figures.

*Answer(b)*

[3]

**(c)** Calculate

**(i)** the area of the triangle $DOC$,

*Answer(c)*(i) ..... $cm^2$ [2]

**(ii)** the area of the pentagon $ABCDE$,

*Answer(c)*(ii) ..... $cm^2$ [1]

**(iii)** the area of the sector $ODC$,

*Answer(c)*(iii) ..... $cm^2$ [2]

**(iv)** the length $XY$.

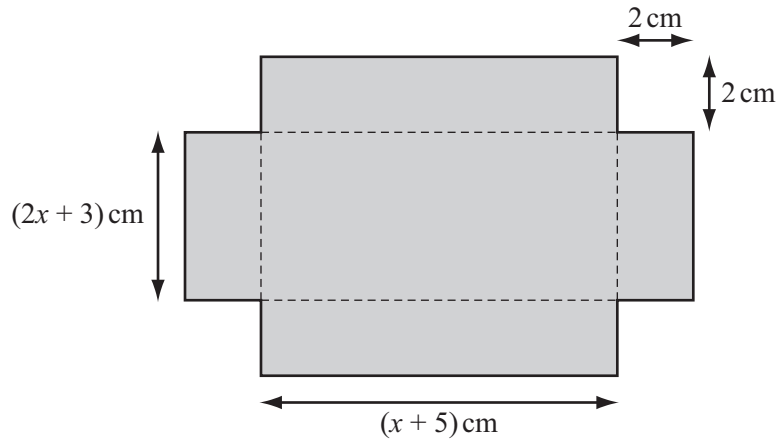
*Answer(c)*(iv) ..... cm [2]

**(d)** Calculate the ratio
area of the pentagon $ABCDE$ : area of the rectangle $WXYZ$.

Give your answer in the form 1 : $n$.

*Answer(d)* 1 : ..... [5]

**8** A rectangular piece of card has a square of side 2 cm removed from each corner.




**(a)** Write expressions, in terms of $x$, for the dimensions of the rectangular card before the squares are removed from the corners.

*Answer(a)* ..... cm by ..... cm [2]

**(b)** The diagram shows a net for an open box.
Show that the volume, $V$ cm$^3$, of the open box is given by the formula $V = 4x^2 + 26x + 30$.

*Answer(b)*

[3]

**(c) (i)** Calculate the values of $x$ when $V = 75$.
Show all your working and give your answers correct to two decimal places.

*For Examiner's Use*

*Answer(c)*(i) $x =$ ..... or $x =$ ..... [5]

**(ii)** Write down the length of the longest edge of the box.

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

**Question 9 is printed on the next page.**

*For Examiner's Use*

**9** Distances from the Sun can be measured in astronomical units, AU.
Earth is a distance of 1 AU from the Sun.
One AU is approximately $1.496 \times 10^8$ km.

The table shows distances from the Sun.

| Name | Distance from the Sun in AU | Distance from the Sun in kilometres |
|---|---|---|
| Earth | 1 | $1.496 \times 10^8$ |
| Mercury | 0.387 | ..... |
| Jupiter | ..... | $7.79 \times 10^8$ |
| Pluto | ..... | $5.91 \times 10^9$ |

**(a)** Complete the table. [3]

**(b)** Light travels at approximately 300 000 kilometres per second.

**(i)** How long does it take light to travel from the Sun to Earth?
Give your answer in seconds.

*Answer(b)*(i) ..... s [2]

**(ii)** How long does it take light to travel from the Sun to Pluto?
Give your answer in minutes.

*Answer(b)*(ii) ..... min [2]

**(c)** One light year is the distance that light travels in one year (365 days).

How far is one light year in kilometres?
Give your answer in standard form.

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

**(d)** How many astronomical units (AU) are equal to one light year?

*Answer(d)* ..... AU [2]