UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
International General Certificate of Secondary Education

CANDIDATE NAME

CENTRE NUMBER | | | | | |

CANDIDATE NUMBER | | | | |

5203274567

MATHEMATICS **0580/21**

Paper 2 (Extended) **October/November 2012**

1 hour 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 70.

This document consists of **12** printed pages.

1 On a mountain, the temperature decreases by 6.5 °C for every 1000 metres increase in height. At 2000 metres the temperature is 10 °C.

Find the temperature at 6000 metres.

6000m
+1000m ↑ -6.5°C
2000m 10°C

6000 - 2000
= 4000m

1000m → -6.5°C
×4 ×4
4000m → -26°C
10°C - 26°C = -16°C

Answer ..... -16 ..... °C [2]

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2 Use your calculator to find the value of

$$\frac{8.1^2 + 6.2^2 - 4.3^2}{2 \times 8.1 \times 6.2}.$$

Answer ..... [2]

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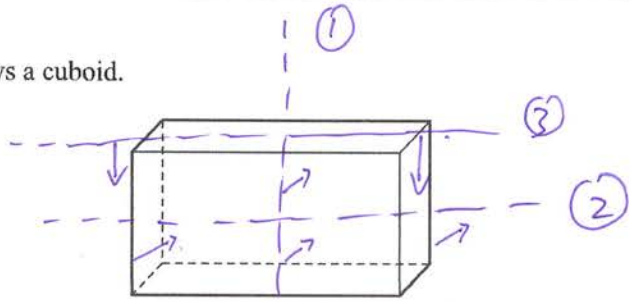
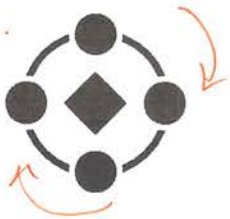
3 **(a)** The diagram shows a cuboid.



How many planes of symmetry does this cuboid have?

Answer(a) ..... 3 ..... [1]

(b) Write down the order of rotational symmetry for the following diagram.



* Rotational Symmetry
when you turn the object one round (360°)
How many time it will look the same

Answer(b) ..... 4 ..... [1]

4 Write down all your working to show that the following statement is correct.

$$\frac{1+\frac{8}{9}}{2+\frac{1}{2}} = \frac{34}{45}$$

Answer

[2]

---

5 Simplify the expression.

$$(a^{\frac{1}{2}} - b^{\frac{1}{2}})(a^{\frac{1}{2}} + b^{\frac{1}{2}})$$

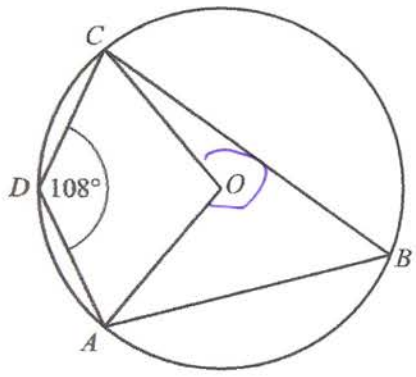
$a^{\frac{1}{2}}a^{\frac{1}{2}} + a^{\frac{1}{2}}b^{\frac{1}{2}} - b^{\frac{1}{2}}a^{\frac{1}{2}} - b^{\frac{1}{2}}b^{\frac{1}{2}}$

(1) (2) (3) (4)

$a^1 - b^1$

Answer $a-b$ [2]

6



NOT TO SCALE

∠ more than 180°

A, B, C and D lie on a circle centre O. Angle $ADC = 108°$.

Work out the obtuse angle AOC.

reflex angle AOC $108° \times 2 = 216°$ (∠ at centre = 2∠ at circumference)

obtuse angle AOC $360 - 216°$ *Answer* Angle AOC = 144 [2]

more than 90° less than 180 $= 144°$ (∠s at a point)

7 The train fare from Bangkok to Chiang Mai is 768 baht.
The exchange rate is £1 = 48 baht.

Calculate the train fare in pounds (£).

Answer £ ..... [2]

---

8 Acri invested \$500 for 3 years at a rate of 2.8% per year compound interest.

Calculate the final amount he has after 3 years.

Total Amount = $P(1+\frac{r}{100})^n$
P+I

Answer \$ ..... [3]

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9 Solve the inequality.

$$\frac{2x-3}{5} - \frac{x}{3} \leqslant 2$$

Answer ..... [3]

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10 A large water bottle holds 25 litres of water correct to the nearest litre.
A drinking glass holds 0.3 litres correct to the nearest 0.1 litre.

Calculate the lower bound for the number of glasses of water which can be filled from the bottle.

Answer ..... [3]

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11 The electrical resistance, R, of a length of cylindrical wire varies inversely as the square of the diameter, d, of the wire.
$R = 10$ when $d = 2$.

Find R when $d = 4$.

step1 Find constant k

$R = \frac{k}{d^2}$

$10 = \frac{k}{2^2}$

$10 \times 4 = k$

$k = 40$

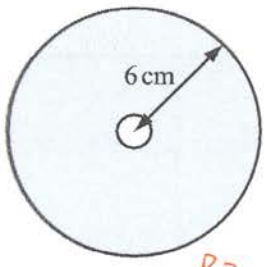
step2 Find unknown variable R

$R = \frac{40}{4^2}$

$R = 2.5$

Answer $R =$ ..... 2.5 ..... [3]

12



NOT TO SCALE

R2

* Area of Big circle − Area of Small circle

The diagram shows a circular disc with radius 6 cm.
In the centre of the disc there is a circular hole with radius 0.5 cm.

r

Calculate the area of the shaded section.

$\pi R^2 - \pi r^2$

$\pi(6)^2 - \pi(0.5)^2 = 112\ cm^2$

Answer ..... 112 ..... cm^2 [3]

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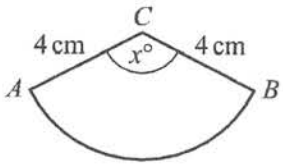
13 Find the matrix which represents the combined transformation of a reflection in the x axis fo... **by** a reflection in the line $y = x$.

For ...iner's

Answer ( ) [3]

14



NOT TO SCALE

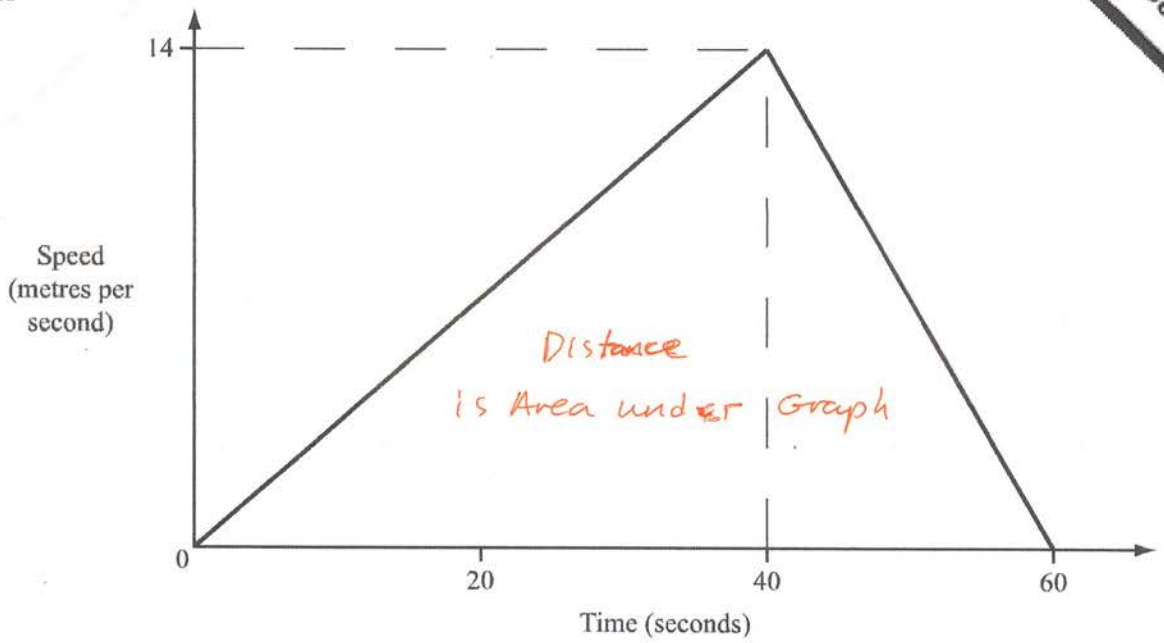
Arc Length = $\frac{\theta}{360} \times 2\pi r$

ABC is a sector of a circle, radius 4 cm and centre C.
The length of the arc AB is 8 cm and angle $ACB = x°$.

Calculate the value of x.

Answer $x =$ ..... [3]

15



The diagram shows the speed-time graph of a bus journey between two bus stops.
Hamid runs at a constant speed of 4 m/s along the bus route.
He passes the bus as it leaves the first bus stop.
The bus arrives at the second bus stop after 60 seconds.

How many metres from the bus is Hamid at this time?

step1 Find Distance bus travel bt 2 bus stop.
$\frac{1}{2} \times 60 \times 14 = 420\text{m}$

step2 Find Distance Hamid ran
$4 \times 60 = 240$.

step3 Find Difference in the distance
$420 - 240 = 180\text{m}$

Answer ..... 180 ..... m [3]

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16 Rearrange the formula $y = \frac{x+2}{x-4}$ to make x the subject.

$y(x-4) = x + 2$

$xy - 4y = x + 2$

you need to factorize to make the 2 'x' become 1

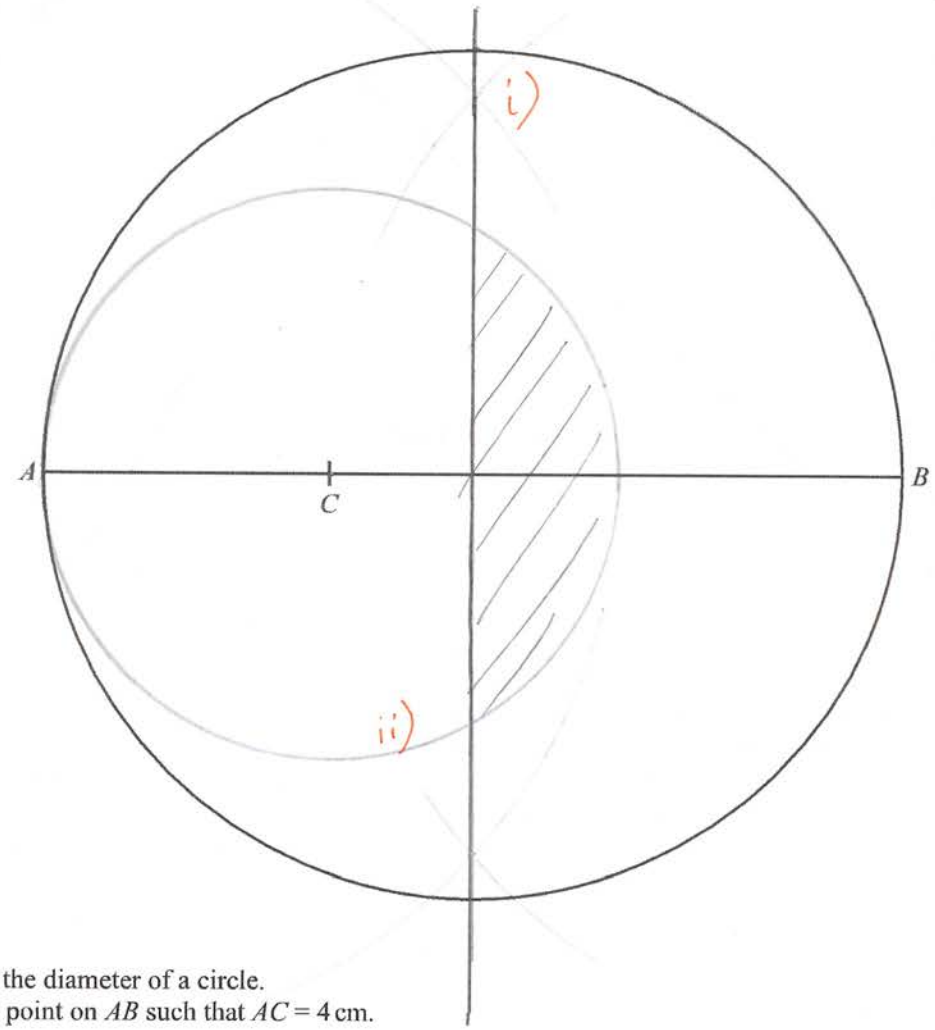
$xy - x = 4y + 2$

$x(y-1) = 4y + 2$

$x = \frac{4y+2}{y-1}$

Answer $x =$ ..... $\frac{4y+2}{y-1}$ ..... [4]

17



AB is the diameter of a circle.
C is a point on AB such that $AC = 4$ cm.

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

(i) the locus of points which are equidistant from A and from B, [2]

(ii) the locus of points which are 4 cm from C. [1]

(b) Shade the region in the diagram which is

- nearer to B than to A

and

- less than 4 cm from C. [1]

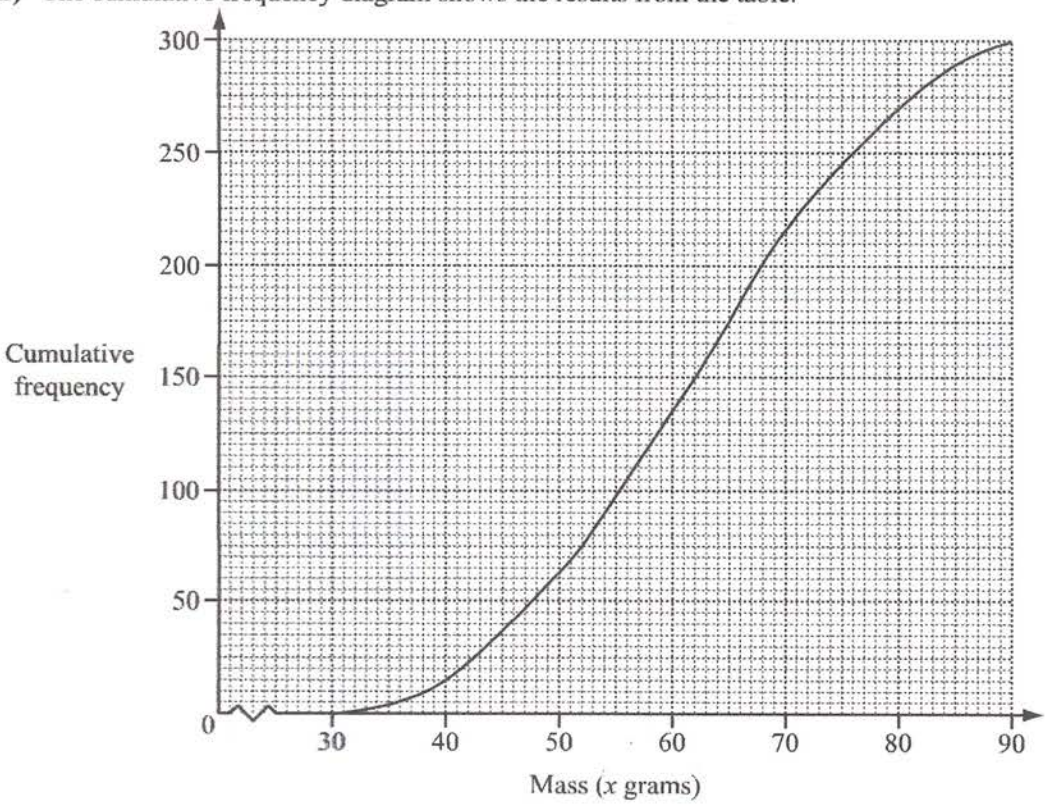
18 Lauris records the mass and grade of 300 eggs. The table shows the results.

Mass (x grams)	$30 < x \leqslant 40$	$40 < x \leqslant 50$	$50 < x \leqslant 60$	$60 < x \leqslant 70$	$70 < x \leqslant 80$	$80 < x \leqslant$
Frequency	15	48	72	81	54	30
Grade	small		medium	large	very large	

(a) Find the probability that an egg chosen at random is graded very large.

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

(b) The cumulative frequency diagram shows the results from the table.



Use the cumulative frequency diagram to find

(i) the median,

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

(ii) the lower quartile,

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

(iii) the inter-quartile range,

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

(iv) the number of eggs with a mass greater than 65 grams.

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

19

$$\mathbf{M} = \begin{pmatrix} 5 & -4 \\ 2 & 3 \end{pmatrix}$$

Find

(a) $\mathbf{M}^2$, $\begin{pmatrix} 5 & -4 \\ 2 & 3 \end{pmatrix}\begin{pmatrix} 5 & -4 \\ 2 & 3 \end{pmatrix}$

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

(b) $2\mathbf{M}$,

Answer(b) $\begin{pmatrix} & \\ & \end{pmatrix}$ [1]

$\begin{pmatrix} a & b \\ c & d \end{pmatrix}$

(c) $|\mathbf{M}|$, the determinant of $\mathbf{M}$,

Det $|ad - bc|$ Det M $|5 \times 3 - (-4 \times 2)|$

$|15 + 8|$

Answer(c) 23 [1]

23

(d) $\mathbf{M}^{-1}$.

$\begin{pmatrix} 5 & -4 \\ 2 & 3 \end{pmatrix}$ ×-1 ×-1

$\frac{1}{23}\begin{pmatrix} 3 & 4 \\ -2 & 5 \end{pmatrix}$

Answer(d) $\frac{1}{23}\begin{pmatrix} 3 & 4 \\ -2 & 5 \end{pmatrix}$ [2]

20 $f(x) = 4(x + 1)$ $g(x) = \frac{x^3}{2} - 1$

(a) Write down the value of x when $f^{-1}(x) = 2$.

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

(b) Find $fg(x)$. Give your answer in its simplest form.

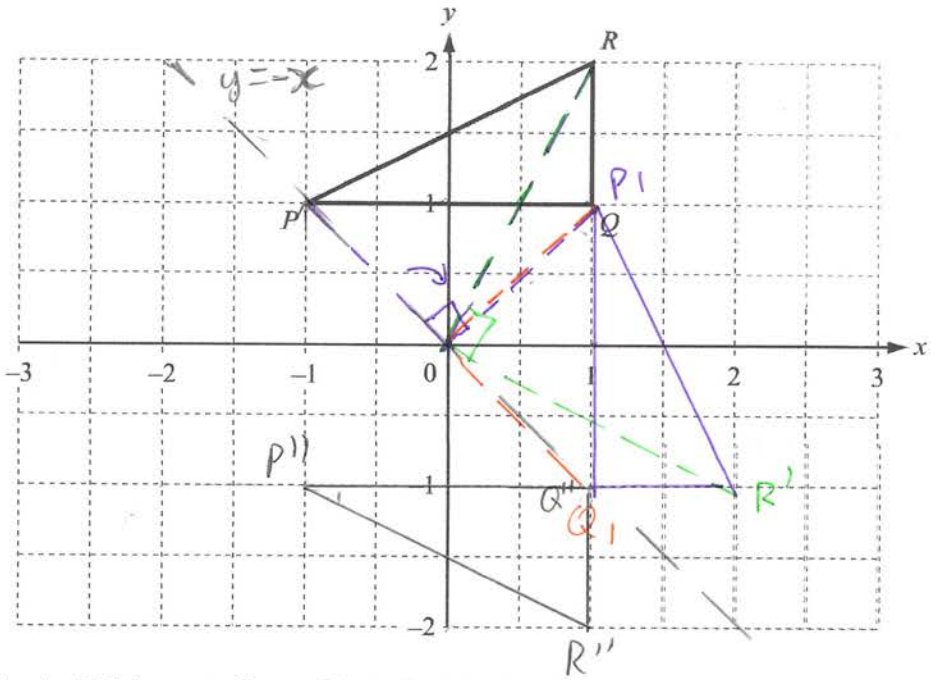
Answer(b) $fg(x) =$ ..... [2]

(c) Find $g^{-1}(x)$.

Answer(c) $g^{-1}(x) =$ ..... [3]

Question 21 is printed on the next page.

21



The triangle PQR has co-ordinates $P(-1, 1)$, $Q(1, 1)$ and $R(1, 2)$.

(a) Rotate triangle PQR by 90° clockwise about (0, 0).
Label your image $P'Q'R'$. [2]

(b) Reflect **your triangle** $P'Q'R'$ in the line $y = -x$.
Label your image $P''Q''R''$. [2]

(c) Describe fully the **single** transformation which maps triangle PQR onto triangle $P''Q''R''$.

Answer(c) Reflection on the x axis or y=0 [2]