

CANDIDATE NAME

**CENTRE** 

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

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NUMBER			NUMBER		

Paper 4 (Extended)

**MATHEMATICS** 

October/November 2012

2 hours 30 minutes

0580/41

Candidates answer on the Question Paper.

Additional Materials: Electronic calculator

Mathematical tables (optional)

Geometrical instruments Tracing paper (optional)

**CANDIDATE** 

## **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.

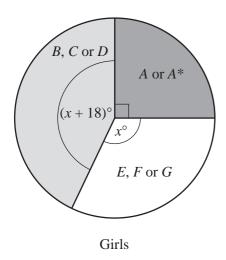
At the end of the examination, fasten all your work securely together.

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



 $A \text{ or } A^*$ E, F or GB, C or D

Boys

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.

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

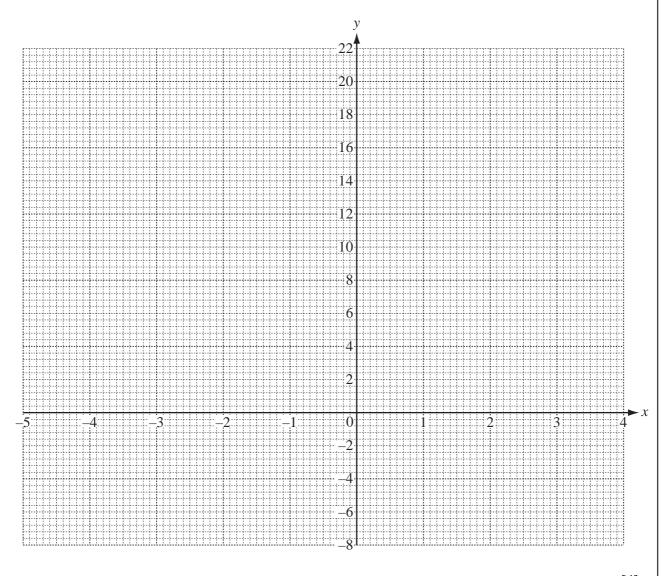
- (c) There were 140 girls and 180 boys.
  - (i) Calculate the percentage of students (girls and boys) who achieved grades A or  $A^*$ .

$$Answer(c)(i) \qquad \qquad \% \quad [3]$$

	(ii)	How many more boy	s than girls achie	eved grades B, (	C or <i>D</i> ?	120	Co
				Answ	er(c)(ii)		[2]
(d)		table shows informat r mathematics examina		mes, t minutes,	, taken by 80 of	the girls to comple	ete
	Tiı	me taken (t minutes)	$40 < t \le 60$	$60 < t \le 80$	$80 < t \le 120$	$120 < t \le 150$	
	Fre	equency	5	14	29	32	
	<b>(1)</b>		0.1	. 1 1 1	00 11	11	
	(i)	Calculate an estimate	of the mean tim	ie taken by these	e 80 giris to comp	olete the examination	on.
				Answ	ver(d)(i)	min	[4]
	(ii)	On a histogram, the h	eight of the colu	umn for the inter	rval $60 < t \le 80$	is 2.8 cm.	
		Calculate the heights <b>Do not draw the his</b>		ee columns.			
		Answe	<i>er(d)</i> (ii) 40 <	$t \le 60 \text{ column } 1$	neight =	cm	
			80 < t	≤ 120 column l	neight =	cm	
			120 < <i>t</i>	≤ 150 column l	height =	cm	[4]

Comple	ete the t	able of	values f	or v=	$\frac{4}{1}$	$r^2 - 7r$				mm.	DahaCa	For iner's
	_5	_4	-3	-2	2	x - 7x.	1	2	3	4	100	Bridge iner's
y	-2.5	12	16.5		7.5	0		-6	1.5		_	COM
									•		[3]	

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



[4]

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

[3]

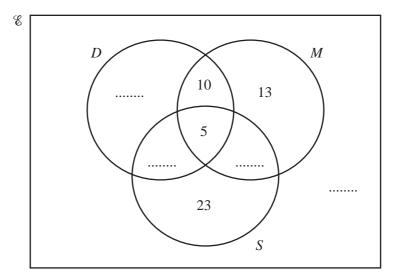
(c)	By drawing	a suitable tangent,	calculate an	estimate of the	e gradient o	of the graph	where $\hat{x}$
( )	Dy diawing	a samatic tangent,	carcarate an	estimate of the	e gradient (	or the graph	WIICI C A

where x For iner's

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

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

- 3 90 students are asked which school clubs they attend.
  - $D = \{ \text{students who attend drama club} \}$
  - $M = \{$ students who attend music club $\}$
  - $S = \{ \text{ students who attend sports club} \}$
  - 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]
	 LJ

(ii) one club only?

- (c) Find
  - (i)  $n(D \cap M)$ ,

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

For iner's

(d)	One	e of the 90 students is chosen at random.		1	aCan.
	Fine	d the probability that the student		Ì	
	(i)	only attends music club,			
	(ii)	attends <b>both</b> music and drama clubs.	Answer(d)(i)		[1]
			Answer(d)(ii)		[1]
(e)	Two	o of the 90 students are chosen at random without	out replacement.		
	Fine	d the probability that			
	(i)	they both attend all three clubs,			
	(ii)	one of them attends sports club only and the o		sic club only.	[2]
			Answer(e)(ii)		[3]

## 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]

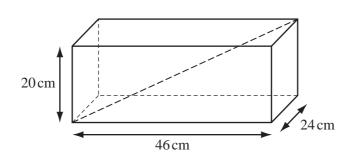
- **(b)** Simplify the expressions.
  - (i)  $(3xy^4)^3$

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

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

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

5 (a)



NOT TO

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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]
111151101	 OIII	رحا

**(b)** Maria has a fish tank with a volume of 20 000 cm<sup>3</sup>.

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

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

Calculate the dimensions of Lorenzo's fish tank.

(d) A sphere has a volume of 20 000 cm<sup>3</sup>. Calculate its radius.

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

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

Annon Ballacan For iner's

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

Answer(a)(i) [1]

(ii) Find | **b** |.

Answer(a)(ii) [2]

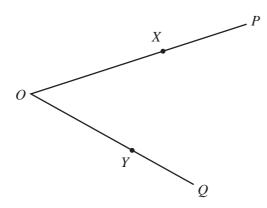
(iii)  $m\mathbf{a} + n\mathbf{b} = \mathbf{c}$ 

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

Answer(a)(iii) m =

n = [6]

**(b)** 



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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**.

<b>→</b>	
Answer(b)(i) PQ =	[1]
	 LJ

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

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

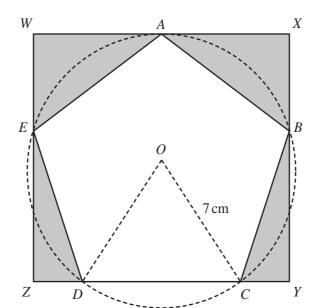
(iii) Complete the following sentences.

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

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  $DOC = 72^{\circ}$ ,

Answer(a)(i)

[1]

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(ii) angle  $DCB = 108^{\circ}$ ,

Answer(a)(ii)

[2]

(iii) angle  $CBY = 18^{\circ}$ .

Answer(a)(iii)

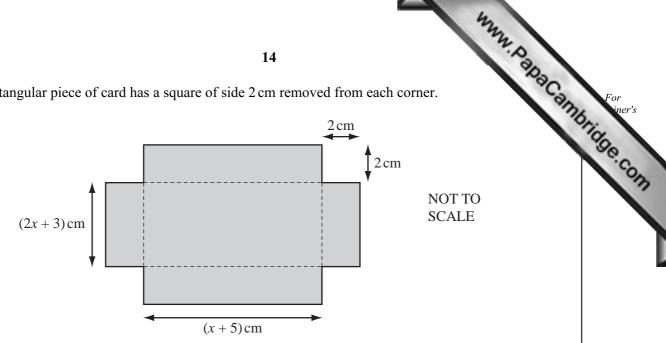
[1]

		e pentagon is 8.23 cm correct to three signal.	
		13 Ody	1
<b>(b)</b>	Show that the length <i>CD</i> of one side of the figures.	e pentagon is 8.23 cm correct to three sign	Cann
	Answer(b)		
			[3]
(c)	Calculate		
	(i) the area of the triangle <i>DOC</i> ,		
		Answer(c)(i) cm <sup>2</sup>	[2]
	(ii) the area of the pentagon <i>ABCDE</i> ,		
		Answer(c)(ii) cm <sup>2</sup>	[1]
	(iii) the area of the sector <i>ODC</i> ,		
	(iv) the length XY.	Answer(c)(iii) $cm^2$	[2]
		Answer(c)(iv) cm	[2]
(d)	Calculate the ratio	(2(1)	
(4)	area of the pentagon ABCDE: area	a of the rectangle WXYZ.	
	Give your answer in the form $1:n$ .		

*Answer(d)* 1:

[5]

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



(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]
miswer (u)	 CIII Uy	 CIII	14

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

Answer(b)

(	c)	(1)	Show all your working and give your answers correct to two decimal places.	di
				•
			Answer(c)(i) x =	[5]
		(ii)	Write down the length of the longest edge of the box.	
			Ancwar(c)(ii)	n [1]

Question 9 is printed on the next page.

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.

a distance of is approxim	un can be measured in astronomic 1 AU from the Sun. ately 1.496 × 10 <sup>8</sup> km.	cal units, AU.  Distance from the Sun in kilometres
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 × 10 <sup>9</sup>

(a)	Complete the table.	[3	-
( )	I	L <sup>-</sup>	-2

- **(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.

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

(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)	 ΑU	[2]

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