Cambridge
O Level

Cambridge International Examinations
Cambridge Ordinary Level

CANDIDATE NAME	
CENTRE NUMBER	
CANDIDATE NUMBER	

3875905395

MATHEMATICS (SYLLABUS D) **4024/22**

Paper 2 **May/June 2017**

2 hours 30 minutes

Candidates answer on the Question Paper.

Additional Materials: Geometrical instruments
Electronic calculator

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.

Section A
Answer **all** questions.

Section B
Answer any **four** questions.

If working is needed for any question it must be shown in the space below that question.
Omission of essential working will result in loss of marks.
You are expected to use an electronic calculator to evaluate explicit numerical expressions.
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, unless the question requires the answer in terms of π.

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 100.

DC (LK/FC) 157824/2

Section A [52 marks]

Answer **all** questions in this section.

1 (a)

FLIGHTS TO SYDNEY

Cost per person: $1199

ACCOMMODATION

Cost per adult per night: $55

Cost per child per night: $40

INSURANCE COVER FOR UP TO 20 DAYS

Cost per adult: $40 and Cost per child: $30

OR

Cost for family (2 adults and up to 4 children): $155

A family of 2 adults and 3 children travel to Sydney for a holiday lasting 14 nights.

Calculate the **lowest total cost** of the flight, accommodation and insurance for their holiday.

Answer $ ..... [3]

(b)

BONUS CARS

$42 per day for any mileage

VALUE CARS

$20 per day **and** $0.50 per mile

The family hires a car for 14 days and estimates their total mileage will be 750 miles.

Which company charges less for this hire and by how much?

Answer ..... by $ ..... [3]

2 The table below shows the population, given to the nearest thousand, of some countries.

Country	Population in 2014	Population in 2015
Pakistan	185 133 000	188 169 000
China	1 393 784 000	1 402 007 000
South Korea	49 512 000	49 765 000
Thailand	67 223 000	67 438 000

(a) In 2015, how much larger was the population of Pakistan than the population of South Korea?

Answer ..... [1]

(b) Which country had the smallest increase in population between 2014 and 2015?

Answer ..... [1]

(c) Write the population of South Korea in 2014 in standard form.

Answer ..... [1]

(d) Find the percentage increase in population of Pakistan from 2014 to 2015.

Answer ..... % [2]

(e) The population of Cambodia in 2015 was 15 677 000.

Given that the increase in population from 2014 to 2015 was 1.68%, calculate the population of Cambodia in 2014.

Give your answer correct to 3 significant figures.

Answer ..... [3]

3 Rowena spins two fair spinners, each numbered 1 to 4.
Her score is the value when the numbers on the two spinners are multiplied together.
The table shows some of Rowena's possible scores.

×	1	2	3	4
1	1	2	3	4
2	2	4		
3				
4				

(a) Complete the table of possible scores. [2]

(b) Find the probability that Rowena's score is less than 4.

Answer ..... [1]

(c) Find the probability that Rowena's score is an even number.
Give your answer as a fraction in its lowest terms.

Answer ..... [2]

(d) Phoebe says that Rowena's score is more likely to be a square number than a factor of 6.

Is she correct?
Show your working.

Answer

[2]

4 $\mathbf{A} = \begin{pmatrix} 3 & 2 \\ -4 & -2 \end{pmatrix}$ $\mathbf{B} = \begin{pmatrix} 5 & 3 \\ -2 & 1 \end{pmatrix}$ $\mathbf{C} = \begin{pmatrix} -2 \\ 1 \end{pmatrix}$

(a) Calculate $2\mathbf{B} - 3\mathbf{A}$.

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

(b) Calculate $\mathbf{BC}$.

Answer [2]

(c) Calculate $\mathbf{A}^{-1} + \mathbf{A}$.

Answer $\begin{pmatrix} & \\ & \end{pmatrix}$ [3]

5 **(a)** Express as a single fraction, as simply as possible, $\frac{1}{2x} + \frac{2}{5x}$.

Answer ..... [1]

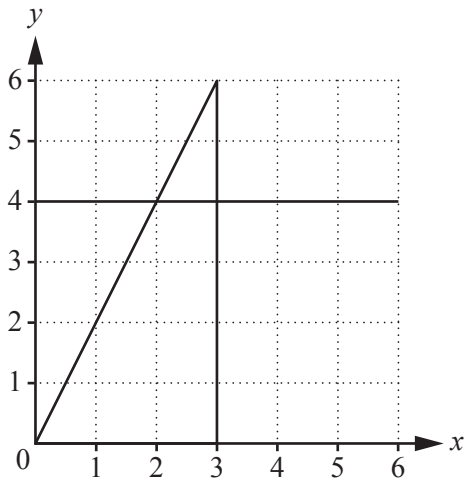
(b) Simplify $4(3x - 2y + 1) - (5x - 3y + 1)$.

Answer ..... [2]

(c) Solve $3x^2 - x - 5 = 0$, giving your answers correct to 2 decimal places.

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

(d)

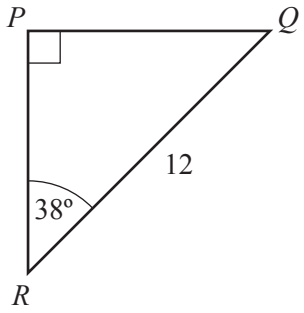


(i) Draw the graph of $x + 2y = 5$. [2]

(ii) Shade the region defined by these inequalities and label it R.

$x \leqslant 3$ $y \leqslant 4$ $y \leqslant 2x$ $x + 2y \geqslant 5$ [1]

6



Triangle PQR has a right angle at P, angle $PRQ = 38°$ and $RQ = 12\,\text{cm}$.

(a) Calculate PQ.

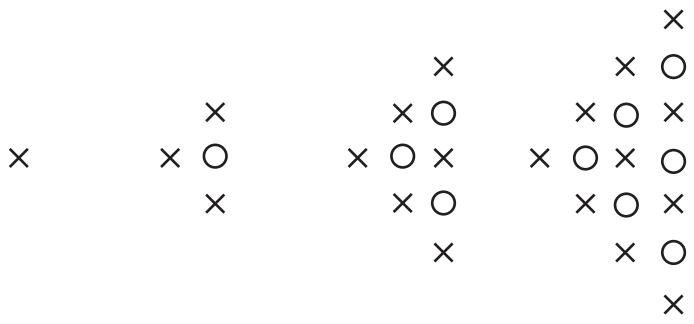
Answer ..... cm [2]

(b) S is a point such that angle PRS is a right angle and $QS = 10\,\text{cm}$.

Calculate the two possible values of angle QSR.

Answer ..... or ..... [4]

7



Pattern 1 Pattern 2 Pattern 3 Pattern 4 Pattern 5

The diagrams show patterns made from crosses (×) and circles (○).

(a) Draw pattern 5 above. [1]

The table shows the number of crosses and circles in each pattern.

Pattern number (n)	1	2	3	4	5	6
Number of crosses	1	3	6	10		
Number of circles	0	1	3	6		
Total number of crosses and circles	1	4	9	16	25	36

(b) Complete the table. [2]

(c) Find an expression, in terms of n, for the total number of crosses and circles in pattern n.

Answer ..... [1]

(d) An expression, in terms of n, for the number of crosses in pattern n is $\frac{1}{2}n^2 + \frac{1}{2}n$.

How many crosses are there in pattern 30?

Answer ..... [1]

(e) Show that the number of circles in pattern n is $\frac{1}{2}n^2 - \frac{1}{2}n$.

[1]

(f) The number of **crosses** in pattern m is equal to $5m$.

Find m.

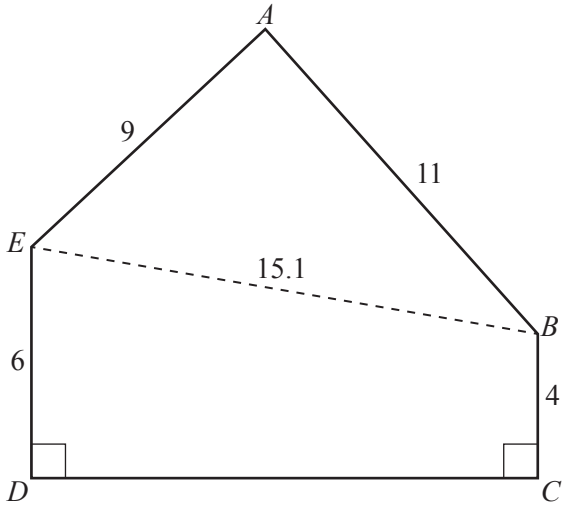
Answer $m =$ ..... [3]

Section B [48 marks]

Answer **four** questions in this section.

Each question in this section carries 12 marks.

8



ABCDE is the cross-section of a building.
All the lengths are given in metres.

(a) Calculate *DC*.

Answer ..... m [3]

(b) Calculate angle *EAB*.

Answer ..... [3]

(c) Calculate the area of the cross-section.

Answer ..... m^2 [4]

(d) A model of the building is made using the scale 1 : 50.

What is the area of the cross-section of the model?
Give your answer in square centimetres.

Answer ..... cm^2 [2]

9 A random number, x, is generated, where x is any real number.

(a) Manuel adds 2 to x.
He subtracts x from 10.
Manuel then multiplies these two results to give his number, y.

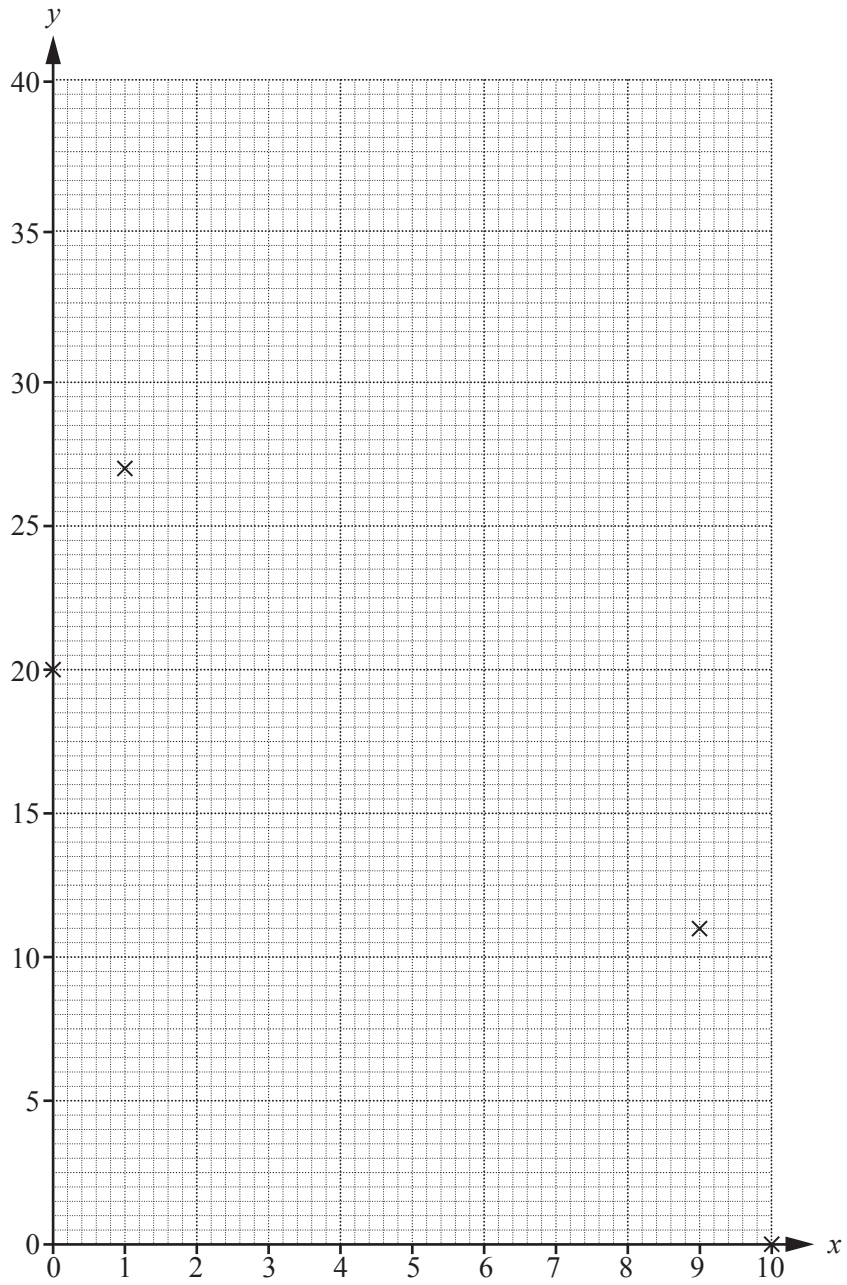
Show that $y = 20 + 8x - x^2$.

[2]

(b) On the grid opposite, draw the graph of $y = 20 + 8x - x^2$ for $0 \leqslant x \leqslant 10$.
Four points have been plotted for you. [4]

(c) On the same grid, draw a suitable line to find the value of Manuel's number, y, when it is the same as the random number, x.

Answer ..... [2]



(d) Jolene multiplies the random number, x, by 5 and then adds 2 to give her number, z.

Calculate the possible values of x when Manuel's number, y, and Jolene's number, z, are the same.

Answer $x =$ ..... or ..... [4]

10

The diagram shows the position of point A.
Point B is 8 cm from A on a bearing of 062°.
Point C is 6.5 cm from A on a bearing of 194°.

(a) (i) Find and label B and C. [3]

Point D is the point on BC that is the shortest distance from A.

(ii) Find and label D. [1]

(iii) Measure AD.

Answer ..... cm [1]

(iv) By taking measurements, find the ratio $CD : DB$.
Give your answer in the form $1 : n$.

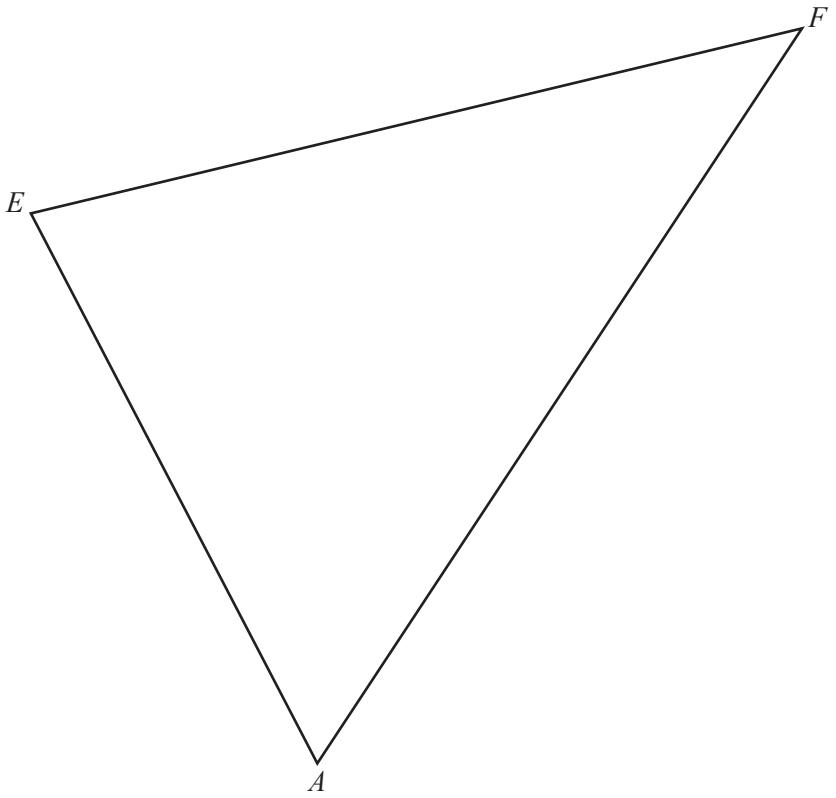
Answer 1 : ..... [2]

(v) The area of triangle ADB is w cm^2.

Giving your answer in terms of w, find the area of triangle ADC.

Answer ..... cm^2 [1]

(b)



The diagram shows the positions of A, E and F.

Construct and shade the region inside triangle AEF that is

- less than 6 cm from E
- nearer to AF than to AE
- nearer to A than to F. [4]

11 **(a)** The table below summarises the times taken by 50 athletes to run 400 m.

Time (t seconds)	$50 \leqslant t < 55$	$55 \leqslant t < 60$	$60 \leqslant t < 65$	$65 \leqslant t < 70$	$70 \leqslant t < 75$
Frequency	7	16	15	11	1

(i) State the modal class.

Answer ..... [1]

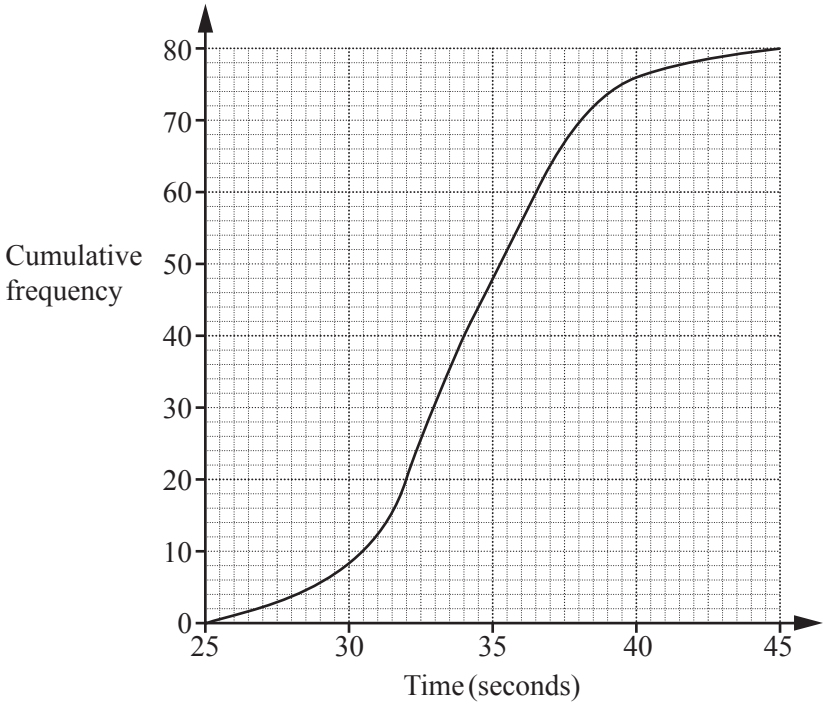
(ii) Calculate an estimate of the mean time taken by these athletes.

Answer ..... s [3]

(iii) Calculate the probability that an athlete chosen at random took less than 60 seconds to run the 400 m.

Answer ..... [2]

(b) The cumulative frequency curve summarises the times taken by 80 boys to run 200 m.



(i) Find the median time.

Answer ..... s [1]

(ii) Find the interquartile range.

Answer ..... s [2]

(iii) 60 girls also ran 200 m.

The girl who took the longest time ran 200 m in 40 seconds.
The girl who took the shortest time ran 200 m in 28 seconds.

The lower quartile for the boys and the girls is the same.
The interquartile range for the girls is 4 seconds.

Draw the cumulative frequency curve on the grid above. [3]

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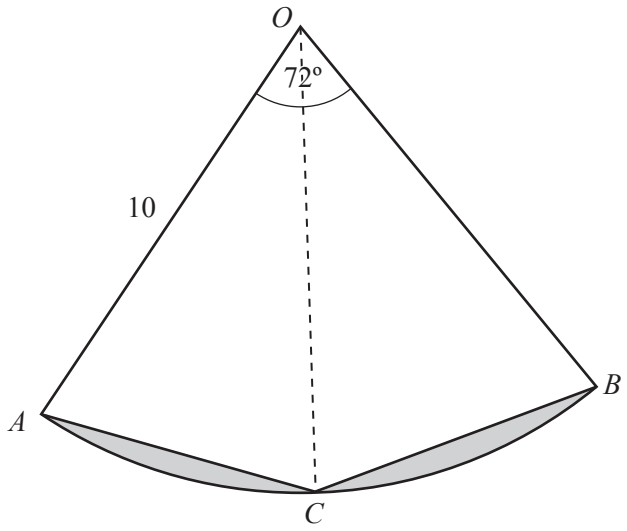


OAB is a sector of a circle, centre O, and radius 10 cm.
$A\hat{O}B = 72°$ and C is the point on the arc AB such that OC bisects $A\hat{O}B$.

(a) Calculate the perimeter of sector OAB.

Answer ..... cm [3]

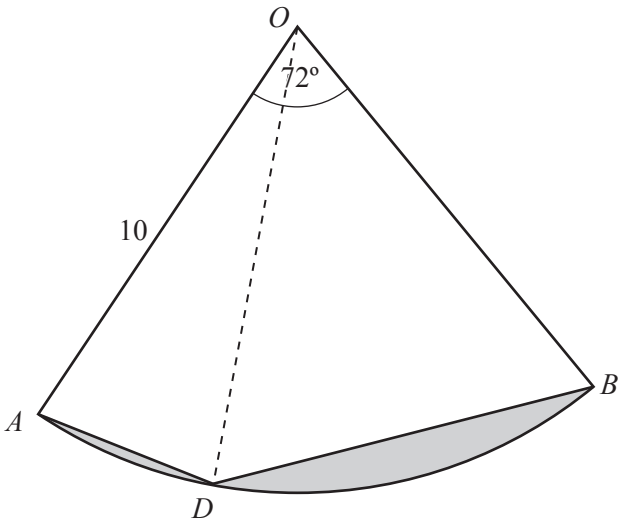
(b) (i) Calculate the area of sector OAB.

Answer ..... cm^2 [2]

(ii) Calculate the total shaded area.

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

(c)



D is the point on the arc AB such that $A\hat{O}D : D\hat{O}B = 1 : 2$.
Gavin says that the shaded area on this diagram is the same as the shaded area calculated in part **(b)(ii)**.

Is he correct? Show your working.

Answer

[4]

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