

MINISTRY OF EDUCATION, SINGAPORE  
in collaboration with  
UNIVERSITY OF CAMBRIDGE LOCAL EXAMINATIONS SYNDICATE  
General Certificate of Education Ordinary Level

**MATHEMATICS**

**4048/02**

Paper 2

**October/November 2017**

**2 hours 30 minutes**

Additional Materials: Answer Paper  
Graph paper (1 sheet)

**READ THESE INSTRUCTIONS FIRST**

Write your Centre number, index number and name on all the work you hand in.  
Write in dark blue or black pen on both sides of the paper.  
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.

Answer **all** questions.

If working is needed for any question it must be shown with the answer.

Omission of essential working will result in loss of marks.

The use of an approved scientific calculator is expected, where appropriate.

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, unless the question requires the answer in terms of  $\pi$ .

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 number of marks for this paper is 100.

This document consists of 11 printed pages and 1 blank page.



Singapore Examinations and Assessment Board

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CAMBRIDGE  
International Examinations

DC (LK/FD) 130020/3

[Turn over

Oct/Nov 2017 Paper 2 (1)

- 1 (a) Solve the inequality  $\frac{x+4}{5} \geq \frac{2-x}{3}$ . [2]
- (b) Express as a single fraction in its simplest form  $\frac{2y}{5-2y} - \frac{3y}{(5-2y)^2}$ . [2]
- (c) Simplify  $\frac{18h^3j^3}{5k^3} \div \frac{3h^5k}{10j^2}$ . [2]
- (d) Simplify  $\left(\frac{16f^8}{v^{12}}\right)^{-\frac{1}{4}}$ . [2]
- (e) Solve the equation  $\frac{2}{x-2} + \frac{3}{x+4} = 1$ . [3]
- 
- 2 (a) In 2014, the number of passengers passing through Changi airport was  $5.41 \times 10^7$ .
- (i) Calculate the mean number of passengers passing through the airport each month.  
Give your answer in millions, correct to 3 significant figures. [2]
- (ii) The number of passengers passing through the airport in December 2014 was 5.09 million.  
Calculate the percentage of the year's passengers that passed through the airport in December 2014. [2]
- (b) In 2013, the number of people from Europe that visited Singapore was  $1.591 \times 10^6$ .  
In 2014, this number increased by 1.6%.  
Calculate the number of people from Europe that visited Singapore in 2014.  
Give your answer in standard form. [2]
- (c) From 2013 to 2014 the total number of international visitors decreased by 3.1%.  
In 2014, the total number was  $1.509 \times 10^7$ .  
Calculate the number of international visitors in 2013. [2]
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- 3 Answer the whole of this question on a sheet of graph paper.

A number of bacteria are introduced to a culture.

The number of bacteria,  $y$ , in the culture  $t$  hours after they are first introduced is given by the formula

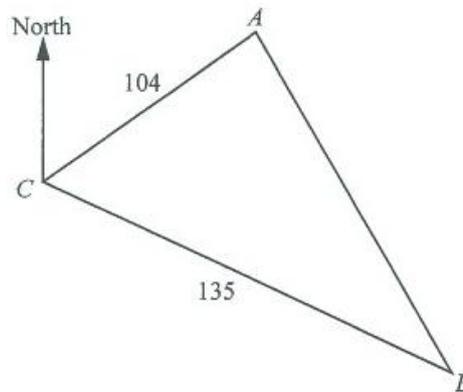
$$y = 50 \times 2^t.$$

The table shows some corresponding values of  $t$  and  $y$ , correct to 3 significant figures.

$t$	0.5	1	1.5	2	2.5	3	3.5	4
$y$	$p$	100	141	200	283	400	566	800

- (a) How many bacteria are introduced to the culture at the start? [1]
- (b) Calculate the value of  $p$ . [1]
- (c) Using a scale of 4 cm to represent 1 hour, draw a horizontal  $t$ -axis for  $0 \leq t \leq 4$ .  
Using a scale of 2 cm to represent 100 bacteria, draw a vertical  $y$ -axis for  $0 \leq y \leq 800$ .  
On your axes, draw a graph to show the number of bacteria in the culture for  $0 \leq t \leq 4$ . [3]
- (d) Use your graph to find how many hours it takes for the number of bacteria to reach 500. [1]
- (e) (i) By drawing a tangent, find the gradient of the curve at (2, 200). [2]
- (ii) What does this gradient represent? [1]
- 
- 4  $A$  is the point  $(-4, 10)$  and  $B$  is the point  $(4, -2)$ .
- (a) Find the length of the line  $AB$ . [2]
- (b) Find the equation of the line  $AB$ . [2]
- (c) The equation of line  $p$  is  $3x + 2y = 5$ .
- (i) Show how you can tell that the line  $p$  does **not** intersect the line  $AB$ . [2]
- (ii) The equation of line  $q$  is  $6y = 4x - 37$ .  
Find the coordinates of the point of intersection of the line  $p$  and the line  $q$ . [3]
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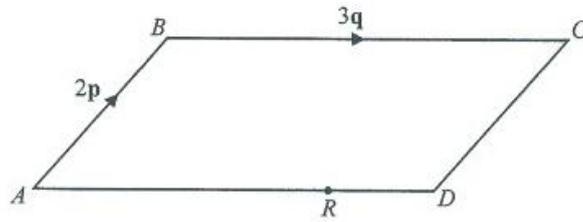
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Points  $A$ ,  $B$  and  $C$  are at sea level.  
 $A$  is 104 m from  $C$  on a bearing of  $064^\circ$ .  
 $B$  is 135 m from  $C$  on a bearing of  $122^\circ$ .

- (a) Calculate  $AB$ . [3]
- (b) Calculate the bearing of  $A$  from  $B$ . [3]
- (c) A boat,  $T$ , travels in a straight line from  $C$  to  $B$ .  
Calculate the shortest distance of  $T$  from  $A$  during this journey. [2]
- (d)  $C$  is a point at the base of a vertical cliff.  
 $D$  is the point on the top of the cliff vertically above  $C$ .  
The angle of depression of  $B$  from  $D$  is  $27^\circ$ .  
Calculate the height of the cliff. [2]

6



$ABCD$  is a parallelogram.

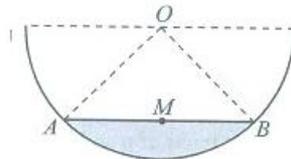
$\vec{AB} = 2\mathbf{p}$  and  $\vec{BC} = 3\mathbf{q}$ .

$R$  is the point on  $AD$  such that  $AR:RD = 2:1$ .

- (a) Express  $\vec{RC}$ , as simply as possible, in terms of  $\mathbf{p}$  and  $\mathbf{q}$ . [2]
- (b)  $S$  is a point on  $AD$  and  $T$  is a point on  $CD$  such that  $\vec{RC} = 2\vec{ST}$ .
- (i) Show that triangles  $RCD$  and  $STD$  are similar.  
Give a reason for each statement you make. [3]
- (ii) Find the ratio area triangle  $STD$ : area parallelogram  $ABCD$ . [2]
- (iii)  $Q$  is a point on  $BC$ .  
Triangle  $QAB$  is congruent to triangle  $RCD$ .  
Find  $\vec{QR}$ , as simply as possible, in terms of  $\mathbf{p}$  and  $\mathbf{q}$ . [2]

- 7 An open box is in the shape of a cuboid.  
The height of the box is 5 cm less than its length.  
The width of the box is twice its height.
- (a) Given that the length of the box is  $x$  cm, write down expressions, in terms of  $x$ , for the height and the width of the box. [2]
- (b) The external surface area of the open box is  $48 \text{ cm}^2$ .  
Write down an equation to represent this information and show that it simplifies to
- $$2x^2 - 15x + 13 = 0. \quad [3]$$
- (c) Solve the equation  $2x^2 - 15x + 13 = 0$ . [3]
- (d) Explain why one of the solutions in part (c) must be rejected as the length of the box. [1]
- (e) Calculate the volume of the box. [2]

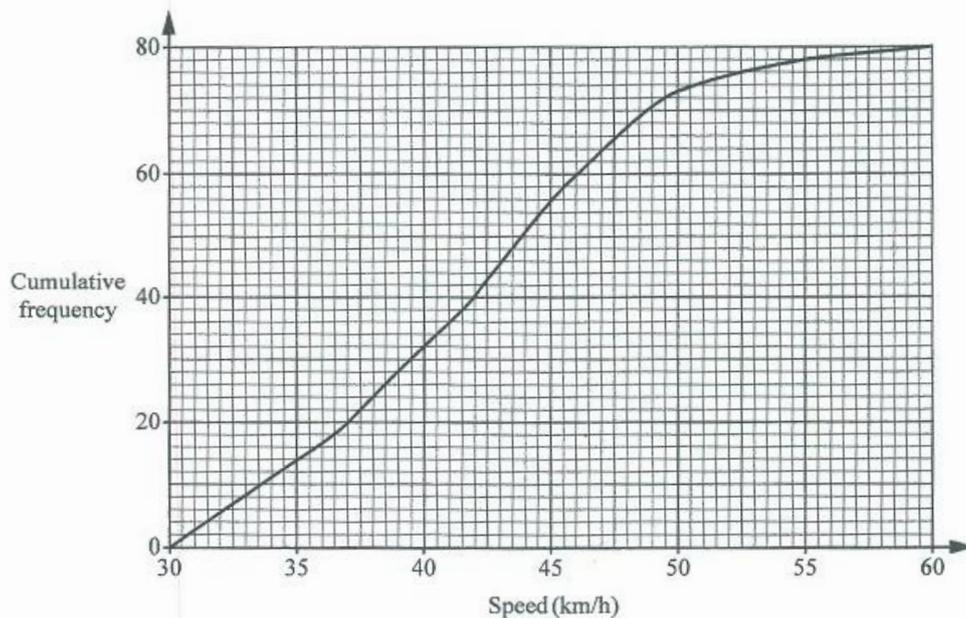
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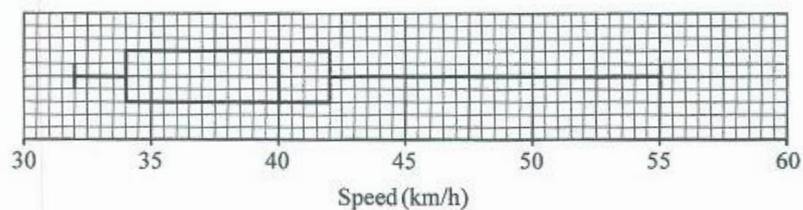
The diagram shows a semicircle, centre  $O$ , radius 30 cm.  
 $M$  is the midpoint of the chord  $AB$ .  
 $OM = 20$  cm.

- (a) Show that angle  $AOB = 96.4^\circ$ , correct to 3 significant figures. [2]
- (b) Calculate the shaded area. [4]
- (c) The semicircle is the cross-section of a water trough of length 1.5 m, standing on level ground. The shaded area represents the water in the trough.
- (i) Calculate the volume of water, in  $\text{cm}^3$ , in the trough. [2]
- (ii) Calculate the number of litres of water that must be added to fill the trough.  
Give your answer correct to the nearest 10 litres. [3]

- 9 (a) The speeds of 80 cars passing a checkpoint one morning were recorded.  
The cumulative frequency curve below shows the distribution of the speeds.



- (i) Use the curve to estimate
- (a) the median speed, [1]
  - (b) the interquartile range of the speeds. [2]
- (ii) The speed limit on the road is 50 km/h.  
Estimate the percentage of the cars that exceeded the speed limit. [2]
- (iii) The speeds of 80 cars passing the same checkpoint in the afternoon were also recorded.  
The box-and-whisker plot shows the distribution of the speeds.



Make two comments comparing the speeds of the cars in the morning and in the afternoon. [2]

(b) The table summarises the number of passengers in each of the cars in the morning.

Number of passengers	0	1	2	3	4
Number of cars	34	17	13	11	5

(i) One of the cars is selected at random.

Find the probability that it has no passengers. [1]

(ii) Two of the cars are selected at random.

Find, as a fraction in its simplest form, the probability that

(a) they both had four passengers, [2]

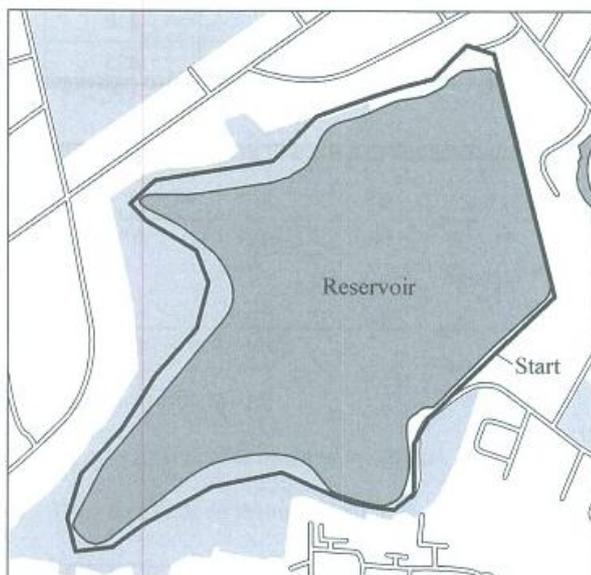
(b) one had more than two passengers and the other had fewer than two passengers. [2]

- 10 Nurul is planning a weekly exercise routine.  
She has read the following health advice:

Time: For optimal health benefits, aim to accumulate 150 minutes of moderate-intensity or 75 minutes of vigorous-intensity aerobic activity each week. Some individuals may need to accumulate 250 minutes a week to prevent weight gain.

1 minute of vigorous-intensity aerobic activity = 2 minutes of moderate-intensity aerobic activity, e.g. 10 minutes of jogging = 20 minutes of brisk walking

She plans to go for three brisk walks each week.  
The map shows her planned route around her local reservoir.



Scale: 1:20 000

Key  
— Nurul's route

- (a) Estimate the length of Nurul's route. [2]  
(b) Nurul aims to walk at 6.5 km/h.

Does Nurul meet the weekly time target recommended in the health advice if she walks at this speed?  
Show how you decide. [2]

- (c) To use more calories during the exercise, Nurul decides to jog the same route three times each week instead of walking.  
Nurul weighs 70 kg and she estimates that her jogging speed will be 9.5 km/h.  
She finds the following information on the internet.

Approximate calories used during 30 minutes of exercise

	Body weight			
	60 kg	70 kg	80 kg	90 kg
Walking 5 km/h	105	120	135	150
Walking 6.5 km/h	130	150	170	190
Jogging 8 km/h	240	280	315	350
Jogging 9.5 km/h	300	345	390	435

Nurul thinks that she will meet the target for time and that she will use more than double the amount of calories.

Is Nurul correct?  
Justify your decision with calculations.

[6]