

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 2016

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

[Turn over

Oct/Nov 2016 Paper 2 (I)

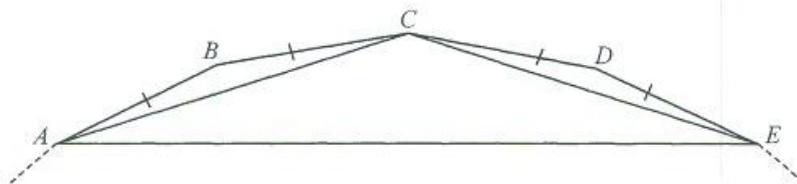
- 1 (a) It is given that  $a = \frac{4b-5c}{b+c}$ .
- (i) Find  $a$  when  $b = 5$  and  $c = -2$ . [1]
- (ii) Express  $b$  in terms of  $a$  and  $c$ . [2]
- (b) Solve the equation  $\frac{2x-3}{4} + \frac{x}{3} = 3$ . [2]
- (c) Solve these simultaneous equations.
- $$\begin{aligned} 4x - 3y &= 18 \\ 6x + 2y &= 1 \end{aligned}$$
- [3]
- (d) Simplify  $\frac{9x^2-4}{3x^2-10x-8}$ . [3]

- 2 Yvette is a French tutor.  
She offers sessions for basic and advanced students on weekdays and at weekends.  
Each student has a 12-week block of sessions with one session per week.  
The matrix  $L$  shows the number of students she tutors each week in one 12-week block.

$$L = \begin{matrix} & \begin{matrix} \text{Basic} & \text{Advanced} \end{matrix} \\ \begin{pmatrix} 8 & 5 \\ 2 & 4 \end{pmatrix} & \begin{matrix} \text{Weekday} \\ \text{Weekend} \end{matrix} \end{matrix}$$

- (a) Evaluate the matrix  $M = 12L$ . [1]
- (b) Yvette charges \$40 for each basic session and \$65 for each advanced session.  
Represent the session charges in a  $2 \times 1$  column matrix  $N$ . [1]
- (c) Evaluate the matrix  $P = MN$ . [1]
- (d) State what the elements of  $P$  represent. [1]
- (e) Yvette wants to attract more students, so in the next 12-week block she reduces her prices by 5%.  
For this block of sessions, on weekdays she has 12 basic students and 6 advanced students.  
On weekends she has 7 basic students and 3 advanced students.  
Calculate the total amount of money she earns for this 12-week block of sessions. [3]

3



The diagram shows part of a regular  $n$ -sided polygon,  $ABCDE\dots$ .

(a) Explain why triangles  $ABC$  and  $CDE$  are congruent. [2]

(b) It is given that angle  $ABC = 160^\circ$ .

Find

(i) the value of  $n$ , [2]

(ii) angle  $BCA$ , [1]

(iii) angle  $DEA$ . [2]

4 The first four terms in a sequence of numbers are given below.

$$T_1 = 2^2 + 5 = 9$$

$$T_2 = 3^2 + 8 = 17$$

$$T_3 = 4^2 + 11 = 27$$

$$T_4 = 5^2 + 14 = 39$$

(a) Find  $T_5$ . [1]

(b) Explain why the value of  $T_n$  must be odd for all values of  $n$ . [1]

(c) Show that the  $n$ th term of the sequence,  $T_n$ , is given by  $n^2 + 5n + 3$ . [3]

(d)  $T_p$  and  $T_{p+1}$  are consecutive terms in the sequence.

Find and simplify an expression, in terms of  $p$ , for  $T_{p+1} - T_p$ . [3]

(e) Explain why two consecutive terms of the sequence cannot have a difference of 4. [1]

5 Answer the whole of this question on a sheet of graph paper.

The variables  $x$  and  $y$  are connected by the equation

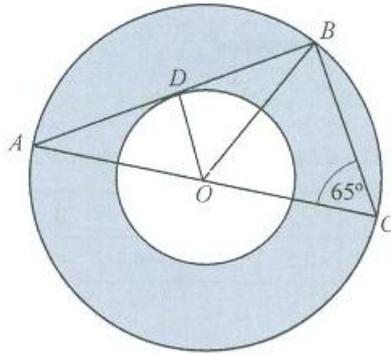
$$y = \frac{x^3}{2} - 5x - 2.$$

Some corresponding values of  $x$  and  $y$  are given in the table below.

$x$	-3	-2	-1	0	1	2	3	4
$y$	$p$	4	2.5	-2	-6.5	-8	-3.5	10

- (a) Find the value of  $p$ . [1]
- (b) Using a scale of 2 cm to represent 1 unit, draw a horizontal  $x$ -axis for  $-3 \leq x \leq 4$ .  
Using a scale of 1 cm to represent 2 units, draw a vertical  $y$ -axis for  $-10 \leq y \leq 12$ .  
On your axes, plot the points given in the table and join them with a smooth curve. [3]
- (c) The equation  $\frac{x^3}{2} - 5x = 8$  has only one solution.  
Explain how this can be seen from your graph. [2]
- (d) By drawing a tangent, find the gradient of the curve at  $(1, -6.5)$ . [2]
- (e) (i) On the same axes, draw the line  $y = 4 - 3x$  for  $-1 \leq x \leq 4$ . [2]  
(ii) Write down the  $x$ -coordinate of the point where this line intersects the curve. [1]  
(iii) This value of  $x$  is a solution of the equation  $x^3 + Ax + B = 0$ .  
Find the value of  $A$  and the value of  $B$ . [2]

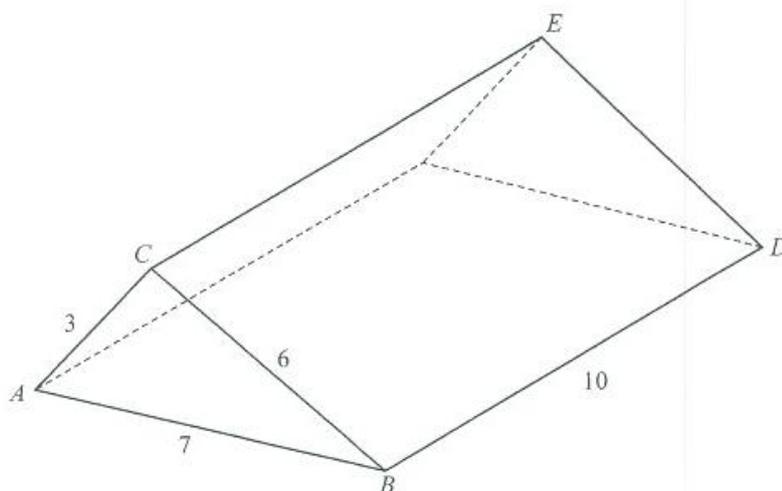
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The diagram shows two concentric circles, centre  $O$ .  
 $A$ ,  $B$  and  $C$  are points on the larger circle and  $D$  is a point on the smaller circle.  
 $ADB$  is a tangent to the smaller circle and angle  $BCO = 65^\circ$ .

- (a) Show that triangles  $ABC$  and  $ADO$  are similar.  
Give a reason for each statement you make. [2]
- (b) Find the ratio area of triangle  $BOC$  : area of triangle  $ADO$ . [2]
- (c) The radius of the smaller circle is 3 cm.  
Find the shaded area. [4]

- 7 A small business makes mugs with designs painted on them.
- (a) Some mugs are sold in a local shop, some in department stores and the rest are exported. The mugs are divided between the local shop, department stores and export in the ratio 3 : 7 : 5. One week, 140 more mugs are sent for export than to the local shop.
- Work out the total number of mugs made in the week. [2]
- (b) David and Maryam paint designs on the mugs.
- (i) David takes  $x$  seconds to paint one mug.
- Write an expression, in terms of  $x$ , for the number of mugs he paints in an hour. [1]
- (ii) Maryam takes 50 seconds less than David to paint one mug.
- Write an expression, in terms of  $x$ , for the number of mugs she paints in one hour. [1]
- (iii) One morning, David and Maryam each work for 4 hours. Altogether they paint a total of 68 mugs.
- Write down an equation in  $x$  to represent this information and show that it reduces to
- $$17x^2 - 8050x + 180\,000 = 0. \quad [3]$$
- (iv) Solve the equation  $17x^2 - 8050x + 180\,000 = 0$ . [3]
- (v) Find the number of mugs Maryam paints in one hour. [2]



The diagram shows a solid triangular prism with three rectangular faces.  
 $AB = 7$  cm,  $AC = 3$  cm,  $BC = 6$  cm and  $BD = 10$  cm.

- (a) Show that angle  $BAC = 58.4^\circ$ , correct to 1 decimal place. [3]
- (b) Calculate the surface area of the prism. [3]
- (c) Calculate the vertical distance of  $C$  above  $AB$ . [2]
- (d) Calculate the angle of elevation of  $E$  from  $A$ . [4]

- 9 (a) A group of 20 students were asked how many minutes they had taken to complete an assignment. The results are shown in the stem-and-leaf diagram.

2	4	5	5	7	7	7	8	8	9
3	1	2	2	2	3	7			
4	4	6	7	8					
5									
6	9								

Key: 3 | 2 means 32 minutes

- (i) The teacher expected the assignment to take 30 minutes.  
Find the percentage of students who took longer than expected. [1]
- (ii) Find the median time. [1]
- (iii) Explain why the mean may not be an appropriate average to use to summarise the times taken by these students. [1]
- (iv) Find the standard deviation of the times. [1]
- (v) The standard deviation of the times taken by a second group of students to complete the same assignment was 8.64 minutes.  
Use this information to comment on one difference between the two distributions. [1]
- (b) A bag contains 9 white balls, 5 red balls and 2 black balls.  
Two balls are taken from the bag without replacement.
- (i) Draw a tree diagram to show the probabilities of the possible outcomes. [2]
- (ii) Find, as a fraction in its simplest form, the probability that
- (a) the two balls are the same colour, [2]
- (b) at least one of the balls is white. [2]

- 10 Peter produces the newsletter for a sports club.  
Each newsletter is printed in black on both sides of four sheets of A4 paper.  
Peter posts the newsletter to subscribers 6 times each year.
- Information that Peter needs is on the opposite page.
- Peter uses a C5 envelope to post the newsletter. He finds that a C5 envelope containing 4 sheets of A4 paper weighs approximately 25 g.
- (a) How much will it cost to post one copy of the newsletter? [1]
- He estimates that there will be 150 subscribers to the newsletter.
- (b) How many toner cartridges will Peter need to print the newsletters for one year? [2]
- Peter needs to decide how much he should charge subscribers for the newsletter.  
He must make sure that he charges enough money to cover all of his costs.
- (c) Suggest a sensible amount for him to charge for a one-year subscription to the newsletter.  
Justify the decision you make and show your calculations clearly. [7]



**LOCAL MAIL RATES** (inclusive of 7% GST)

For Letters, Postcards, Printed Papers and Packets/Packages

Weight Step Up To	Standard Mail	Non-Standard Mail
<b>Regular</b>		
20g	\$0.30	\$0.60
40g	\$0.37	
<b>Large</b>		
100g	\$0.60	\$0.90
250g	\$0.90	\$1.15
500g	\$1.15	\$1.70
1 kg	\$2.55	
2 kg	\$3.35	

**Standard regular mail**  
(C5, C6 and DL size envelope)

**Standard large mail**  
(up to C4 size envelope)

**Stationery supplies (costs excluding 7% GST)**

Item	Description	Unit cost
A4 paper	White printer paper	
	Pack of 500 sheets	\$3.90
	Bulk price (10+ packs)	\$3.50
	Bulk price (30+ packs)	\$3.30
Toner cartridges	Black printing Average yield 1300 pages	\$147.00
	Colour printing Cyan/yellow/magenta cartridges Average yield 1000 pages	\$151.00
C5 envelopes	White self-seal envelopes	
	Pack of 10 Pack of 500	\$1.50 \$34.00