

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

MATHEMATICS

4016/02

Paper 2

October/November 2014

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 π , use either your calculator value or 3.142, unless the question requires the answer in terms of π .

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 10 printed pages and 2 blank pages.



Singapore Examinations and Assessment Board

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[Turn over

Oct/Nov 2014 Paper 2 (1)

Answer all the questions.

- 1 (a) Solve the inequality $\frac{4-5x}{2} > \frac{4x+1}{4}$. [2]
- (b) It is given that $W = \frac{1}{2}m(v^2 - u^2)$.
- (i) Find W when $m = 3$, $u = 4$ and $v = 10$. [1]
- (ii) Express u in terms of W , m and v . [2]
- (c) Simplify $\frac{8xy + 2x^2}{x^2 - 16y^2}$. [2]
- (d) Solve the equation $\frac{4}{x+3} + \frac{3}{x-2} = 1$. [3]

- 2 The table shows the electricity consumption, in gigawatt hours (GWh), in Singapore in 2010.

Domestic	Manufacturing	Other Industries	TOTAL
7304.5	16693.0	17202.3	41199.8

- (a) Convert the total amount of electricity consumed into kilowatt hours (kWh).
Give your answer in standard form correct to 3 significant figures. [2]
- (b) Calculate the percentage of the total that was consumed by manufacturing. [2]
- (c) The population of Singapore in 2010 was 5.077 million.
Calculate the average amount of domestic electricity consumed per person.
Give your answer to the nearest kWh. [2]
- (d) The amount of electricity consumed by other industries in 2009 was 13628.0 GWh.
Calculate the percentage increase in electricity consumption by other industries from 2009 to 2010. [2]
- (e) From 2000 to 2010, the amount of domestic electricity consumption increased by 27.6%.
Calculate the domestic electricity consumption in 2000.
Give your answer to the nearest GWh. [2]

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

The variables x and y are connected by the equation

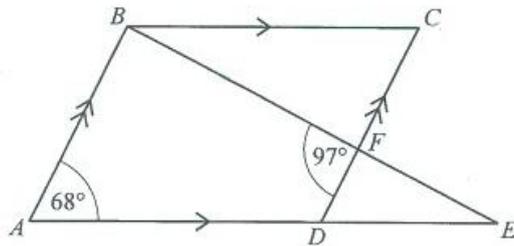
$$y = \frac{x}{5}(2 + 4x - x^2).$$

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

x	-3	-2	-1	0	1	2	3	4	5
y	p	4	0.6	0	1	2.4	3	1.6	-3

- (a) Find the value of p . [1]
- (b) Using a scale of 2 cm to represent 1 unit, draw a horizontal x -axis for $-3 \leq x \leq 5$.
Using a scale of 1 cm to represent 1 unit, draw a vertical y -axis for $-4 \leq y \leq 12$.
On your axes, plot the points given in the table and join them with a smooth curve. [3]
- (c) Use your graph to find the solutions of $\frac{x}{5}(2 + 4x - x^2) = 2$. [2]
- (d) By drawing a tangent, find the gradient of the curve at the point $(-2, 4)$. [2]
- (e) (i) On the same axes, draw the line $3y = 2x - 6$ for $-3 \leq x \leq 5$. [2]
(ii) Write down the coordinates of the point where the line intersects the curve. [1]

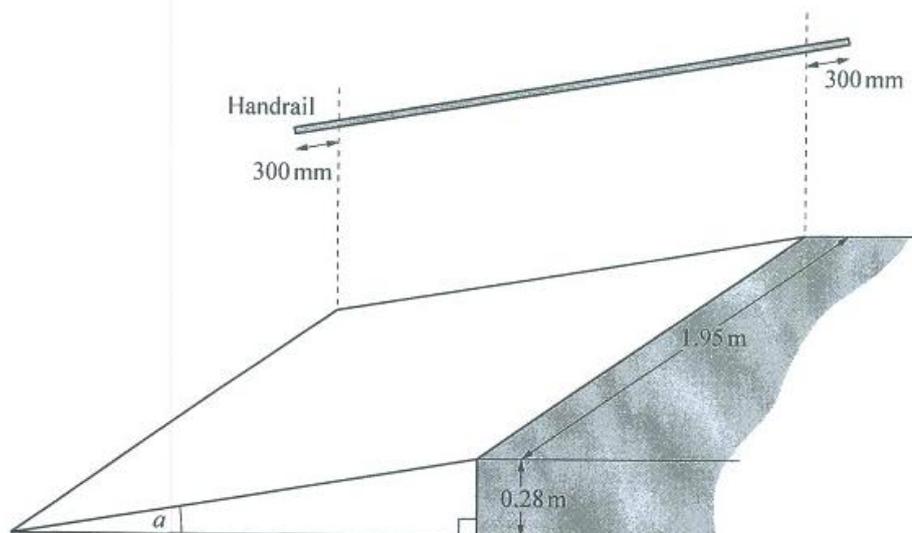
4



The diagram shows a parallelogram $ABCD$ with AD produced to E .
 F is the point of intersection of CD and BE .
 Angle $BAD = 68^\circ$ and angle $BFD = 97^\circ$.

- (a) Find angle ABF . [1]
- (b) Show that triangles BCF and EDF are similar. [2]
- (c) State another triangle that is similar to BCF and EDF . [1]
- (d) The ratio $AD:DE = 3:2$.
- (i) Find the ratio $AB:CF$. [1]
- (ii) Given that the area of triangle $EDF = 9.72 \text{ cm}^2$, find the total area of the shape $ABCFE$. [3]
-
- 5 (a) The position vector of point A is $\begin{pmatrix} 1 \\ 5 \end{pmatrix}$ and the position vector of point B is $\begin{pmatrix} -5 \\ -2 \end{pmatrix}$.
- (i) Find the column vector \vec{AB} . [1]
- (ii) Find $|\vec{AB}|$. [2]
- (iii) Given that $\vec{BA} = 2\vec{AC}$, find the coordinates of point C . [2]
- (b) The point P has coordinates $(8, -2)$ and $\vec{PQ} = \begin{pmatrix} 4 \\ -3 \end{pmatrix}$.
- (i) Find the equation of the line PQ . [2]
- (ii) The equation of the line RS is $2y - 4x = 19$.
 Find the coordinates of the point of intersection of PQ and RS . [3]
-

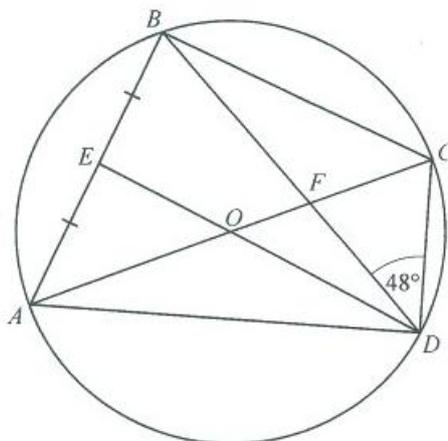
6



There is a vertical step 0.28 m high on horizontal ground at the entrance to a building.
 The width of the step is 1.95 m.
 A ramp in the shape of a prism is to be installed so that wheelchairs can enter the building.
 The gradient of the ramp is such that the ratio vertical distance : horizontal distance is 1 : 12.

- (a) Show that the angle, a , of the ramp is 4.76° , correct to 3 significant figures. [1]
- (b) The ramp is to be made of concrete.
 When it is set, the mass of 1 m^3 of concrete is 2300 kg.
 Calculate the mass of the completed ramp. [4]
- (c) A handrail is to be positioned on the wall, parallel to the ramp.
 The handrail must extend 300 mm at both ends of the ramp.
 Calculate the total length, in metres, of the handrail. [3]

7 (a)

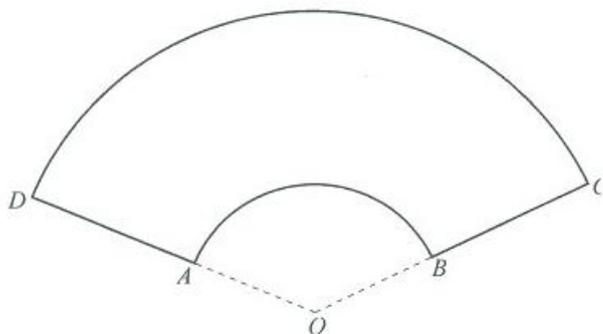


The diagram shows a circle $ABCD$, centre O .
 E is the midpoint of the chord AB . ED passes through O .
 F is the point of intersection of BD and diameter AC .
 Angle $BDC = 48^\circ$.

Find, giving reasons for each answer,

- (i) angle BAC , |1|
- (ii) angle BCA , |1|
- (iii) angle AOD , |2|
- (iv) angle AFB . |2|

(b)

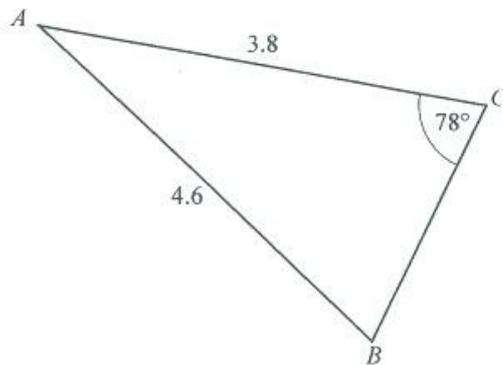


The diagram shows a mirror $ABCD$.
 AB and DC are arcs of circles centre O with radii 20 cm and 50 cm respectively.
 The perimeter of the mirror is 235 cm.

- (i) Calculate the angle AOB in radians. |2|
- (ii) Calculate the area of the mirror. |2|

- 8 Daniel went on a journey of 90 km.
- (a) Daniel took x minutes to drive the first 40 km at a constant speed.
Write down an expression, in terms of x , for his speed in km/h for the first 40 km. [1]
- (b) It took Daniel $(x + 15)$ minutes to drive the rest of the distance at a different constant speed.
Write down an expression, in terms of x , for his speed in km/h for this part of the journey. [1]
- (c) Daniel's speed for the first part of the journey was 9 km/h faster than for the second part.
Write down an equation in x to represent this information, and show that it reduces to
- $$3x^2 + 245x - 12000 = 0. \quad [3]$$
- (d) Solve the equation $3x^2 + 245x - 12000 = 0$, giving your solutions correct to 2 decimal places. [4]
- (e) Calculate Daniel's average speed, in km/h, for the whole journey. [3]
-

9



The diagram shows a triangular flower bed ABC on horizontal ground. $AB = 4.6$ m, $AC = 3.8$ m and angle $ACB = 78^\circ$.

(a) Calculate

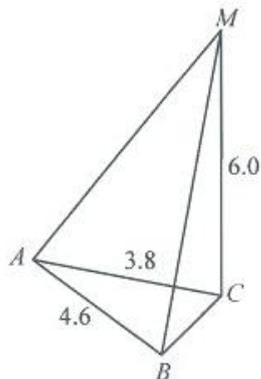
(i) angle ABC ,

[2]

(ii) the area of the flower bed.

[2]

(b)



The base of a vertical flagpole, CM , is at vertex C of the flower bed. The flagpole is held in place by two cables, AM and BM . $CM = 6.0$ m.

(i) Show that $AM = 7.10$ m, correct to 2 decimal places.

[1]

(ii) Given that $BM = 6.95$ m, find the angle of elevation of M from B .

[2]

(iii) Find angle AMB , the angle between the two cables.

[3]

10 (a) The table below summarises the times taken by 100 males to complete a 10 km race.

Time (t minutes)	$30 \leq t < 40$	$40 \leq t < 50$	$50 \leq t < 60$	$60 \leq t < 70$	$70 \leq t < 80$
Frequency	15	32	30	16	7

- (i) What percentage of the males ran faster than 10 km/h? [1]
 - (ii) Calculate an estimate of
 - (a) the mean time, [1]
 - (b) the standard deviation. [2]
 - (iii) The mean time for females to complete the race was 58.3 minutes and the standard deviation was 9.6 minutes.
 - Make two comparisons between the times for males and the times for females. [2]
- (b) In a class of 25 children, there are 13 boys and 12 girls.
Two of the children are selected at random to represent the class at a conference.
- (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) two girls are selected, [1]
 - (b) one boy and one girl are selected. [2]