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 2011

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 a pencil for any diagrams or graphs.
Do not use staples, paper clips, highlighters, glue or correction fluid.

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.
Calculators should be used 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 **11** printed pages and **1** blank page.

Singapore Examinations and Assessment Board

UNIVERSITY of CAMBRIDGE
International Examinations

DC (LEO/DJ) 27959/7

[Turn over

Oct/Nov 2011 Paper 2 (1)

Answer **all** the questions.

1 (a) Solve the equation

$$\frac{2x + 7}{3} = \frac{3 - x}{5}.$$ [2]

   (b) Given that $xy = 2(x + 3)$, express x in terms of y. [2]

   (c) Express as a single fraction in its simplest form

$$\frac{4}{x - 2} + \frac{2}{2x + 1}.$$ [2]

   (d) Simplify $\dfrac{4x^2 - y^2}{2x^2 + xy}$. [2]

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2 (a) (i) A car uses 15.75 litres of fuel to travel a distance of 250 km.

            Giving your answer in litres per 100 km, calculate the fuel consumption of the car. [2]

      (ii) Anne's car has a fuel consumption of 8.2 litres per 100 km.

            (a) Calculate the distance she can travel on a full tank of 60 litres. [1]

            (b) Petrol costs $1.65 per litre.

                 Calculate how much, correct to the nearest cent, the petrol will cost Anne for a journey of 120 km. [2]

   (b) Ben inherits some money.
        He divides the money between education, holiday and savings in the ratio $3 : 4 : 5$ respectively.

      (i) He puts $1000 into savings.

           Calculate the total amount of money he inherits. [2]

      (ii) He puts the $1000 savings into an account paying compound interest of 3.5% per annum.

            Calculate the total amount of money, correct to the nearest cent, in his account after 5 years. [2]
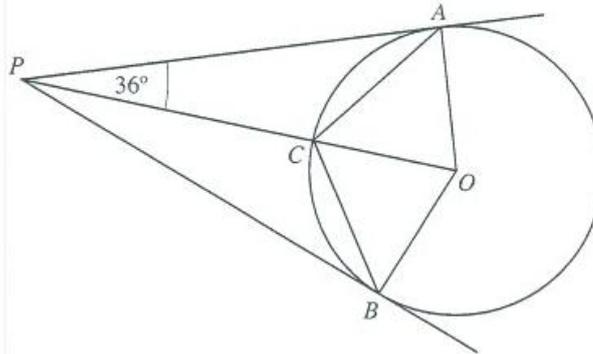
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3 (a)

The diagram shows part of a regular polygon.

How many sides does the polygon have? [2]

(b)

The diagram shows a circle ABC, with centre O.
AP and BP are tangents to the circle.
Angle $APO = 36°$.

(i) Find

    (a) angle AOP, [1]

    (b) angle OBC, [1]

    (c) angle ACB. [1]

(ii) Given that the radius of the circle is 6 cm, find the area of quadrilateral $AOBP$. [3]

4 The width of a solid rectangular block is 3 cm less than its length.
Its height is 1 cm more than its length.

(a) Given that the length of the block is x cm, write down an expression, in terms of x, for the total surface area of the block. [2]

(b) The total surface area of the block is 500 cm².

Write down an equation to represent this information and show that it simplifies to

$$3x^2 - 4x - 253 = 0.$$ [3]

(c) Solve the equation $3x^2 - 4x - 253 = 0$, giving your solutions correct to 2 decimal places. [4]

(d) Find the height of the block. [1]

5 (a) The nth term of a sequence is given by $T_n = \dfrac{n(n+1)}{4}$.

(i) Use the formula to find T_{20}. [1]

(ii) Which term of the sequence has value 33? [2]

(b) p is a positive integer.

(i) Explain why $(2p + 1)$ is an odd number. [1]

(ii) Write down an expression for the next odd number which is greater than $(2p + 1)$. [1]

(iii) Find and simplify expressions for the squares of these two odd numbers. [2]

(iv) Hence explain why the difference between the squares of two consecutive odd numbers is always a multiple of 8. [1]

6
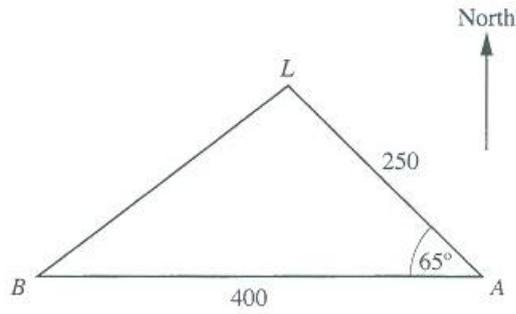
The base, *L*, of a lighthouse is at sea level.
Yacht *A* is 250 m from *L*.
Yacht *B* is 400 m due west of yacht *A*.
Angle *LAB* = 65°.

(a) Calculate

    (i) *LB*,   [3]

    (ii) the area of triangle *LAB*,   [2]

    (iii) angle *LBA*,   [3]

    (iv) the bearing of *B* from *L*.   [1]

(b) The angle of elevation of the top of the lighthouse seen from *A* is 7°.

    Calculate the angle of elevation of the top of the lighthouse from *B*.   [3]

7 **(a)** The quantity of paint needed to cover the outside of a container is proportional to the square of the depth of the container.
When the depth is 50 cm, the quantity of paint needed is 150 ml.

Calculate

   (i) the quantity of paint needed when the depth is 70 cm, [2]

   (ii) the depth when the quantity of paint needed is 54 ml. [1]

(b) The diagram shows a pot which is part of a right circular cone of height 120 cm.
The open end of the pot is a circle of radius 36 cm.
The base of the pot is a circle of radius 24 cm.
The height of the pot is 40 cm.
The slant height of the pot is x cm.
[You may ignore any holes in the base of the pot.]
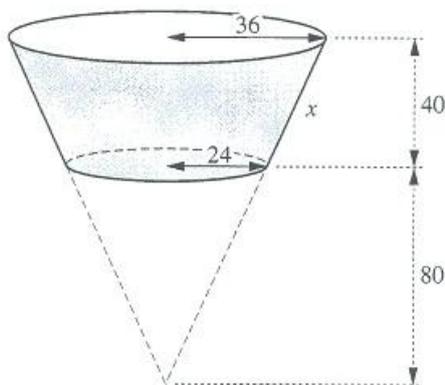
   (i) Show that $x = 41.8$, correct to 3 significant figures. [2]

   (ii) Calculate the total surface area of the outside of the pot. [3]

   (iii) Another pot is to be made with a volume twice the volume of this pot.

   Given that the two pots are geometrically similar, find the height of the larger pot. [2]

8 (a) P is the point $(3,4)$. Q is the point $(-1,2)$.

   (i)   Write down the column vector $\overrightarrow{PQ}$.   [1]

   (ii) Find $|\overrightarrow{PQ}|$.   [2]

   (iii) Given that $\overrightarrow{PL} = \frac{1}{2}\overrightarrow{PQ}$, find $\overrightarrow{PL}$.   [1]

   (b)
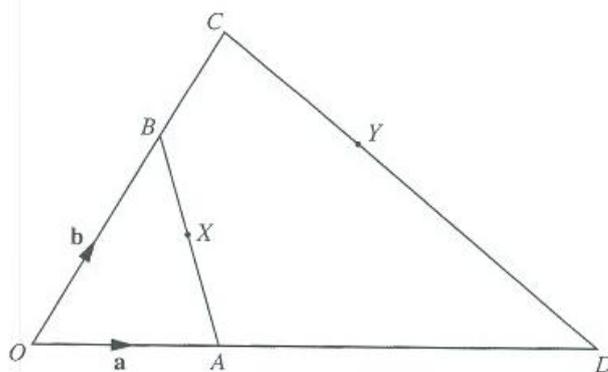
In the diagram, $\overrightarrow{OA} = \mathbf{a}$, $\overrightarrow{OB} = \mathbf{b}$, $\overrightarrow{OB} = 2\overrightarrow{BC}$, $\overrightarrow{AD} = 2\overrightarrow{OA}$ and $\overrightarrow{AB} = 2\overrightarrow{AX}$.

   (i)   Express, as simply as possible, in terms of $\mathbf{a}$ and $\mathbf{b}$,

        (a) $\overrightarrow{AB}$,   [1]

        (b) $\overrightarrow{OX}$,   [1]

        (c) $\overrightarrow{CD}$.   [1]

   Y is the point on CD such that $CY:YD = 1:2$.

   (ii) Express $\overrightarrow{OY}$ in terms of $\mathbf{a}$ and $\mathbf{b}$.   [2]

   (iii) Hence write down two facts about O, X and Y.   [1]

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

The variables x and y are connected by the equation

$$y = \frac{1}{5}x^2(x-4).$$

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

x	-2	-1	0	1	2	3	4	5
y	p	-1	0	-0.6	-1.6	-1.8	0	5

(a) Find the value of p.   [1]

(b) Using a scale of 2 cm to 1 unit, draw a horizontal x-axis for $-2 \leqslant x \leqslant 5$.
Using a scale of 1 cm to 1 unit, draw a vertical y-axis for $-6 \leqslant y \leqslant 6$.
On your axes, plot the points given in the table and join them with a smooth curve.   [3]

(c) Use your graph to find three solutions of $\frac{1}{5}x^2(x-4) = -1$.   [2]

(d) By drawing a tangent, find the gradient of the curve at the point $(4, 0)$.   [2]

(e) (i)   On the same axes, draw the line $y = 4 - 2x$ for $0 \leqslant x \leqslant 5$.   [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 $x^3 - 4x^2 + Ax + B = 0$.

           Find the value of A and the value of B.   [2]

4016/02/O/N/11
                                    Oct/Nov 2011 Paper 2 (8)

10 (a) A survey was carried out to find the number of emails received in a week by each of a group of students. This information was grouped as follows.

Number of emails (n)	$0 \leqslant n < 10$	$10 \leqslant n < 20$	$20 \leqslant n < 30$	$30 \leqslant n < 40$	$40 \leqslant n < 50$	$50 \leqslant n < 60$

The histogram below represents the results of the survey.
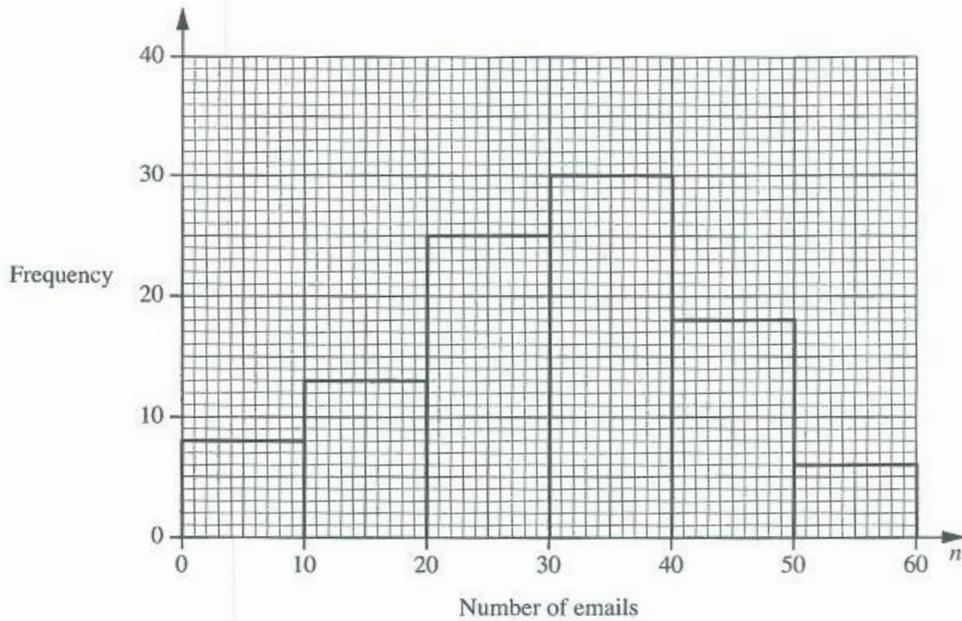
Number of emails

(i) Find the percentage of students who received less than 20 emails in a week. [2]

(ii) Calculate an estimate of

(a) the mean number of emails received in a week, [1]

(b) the standard deviation. [2]

(b) A bag contains 5 red sweets, 4 green sweets and 1 blue sweet.
Two sweets are taken out at random, without replacement.

(i)

First   Second

Copy and complete the tree diagram to show this information. [2]

(ii) Find, in its simplest form, the probability that

(a) two blue sweets are taken, [1]

(b) both sweets are the same colour, [2]

(c) one of the sweets taken is blue. [2]

4016/02/O/N/11

Oct/Nov 2011 Paper 2 (10)