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 2012

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.

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[Turn over

Oct/Nov 2012 Paper 2 (1)

Answer **all** the questions.

1 (a) Factorise completely $3x^2 - 48y^2$. [2]

(b) Express as a single fraction in its simplest form $\frac{2x}{5} - \frac{x-1}{15}$. [1]

(c) Simplify $\frac{x}{2y} \div \frac{3x^2y}{4}$. [1]

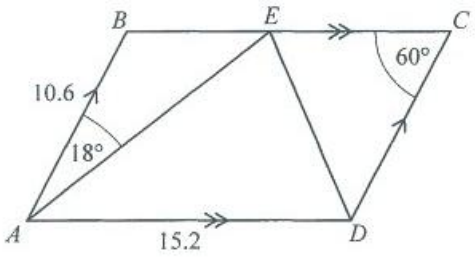
(d) It is given that $V = \frac{4\pi}{3}(a^3 - b^3)$.

(i) Evaluate V when $a = 2.5$ and $b = 1.9$. [1]

(ii) Express a in terms of V, π and b. [2]

(e) Solve the equation $\frac{2x-7}{3x+2} = 4$. [2]

2



$ABCD$ is a parallelogram with $AB = 10.6$ cm and $AD = 15.2$ cm.
Angle $BAE = 18°$ and angle $ECD = 60°$.

(a) Find

(i) angle ABC, [1]

(ii) angle DAE. [1]

(b) Find the area of parallelogram $ABCD$. [2]

(c) Show that $AE = 13.72$ cm, correct to four significant figures. [2]

(d) Calculate DE. [3]

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Oct/Nov 2012 Paper 2 (2)

3 (a) A is the point $(-5, 1)$ and B is the point $(3, -3)$.

(i) Find the vector $\overrightarrow{AB}$. [1]

(ii) Find the equation of the line AB. [2]

(b) The line l has equation $4y - 3x + 8 = 0$.

(i) Find

(a) the gradient of line l, [1]

(b) the y-intercept of line l. [1]

(ii) The line with equation $3x + 2y = 5$ intersects the line l at the point C.

Find the coordinates of C. [3]

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4 (a) One day the exchange rate between pounds (£) and Singapore dollars ($) was £1 = $2.10.
On the same day, the exchange rate between euros (€) and pounds was €1 = £0.93.

(i) Ann changed £200 into Singapore dollars.

Calculate how many dollars she received. [1]

(ii) Bill converted $500 into euros.

Calculate how many euros he received, correct to the nearest euro. [2]

(b) The price of a camera is $295 including 7% sales tax.

Calculate the price of the camera before tax, correct to the nearest cent. [2]

(c) (i) In this part, use the fact that 1 light year = 9.46×10^{15} metres.

The distance of the star Sirius from the Sun is 8.6 light years.

Calculate the distance, in kilometres, of Sirius from the Sun.
Give your answer in standard form. [2]

(ii) The distance of the star Proxima Centauri from the Sun is 3.97×10^{13} km.
A space probe travels at 60 000 km/h.

Calculate the time taken for the probe to travel from the Sun to Proxima Centauri.
Give your answer in years, correct to three significant figures. [3]

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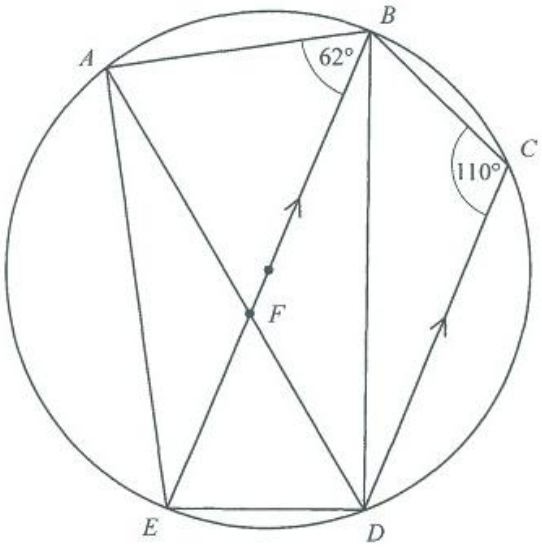
5 (a)



The diagram shows a circle $ABCDE$.
BE is a diameter of the circle and BE is parallel to CD.
F is the point of intersection of AD and BE.
Angle $ABE = 62°$ and angle $BCD = 110°$.

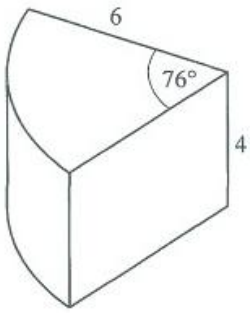
(i) Find angles ADE, AEB and BAD giving reasons for each answer. [4]

(ii) Find

(a) angle BFD, [1]

(b) angle DBC. [2]

(b)



The cross-section of a solid is the sector of a circle of radius 6 cm and angle 76°.
The height of the solid is 4 cm.

Calculate the volume of the solid. [3]

6 (a) $\mathscr{E} = \{\text{integers } x : 1 \leqslant x \leqslant 15\}$
$A = \{\text{factors of } 24\}$
$B = \{\text{multiples of } 3\}$

(i) Draw a Venn diagram to illustrate this information. [2]

(ii) Write down $n(A \cap B)$. [1]

(iii) List the elements contained in the set $A' \cup B$. [1]

(b) A playgroup is open for a morning session (am) and an afternoon session (pm) each weekday.
Each morning, 25 boys and 20 girls attend the playgroup.
Each afternoon, 10 boys and 30 girls attend.

This information can be represented by the matrix $\mathbf{L} = \begin{matrix} \text{am} & \text{pm} \\ \begin{pmatrix} 25 & 10 \\ 20 & 30 \end{pmatrix} & \begin{matrix} \text{Boys} \\ \text{Girls} \end{matrix} \end{matrix}$

(i) Evaluate the matrix $\mathbf{M} = 5\mathbf{L}$. [1]

(ii) The fee for a morning session is \$3 and the fee for an afternoon session is \$2.50.

Represent the session fees by a 2×1 column matrix $\mathbf{N}$. [1]

(iii) Evaluate the matrix $\mathbf{P} = \mathbf{MN}$. [1]

(iv) State what the elements of $\mathbf{P}$ represent. [1]

(v) The fees for the playgroup are increased by 5%, but the attendance remains the same.

Calculate the total fees taken in a week by the playgroup after the increase.
Give your answer correct to the nearest dollar. [2]

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

The variables x and y are connected by the equation

$$y = \frac{x^3}{20} + \frac{10}{x} - 5.$$

Some corresponding values of x and y, correct to 2 decimal places, are given in the table below.

x	1	2	3	4	5	6
y	5.05	0.40	–0.32	0.70	3.25	p

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

(b) Using a scale of 2 cm to represent 1 unit, draw a horizontal x-axis for $1 \leqslant x \leqslant 6$.
Using a scale of 1 cm to represent 1 unit, draw a vertical y-axis for $-1 \leqslant y \leqslant 8$.

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 to the equation $\frac{x^3}{20} + \frac{10}{x} = 5$, in the range $1 \leqslant x \leqslant 6$. [2]

(d) By drawing a tangent, find the gradient of the curve at (4, 0.70). [2]

(e) Use your graph to find the coordinates of the minimum point of $y = \frac{x^3}{20} + \frac{10}{x} - 5$, in the range $1 \leqslant x \leqslant 6$. [2]

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Oct/Nov 2012 Paper 2 (6)

8 A full tank contains 2000 litres of water.

(a) A small pump can empty water from the tank at a rate of x litres per minute.

Write down an expression, in terms of x, for the number of minutes the pump would take to empty the full tank. [1]

(b) A large pump can empty water from the tank at a rate of $(x + 100)$ litres per minute.

Write down an expression, in terms of x, for the number of minutes the large pump would take to empty the full tank. [1]

(c) It takes 20 minutes longer to empty the tank using the small pump than it does to empty it using the large pump.

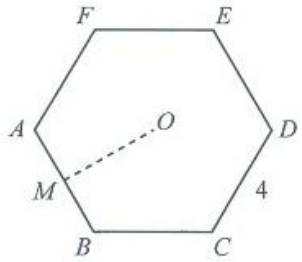
Write down an equation in x to represent this information, and show that it reduces to

$$x^2 + 100x - 10\,000 = 0.$$ [3]

(d) Solve the equation $x^2 + 100x - 10\,000 = 0$, giving your solutions correct to one decimal place. [4]

(e) Find the time taken to empty the full tank using the large pump.
Give your answer in minutes and seconds, correct to the nearest second. [2]

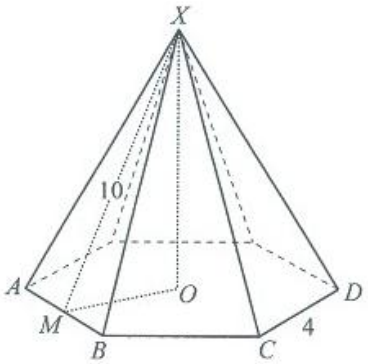
9



A regular hexagon, $ABCDEF$, has sides of length 4 cm.
M is the midpoint of AB and O is the centre of the hexagon.

(a) Show that the area of the hexagon $ABCDEF$ is 41.6 cm^2, correct to 3 significant figures. [3]

Hexagon $ABCDEF$ forms the base of a pyramid.
The vertex, X, is directly above O.
The slant height, MX, of the pyramid is 10 cm.



(b) Calculate the **total** surface area of the pyramid. [2]

(c) Calculate the height, OX, of the pyramid. [2]

(d) Calculate the volume of the pyramid. [2]

(e) Another similar pyramid is made, with a hexagonal base of side 9 cm.

Find the volume of this pyramid. [2]

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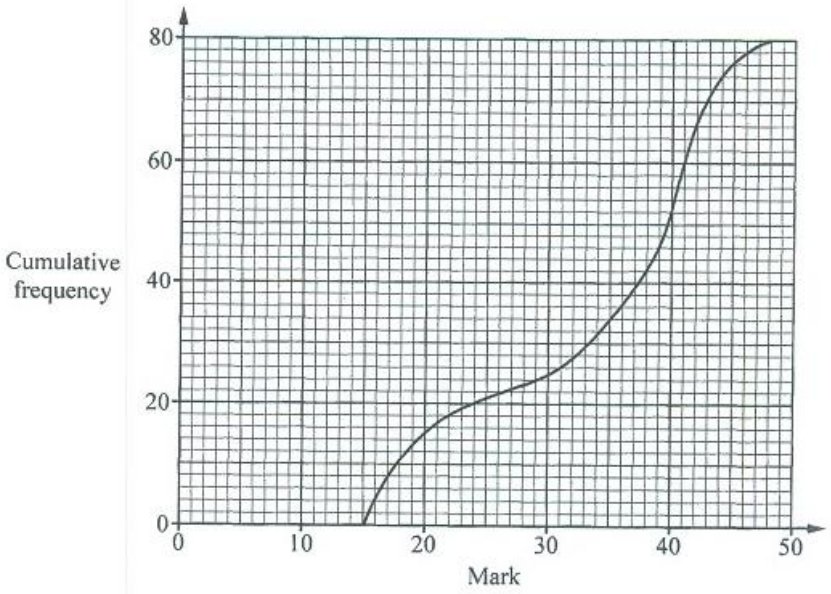
Oct/Nov 2012 Paper 2 (8)

10 **(a)** A group of 80 students took a Physics test.
The cumulative frequency curve below shows the distribution of their marks.



(i) Use the curve to estimate

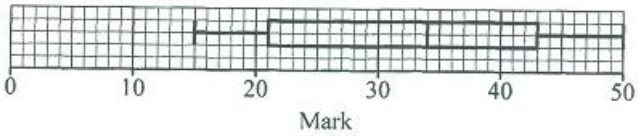
(a) the median mark, [1]

(b) the interquartile range. [2]

(ii) The pass mark for the test was 35.

Estimate the number of students who passed the test. [1]

(iii) The same group of students took a Chemistry test.
The box-and-whisker plot shows the distribution of their marks.



Make two comparisons between the performances of the students in the two tests. [2]

(b) This table shows information about a group of students.

	Male	Female
Right-handed	6	5
Left-handed	3	2

(i) A member of the group is selected at random.

Find, as a fraction in its lowest terms, the probability that the student is

(a) a right-handed male, [1]

(b) a female. [1]

(ii) Two members are selected at random from the whole group of students.

Find, as a fraction in its lowest terms, the probability that

(a) they are both males, [2]

(b) neither of them is a right-handed female. [2]