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

CANDIDATE NAME

CENTRE NUMBER S

INDEX NUMBER

MATHEMATICS

4016/01

Paper 1

October/November 2011

2 hours

Candidates answer on the Question Paper.

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.
You may use a pencil for any diagrams or graphs.
Do not use staples, paper clips, highlighters, 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.
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 of the marks for this paper is 80.

For Examiner's Use

This document consists of **16** printed pages.

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Oct/Nov 2011 Paper 1 (1)

For Examiner's Use

Answer **all** the questions.

For Examiner's Use

1 Calculate $\frac{4.51}{19.6 - 3.91^2}$, giving your answer correct to 3 significant figures.

Answer .....[2]

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2 The table shows the highest and lowest temperatures one day in London, Singapore and Moscow.

	London	Singapore	Moscow
Highest	5 °C	32 °C	−4 °C
Lowest	−3 °C	25 °C	−7 °C

Find

(a) the difference between the highest temperature in Singapore and the lowest temperature in Moscow,

Answer (*a*) ..... °C [1]

(b) the mean of the lowest temperatures in the three cities.

Answer (*b*) ..... °C [1]

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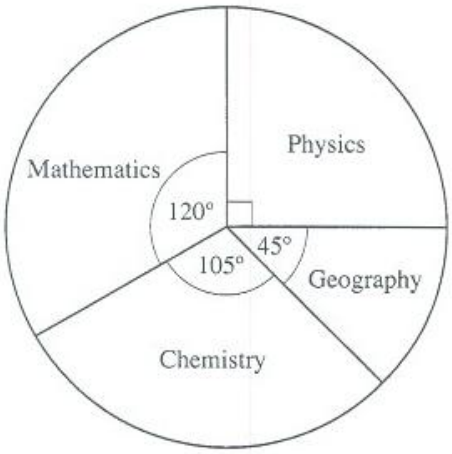
3 The students in a college were asked to vote for their favourite subject.
The pie chart represents the number of votes for each subject.

Mathematics obtained 25 more votes than Chemistry.

Calculate the number of students who took part in the survey.



Answer .....[2]

For Examiner's Use

4 Tickets for football matches cost \$10 for adults, \$7 for senior citizens and \$5 for students.
At one match there were 59 adults, 15 senior citizens and 101 students.
At another match there were 102 adults, 3 senior citizens and 72 students.

(a) Calculate $\begin{pmatrix} 59 & 15 & 101 \\ 102 & 3 & 72 \end{pmatrix} \begin{pmatrix} 10 \\ 7 \\ 5 \end{pmatrix}$.

Answer (a) [1]

(b) Explain what your answer represents.

Answer (b) .....

.....[1]

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5 Petrol costs x cents per litre.
John buys some petrol and it costs him y dollars.

Find an expression, in terms of x and y, for the number of litres that John buys.

Answer .....[2]

---

6 (a) 12 identical bottles are full of water.
A full glass will hold $\frac{2}{3}$ of the water from one of these bottles.

How many glasses can be filled using all the water from the 12 bottles?

Answer (a) .....[1]

(b) Express 3 centimetres as a percentage of 6 metres.

Answer (b) ..... % [2]

For Examiner's Use

7 When written as the product of their prime factors,

p is $2^3 \times 3^6$,
q is $2 \times 3^2 \times 5$,
r is $2^2 \times 3 \times 7$.

Find

(a) the value of the cube root of p,

Answer (a) ..... [1]

(b) the LCM of p, q and r, giving your answer as the product of its prime factors,

Answer (b) ..... [1]

(c) the greatest number that will divide p, q and r exactly.

Answer (c) ..... [1]

8 (a) Simplify $\frac{5c}{2} \div \frac{20c^2}{d}$.

Answer (a) .....[1]

(b) Factorise fully $6x^2 + 14x - 12$.

Answer (b) .....[2]

For Examiner's Use

9 A map is drawn to a scale of 1 : 25000.

(a) This scale can be expressed as 1 cm represents n km.

Find n.

Answer (a) n = ... [1]

(b) The distance between two towns on the map is 30 cm.

Find the actual distance, in kilometres, between the two towns.

Answer (b) ..... km [1]

(c) A lake has an actual area of 2.5 km^2.

Find the area, in square centimetres, of the lake on the map.

Answer (c) ..... cm^2 [1]

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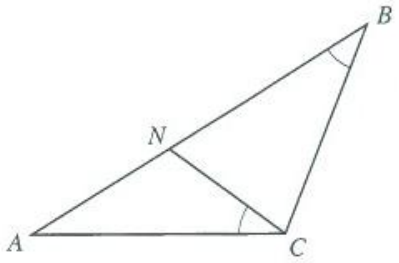
10 In the diagram, ABC is a triangle.

N is the point on AB such that $A\hat{B}C = A\hat{C}N$.



(a) Show that triangles ABC and ACN are similar.

Answer (a) In triangles ABC and ACN .....

.....

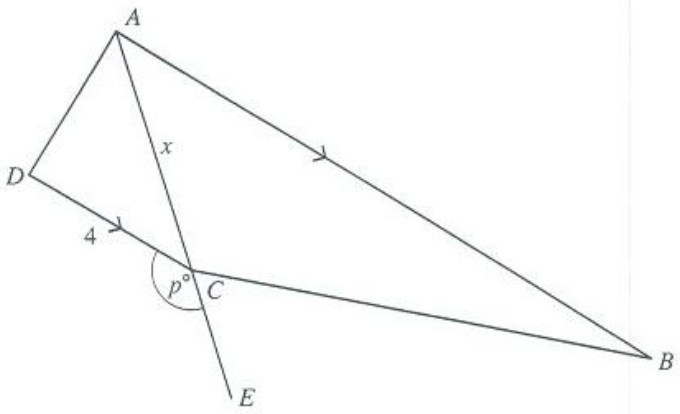
.....[1]

(b) Given that AN = 4 m and NB = 5 m, find AC.

Answer (b) AC = ... m [2]

For Examiner's Use

11



In the diagram, $ABCD$ is a trapezium with AB parallel to DC.
AD is perpendicular to AB and DC, and ACE is a straight line.
$DC = 4$ cm and $AC = x$ cm.
Angle $DCE = p°$.

(a) Write down an expression, in terms of x, for $\cos p°$.

Answer (a) $\cos p° =$ ..... [1]

(b) The area of the trapezium $ABCD$ is 5 times the area of the triangle ADC.

Find AB.

Answer (b) $AB =$ ..... cm [2]

For Examiner's Use

12 A glass block has a mass of 43 grams, correct to the nearest gram.

(a) Find the least possible mass of the glass block.

Answer (a) ..... g [1]

(b) The volume of the glass block is 15 cm^3, correct to the nearest cubic centimetre.

Find the greatest possible mass of 1 cubic centimetre of the glass.

Answer (b) ..... g [2]

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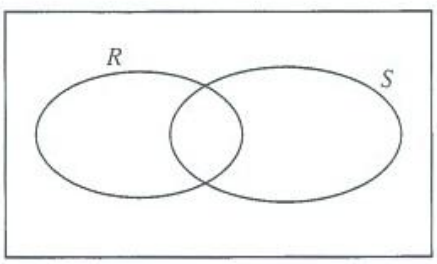
13 $\mathscr{E}$ = {all triangles}
R = {right-angled triangles}
S = {triangles with three unequal sides}

A is a triangle with angles 45°, 45° and 90°.
B is a triangle with sides 7 cm, 7 cm and 3 cm.
C is a triangle with sides 3 cm, 4 cm and 5 cm.

On the Venn Diagram below, write A, B and C in the appropriate subsets.

Answer



[3]

For Examiner's Use

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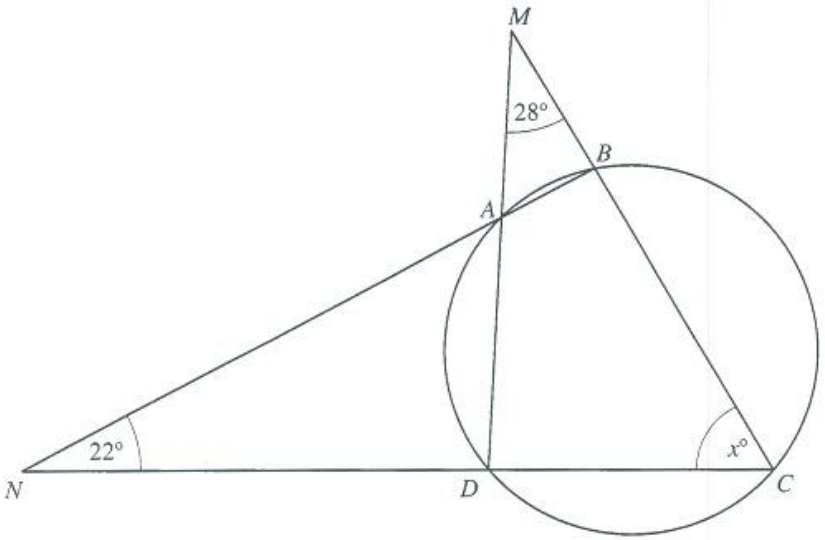


For Examiner's Use

$ABCD$ is a cyclic quadrilateral.
When produced, the lines CB and DA meet at M.
When produced, the lines BA and CD meet at N.
$D\hat{M}C = 28°$ and $B\hat{N}C = 22°$.

(a) Given that $B\hat{C}D = x°$, find an expression, in terms of x, for

(i) $M\hat{D}C$,

Answer (a)(i) $M\hat{D}C$ = ...[1]

(ii) $N\hat{B}C$.

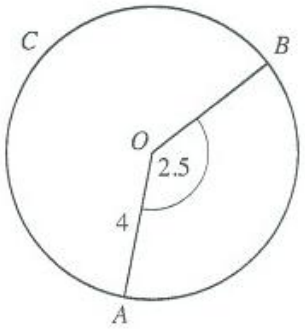
Answer (a)(ii) $N\hat{B}C$ = ...[1]

(b) Use your answers to part **(a)** to find x.

Answer (b) x = ...[1]

For Examiner's Use

15 A, B and C lie on a circle with centre O and radius 4 cm. $A\hat{O}B = 2.5$ radians.



(a) Find the area of the minor sector AOB.

Answer (*a*) ..... cm^2 [1]

(b) **(i)** Write down an expression, in terms of π, for the reflex angle AOB.

Answer (*b*)(i) ..... radians [1]

(ii) Find an expression, in terms of π, for the length of the arc ACB.

Answer (*b*)(ii) ..... cm [1]

---

16 **(a)** Solve $3(a-4) = 1-(3-a)$.

Answer (*a*) $a =$ .....[2]

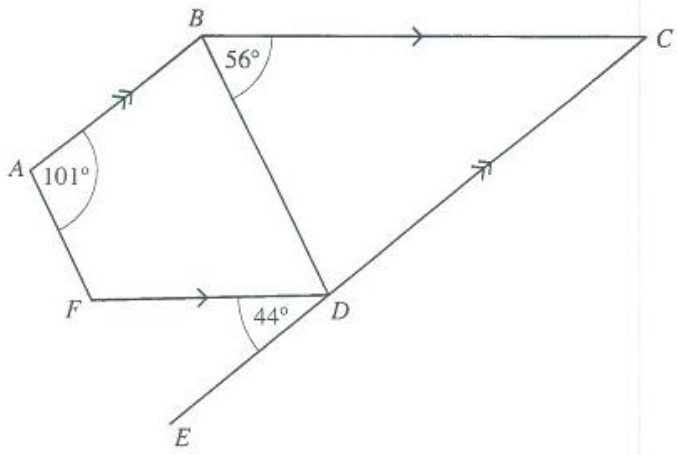
(b) Solve the equations $y = 3x - 7$,
$x = y + 4$.

Answer (*b*) $x =$ .....

$y =$ .....[2]

For Examiner's Use

17



For Examiner's Use

In the diagram, AB is parallel to EDC and BC is parallel to FD.
$C\hat{B}D = 56°$, $F\hat{D}E = 44°$ and $B\hat{A}F = 101°$.

(a) Calculate

(i) $B\hat{C}D$,

Answer (a)(i) $B\hat{C}D$ = ...[1]

(ii) $A\hat{B}D$,

Answer (a)(ii) $A\hat{B}D$ = ...[1]

(iii) $A\hat{F}D$.

Answer (a)(iii) $A\hat{F}D$ = ...[1]

(b) State, showing your reasoning, whether AF is or is not parallel to BD.

Answer (b) AF .....parallel to BD because .....

.....

.....[1]

For Examiner's Use

18 **(a)** Expressing your answer as a power of 7, find

(i) $7^{12} \div 7^3$,

Answer (a)(i).....[1]

(ii) $\frac{1}{49}$,

Answer (a)(ii) .....[1]

(iii) $\sqrt[4]{7}$.

Answer (a)(iii) .....[1]

(b) Given that $3^{-2} \times 3^k = 1$, write down the value of k.

Answer (b) k = ...[1]

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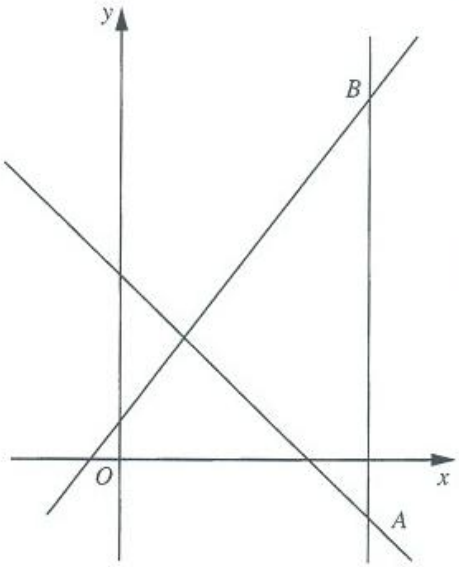
19 The diagram, which is not drawn accurately, shows the three lines $x = 8$, $y = 6 - x$ and $2y = 3x + 2$.



(a) Find the coordinates of A and B.

Answer (a) A is (..... , ...) [1]

B is (..... , ...) [1]

(b) Find the gradient of the line $y = 6 - x$.

Answer (b) .....[1]

(c) The point $(0, k)$ is the same distance from A as it is from B.

Find the value of k.

Answer (c) k = ...[1]

For Examiner's Use

20 (a) Construct triangle ABC where $BC = 9\,\text{cm}$ and $AC = 10\,\text{cm}$. AB has already been drawn. [1]

Answer (a), (b) and (c).

(b) Construct

(i) the perpendicular bisector of AB, [1]

(ii) the bisector of angle ABC. [1]

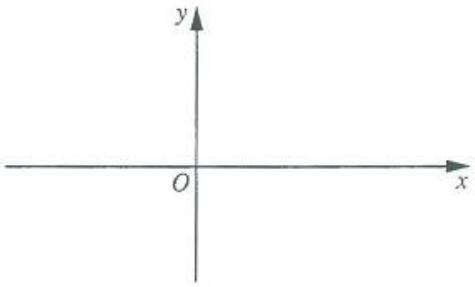
(c) Mark clearly a possible point which is inside the triangle, equidistant from A and B, and is nearer to BC than BA.

Label this point P. [1]

For Examiner's Use

21 (a) Sketch the graph of $y = -(x - 3)(x + 1)$.

Answer (a)



[2]

(b) Write down the equation of the line of symmetry of the graph.

Answer (b) .....[1]

(c) Find the coordinates of the maximum point.

Answer (c) (..... , ...) [1]

22 (a) 1.34×10^{-7} seconds can be written as k nanoseconds.

Find k.

Answer (a) $k =$ .....[1]

(b) In 2009 the population of the United Kingdom was 6.1×10^7.

(i) In the same year the population of Singapore was 4.8×10^6.

How many more people lived in the United Kingdom than in Singapore? Give your answer in standard form, to a sensible degree of accuracy.

Answer (b)(i).....[2]

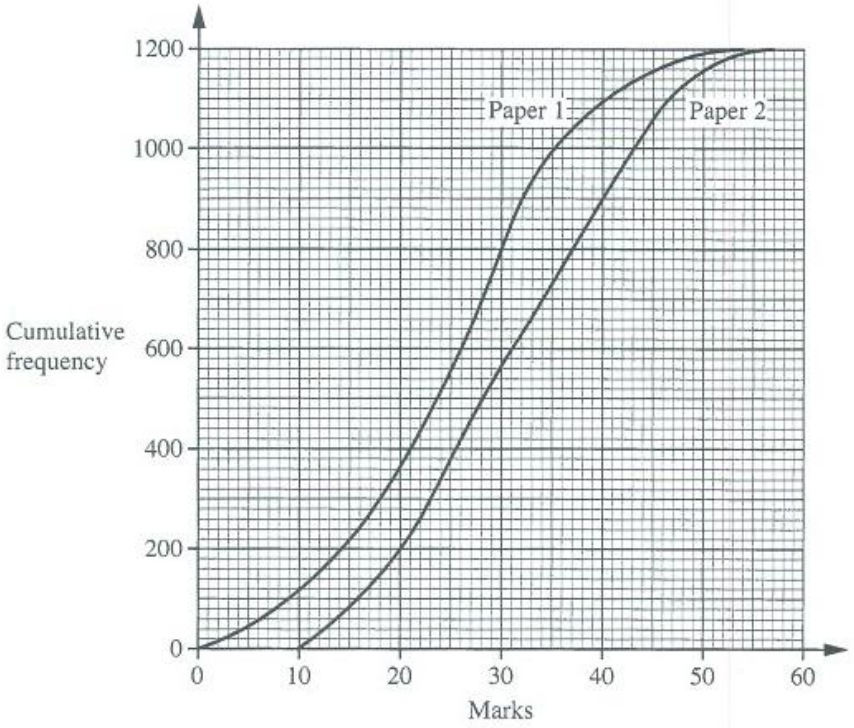
(ii) Between 1851 and 2009 the population of the United Kingdom increased by 173%.

Calculate the population in 1851.

Answer (b)(ii) .....[2]

For Examiner's Use

23 In a Mathematics examination, 1200 students each took two papers.
Both papers were marked out of 60.
The cumulative frequency curves show the distribution of the marks for the two papers.



(a) For Paper 1, estimate the interquartile range.

Answer (*a*) .....[2]

(b) Estimate the number of candidates that gained at least 75% of the marks for Paper 2.

Answer (*b*) .....[2]

(c) One additional student gained 35 marks in Paper 1, but was absent for Paper 2.
Estimate the mark he would have obtained if he had taken Paper 2.

Answer (*c*).....[1]

(d) Which was the more difficult paper? Justify your answer.

Answer (*d*) Paper ..... was more difficult because .....

.....[1]

[Question 24 is printed on the next page]

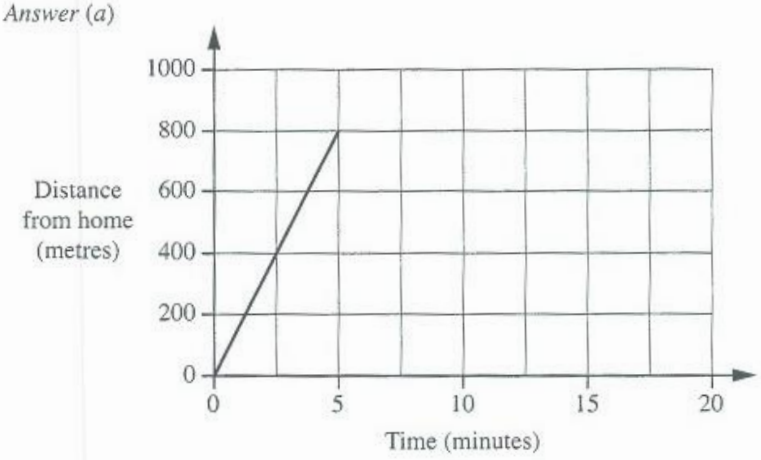
For Examiner's Use

24 Ali runs at a constant speed from home to a shop.
After spending 5 minutes in the shop, he walks back home at a constant speed.
He is away from home for 20 minutes.
The first part of his journey is shown on the distance–time graph below.

For Examiner's Use

(a) On the grid, complete the graph for Ali's journey.

Answer (a)



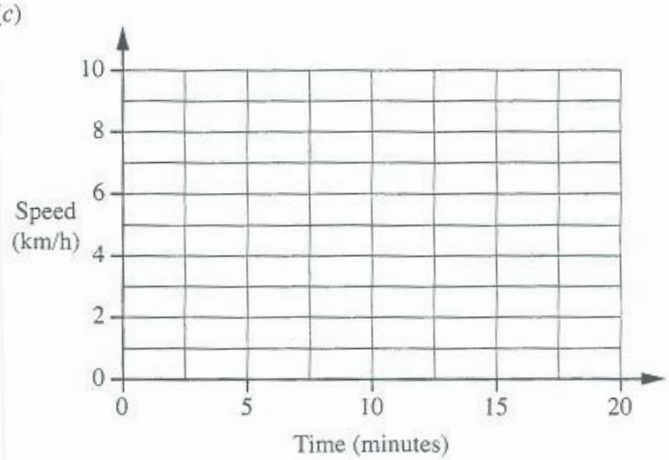
[1]

(b) Calculate Ali's speed as he runs to the shop.
Give your answer in kilometres per hour.

Answer (b) ..... km/h [2]

(c) On the grid below, draw the speed–time graph for the whole of Ali's journey.

Answer (c)



[2]