

GENERAL CERTIFICATE OF SECONDARY EDUCATION

METHODS IN MATHEMATICS

Methods in Mathematics 1 (Higher Tier)

B391/02



Candidates answer on the question paper.

OCR supplied materials:

None

Other materials required:

- Geometrical instruments
- Tracing paper (optional)

Tuesday 21 June 2011

Afternoon

Duration: 1 hour 15 minutes



Candidate forename					Candidate surname				
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Centre number						Candidate number			
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INSTRUCTIONS TO CANDIDATES

- Write your name, centre number and candidate number in the boxes above. Please write clearly and in capital letters.
- Use black ink. Pencil may be used for graphs and diagrams only.
- Read each question carefully. Make sure you know what you have to do before starting your answer.
- Your answers should be supported with appropriate working. Marks may be given for a correct method even if the answer is incorrect.
- Write your answer to each question in the space provided. Additional paper may be used if necessary but you must clearly show your candidate number, centre number and question number(s).
- Answer **all** the questions.
- Do **not** write in the bar codes.

INFORMATION FOR CANDIDATES

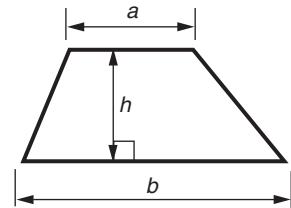
- The number of marks is given in brackets [] at the end of each question or part question.
- Your Quality of Written Communication is assessed in questions marked with an asterisk (*).
- The total number of marks for this paper is **60**.
- This document consists of **16** pages. Any blank pages are indicated.



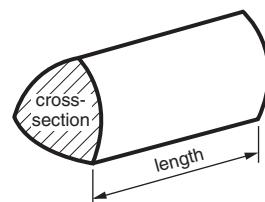
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Formulae Sheet: Higher Tier

$$\text{Area of trapezium} = \frac{1}{2} (a + b)h$$



$$\text{Volume of prism} = (\text{area of cross-section}) \times \text{length}$$

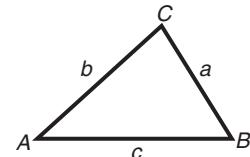


In any triangle ABC

$$\text{Sine rule} \quad \frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$$

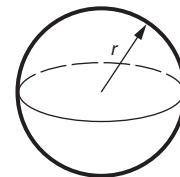
$$\text{Cosine rule} \quad a^2 = b^2 + c^2 - 2bc \cos A$$

$$\text{Area of triangle} = \frac{1}{2} ab \sin C$$



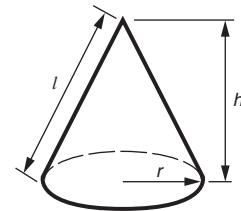
$$\text{Volume of sphere} = \frac{4}{3} \pi r^3$$

$$\text{Surface area of sphere} = 4\pi r^2$$



$$\text{Volume of cone} = \frac{1}{3} \pi r^2 h$$

$$\text{Curved surface area of cone} = \pi r l$$



The Quadratic Equation

The solutions of $ax^2 + bx + c = 0$, where $a \neq 0$, are given by

$$x = \frac{-b \pm \sqrt{(b^2 - 4ac)}}{2a}$$

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1 (a) You are given that $4.35 \times 6.38 = 27.753$.

Use this information to find the value of the following.

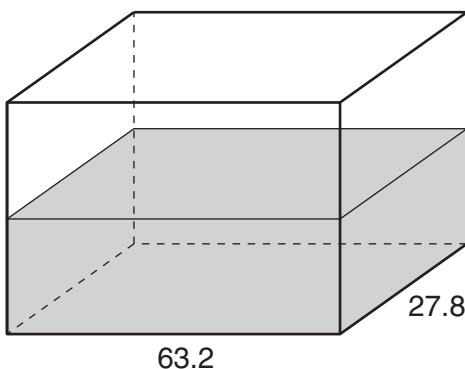
(i) 43.5×638

(a)(i) _____ [1]

(ii) $277.53 \div 0.435$

(ii) _____ [1]

(b) This tank is a cuboid containing 39.4 litres of water.
 The length of the tank is 63.2 cm and the width is 27.8 cm.
 $1 \text{ litre} = 1000 \text{ cm}^3$.



Estimate the depth of water in the tank in centimetres.
 Show the values you use.

(b) _____ cm [4]

2 When Jake catches the bus to school in the morning, it may be early, on time or late. The probability that it is early is 0.05. The probability that it is late is 0.4.

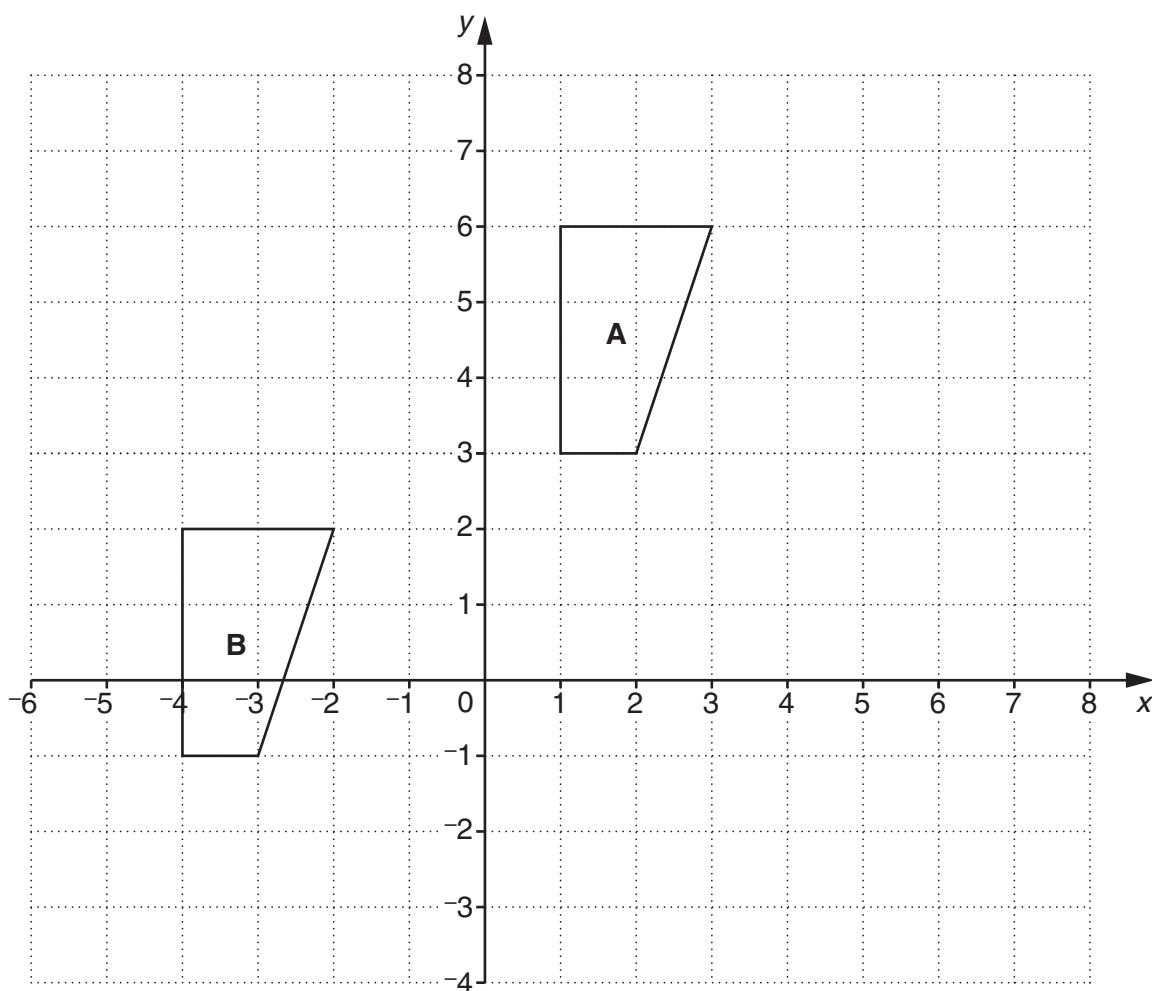
(a) What is the probability that the bus is on time?

(a) _____ [2]

(b) Calculate how many times you would expect the bus to be late in a school year of 190 days.

(b) _____ [2]

3



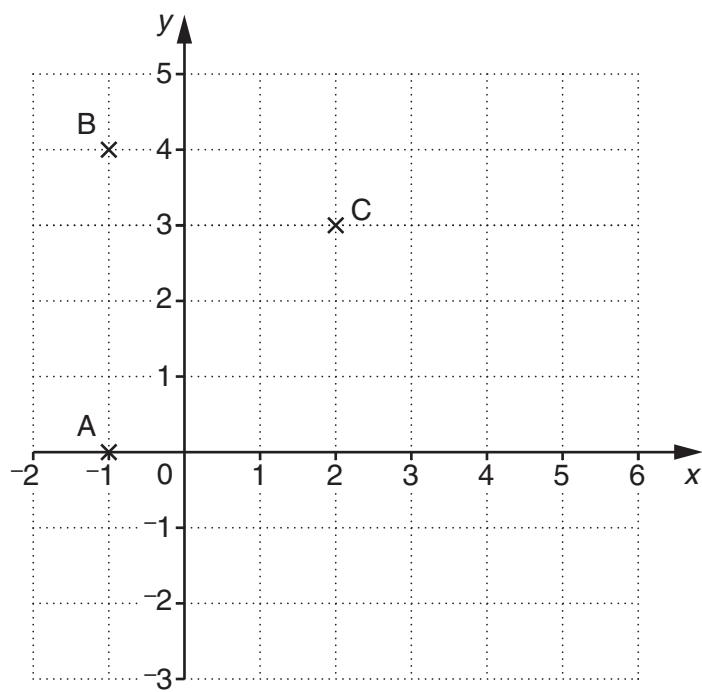
(a) Describe fully the **single** transformation that maps shape **A** onto shape **B**.

[2]

(b) Reflect shape **A** in the line $y = x$.
Label the image **C**.

[3]

4 The points A, B and C are drawn on a centimetre square grid.



(a) ABCD is a parallelogram.

Mark the point D and write down its coordinates.

(a) (_____, _____) [1]

(b) Calculate the area of the parallelogram ABCD.
Give the units of your answer.

(b) _____ [2]

(c) Calculate the gradient of the line BC.

(c) _____ [2]

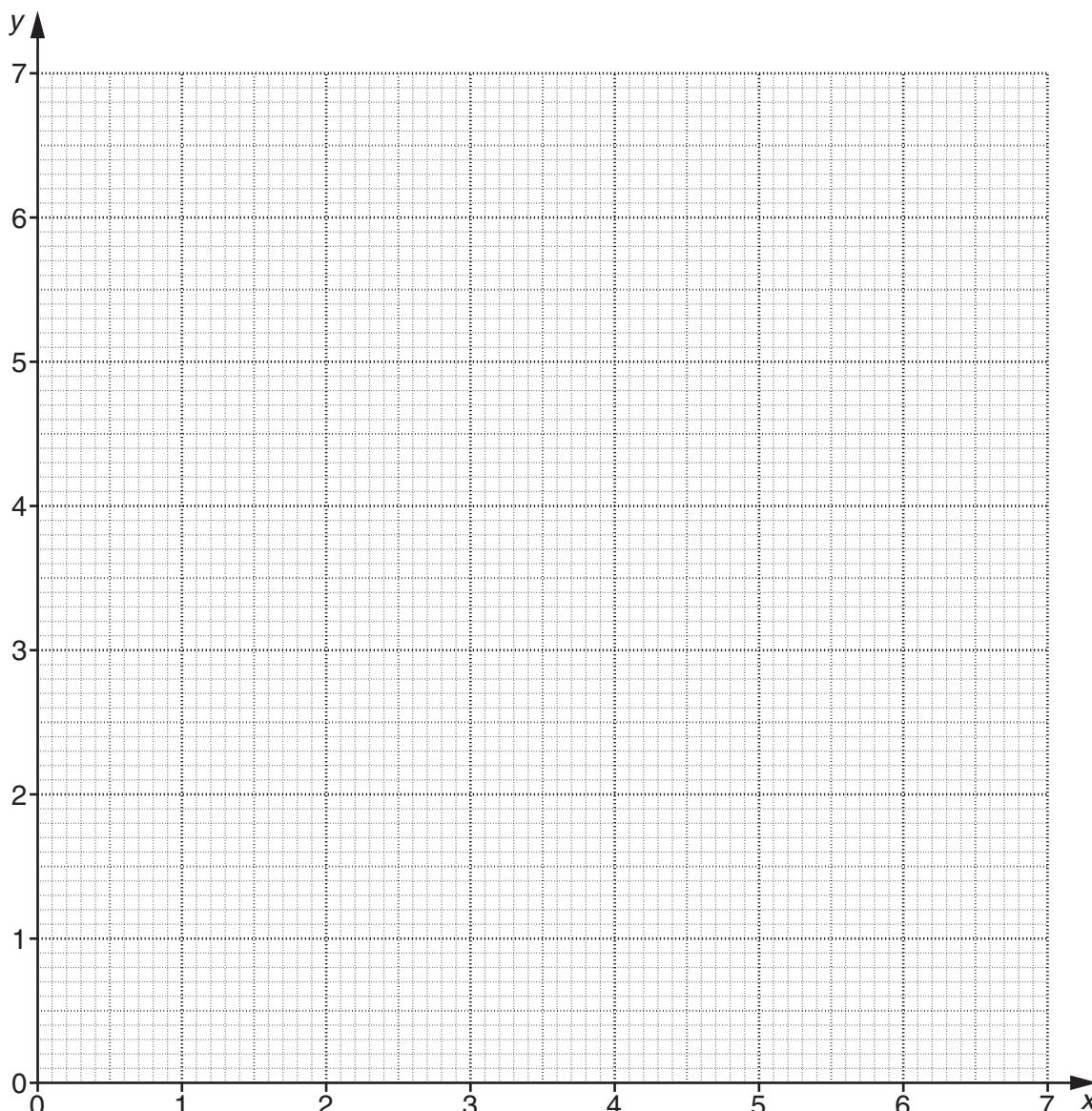
5 Ahmed buys 4 notepads and 5 pens.
The total cost is £20.

The cost of a notepad is £ x and the cost of a pen is £ y .

(a) Explain why $4x + 5y = 20$.

[1]

(b) Draw the graph of $4x + 5y = 20$.



[3]

(c) The cost of one notepad is £1.75.

Use your graph to find the cost of one pen.

(c) £ _____ [1]

6



The diagram shows a fraction line where the fractions are equal distances apart.

Find the fractions a and b .

$$a = \underline{\hspace{2cm}}, b = \underline{\hspace{2cm}} \quad [3]$$

7 (a) Expand.

$$2x^2(x^2 - 5x)$$

$$(a) \underline{\hspace{2cm}} \quad [2]$$

(b) Factorise.

$$2x^2y + 4xy^2 - 6xy$$

$$(b) \underline{\hspace{2cm}} \quad [3]$$

8 180 expressed as the product of its prime factors is $2 \times 2 \times 3 \times 3 \times 5$.

(a) Express 140 as a product of its prime factors.

(a) _____ [2]

(b) Find the least common multiple (LCM) of 180 and 140.

(b) _____ [2]

(c) Find the smallest value of n such that $180n$ is a cube number.

(c) _____ [2]

10

9 (a) Find the value of x if

$$2^{x+2} \div 2^3 = 2^6.$$

(a) _____ [2]

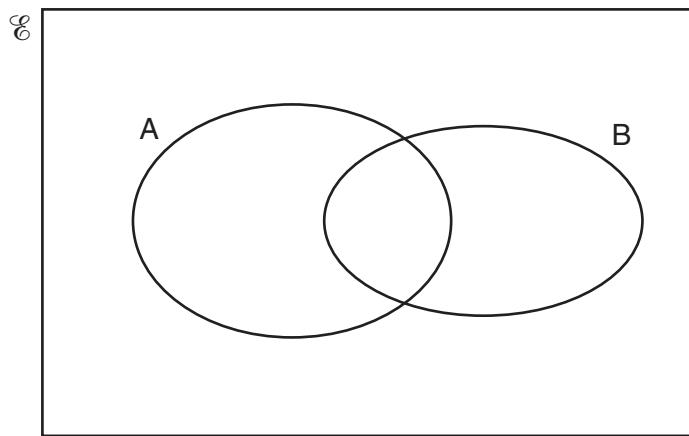
(b) Find the value of y if

$$(3^{2y})^2 = 3^y \times 3^6.$$

(b) _____ [3]

10 In this question

- $\mathcal{E} = \{\text{Integers from 1 to 15}\}$
- $A = \{\text{Prime numbers}\}$
- $B = \{\text{Factors of 30}\}$.



(a) Complete the Venn diagram to show this information.

[2]

(b) Janine chooses a number at random from the universal set.

Find the probability that Janine's number is

(i) a member of $A \cap B$,

(b)(i) _____ [1]

(ii) neither a prime number nor a factor of 30,

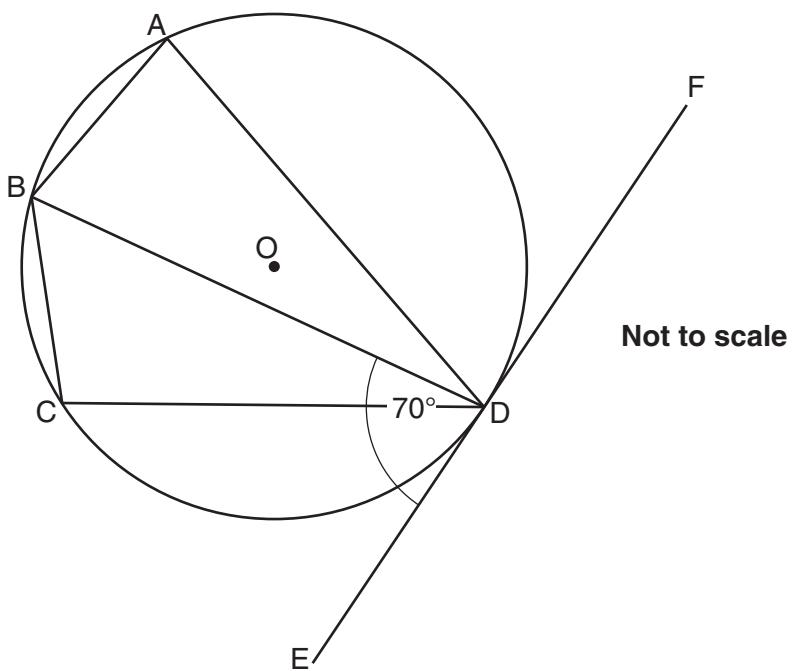
(ii) _____ [1]

(iii) a member of $A \cap B'$.

(iii) _____ [1]

12

11*



In the diagram, A, B, C and D are points on the circle, centre O.
EDF is a tangent.
Angle BDE = 70° .

Calculate the size of angle BCD.
Give reasons for each step in the calculation.

13

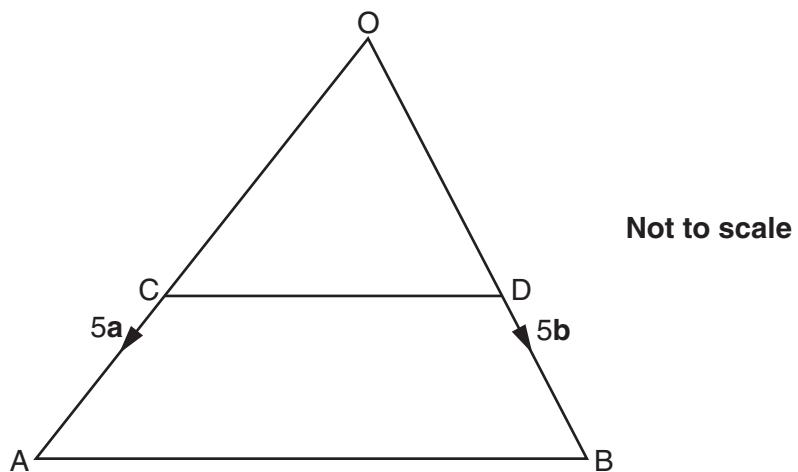
12 In a school fair there is a tombola stall.

There are one hundred tickets numbered from 1 to 100.
The tickets with numbers ending in 5 or 0 win a prize.
Lee picks two tickets at random without replacement.

Find the probability that both of Lee's tickets win a prize.

[3]

13



In the diagram, $\vec{OA} = 5\mathbf{a}$ and $\vec{OB} = 5\mathbf{b}$.

C divides OA in the ratio 3 : 2.

D divides OB in the ratio 3 : 2.

(a) Prove that CD is parallel to AB.

[3]

(b) State the ratio of CD : AB.

(b) _____ [1]

15

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