

GENERAL CERTIFICATE OF SECONDARY EDUCATION
METHODS IN MATHEMATICS

B391/02

Methods in Mathematics 1 (Higher Tier)

Candidates answer on the question paper.

OCR supplied materials:
None

Other materials required:

- Geometrical instruments
- Tracing paper (optional)

Friday 14 January 2011
Morning

Duration: 1 hour 15 minutes



Candidate forename		Candidate surname	
--------------------	--	-------------------	--

Centre number							Candidate number				
---------------	--	--	--	--	--	--	------------------	--	--	--	--

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.



This paper has been pre modified for carrier language

Formulae Sheet: Higher Tier

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



Volume of prism = (area of cross-section) \times length



In any triangle ABC

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

Cosine rule $a^2 = b^2 + c^2 - 2bc \cos A$

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



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

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



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

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

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

PLEASE DO NOT WRITE ON THIS PAGE

- 1 Ged throws two fair dice.
One dice is red and one is blue.
Each dice has the numbers 1 to 6 on it.

Ged's score is the positive **difference** between the two numbers that are thrown.

- (a) Complete the table below to show the possible scores.

		Number on Red Dice					
		1	2	3	4	5	6
Number on Blue Dice	1				3		
	2						4
	3						
	4	3					
	5						
	6		4				

[2]

- (b) On his next throw,

- (i) find the probability that Ged scores 2.

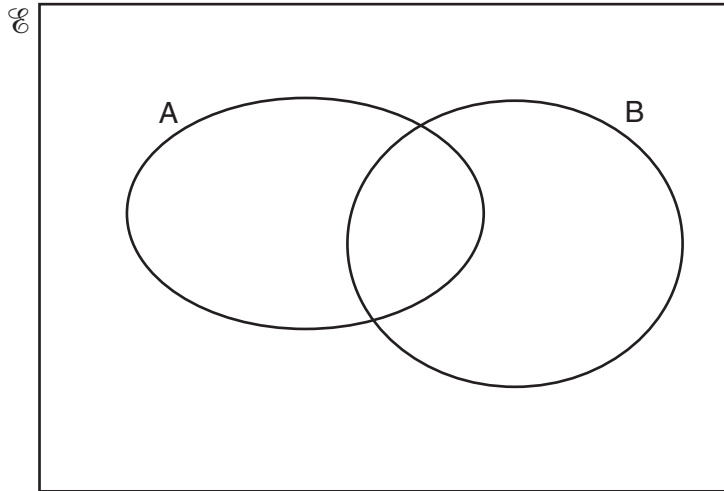
(b)(i) _____ [1]

- (ii) find the probability that Ged scores an odd number.

(ii) _____ [2]

- 2 The universal set, $\mathcal{U} = \{1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12\}$.
Set A = {multiples of 3}.
Set B = {factors of 12}.

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

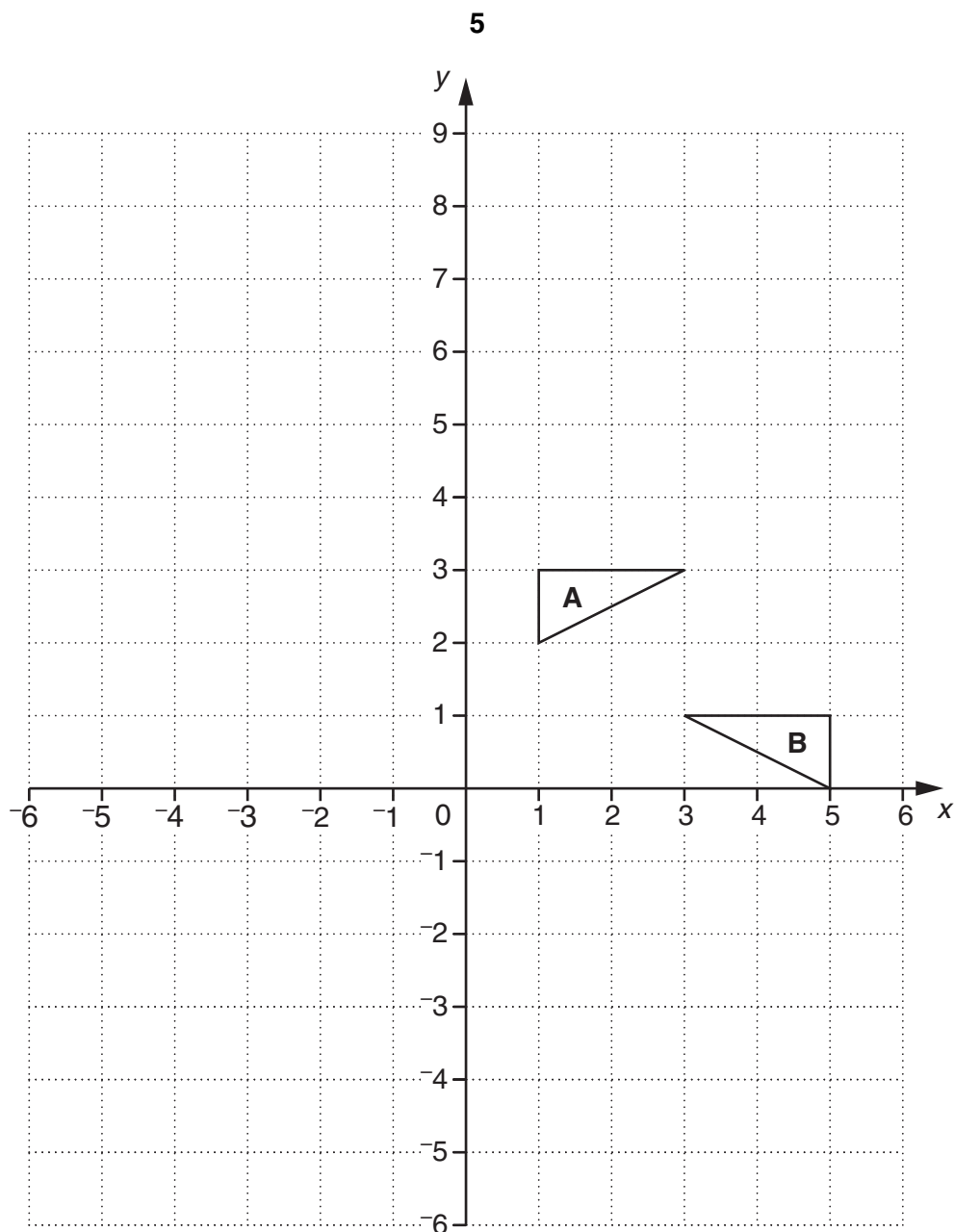


[3]

(b) Write down the value of $n(A \cap B)$.

(b) _____ [1]

3



(a) Enlarge triangle **B** using scale factor 3 and centre (6, 2). [3]

(b) Triangle **A** can be mapped onto triangle **B** by a rotation through 180° followed by a reflection.

Find a possible centre of rotation and the equation of the corresponding mirror line.

(b) Centre of rotation (_____ , _____)

Equation of mirror line _____ [3]

- 4 (a) Jack records the colours of 10 cars passing his school. These are his results.

Colour	Silver	Black	Red	Blue
Numbers of cars	4	3	1	2

Jack says, "The probability that the next car is silver is 0.4". Explain why Jack may be wrong.

_____ [1]

- (b) Anya records the types of vehicle passing her house one morning. Here is a summary of her results.

Type of Vehicle	Motorcycle	Car	Lorry	Van	Bus	Total
Number	18	96	37	40	9	200

- (i) Write down the relative frequency of a bus passing Anya's house.

(b)(i) _____ [1]

- (ii) Use Anya's results to estimate the probability that the next two vehicles passing her house will both be vans.

(ii) _____ [2]

5 (a) Work out.

$$\frac{2}{5} \times \frac{3}{4}$$

(a) _____ [2]

(b) Give an example to show that each of these statements is **not always** true.

(i) If $a > 0$ and $b > 0$ then $ab > a$.

_____ [1]

(ii) If $a > b$ then $a^2 > b^2$.

_____ [1]

6 (a) Simplify.

$$3(2x - 2) - 2(x + 5)$$

(a) _____ [3]

(b) Simplify.

(i) $(x^3)^2$

(b)(i) _____ [1]

(ii) $\frac{a^3 \times a^4}{a^2}$

(ii) _____ [2]

(c) Factorise.

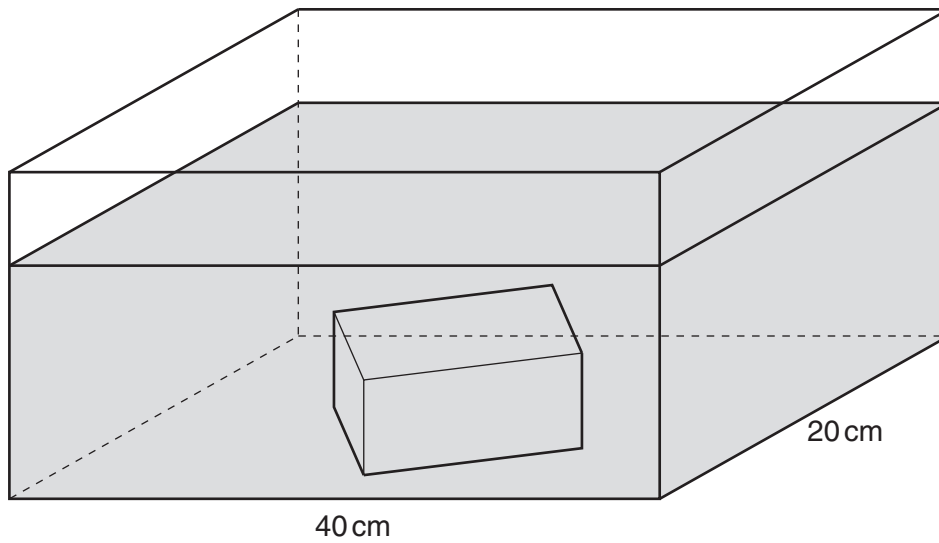
(i) $8a - 4$

(c)(i) _____ [1]

(ii) $4x^2y - 6xy^2$

(ii) _____ [3]

- 7* The diagram shows a block in a rectangular tank.
The tank has vertical sides.
The block is completely covered by water.
The block is a cuboid measuring 20 cm by 10 cm by 6 cm.



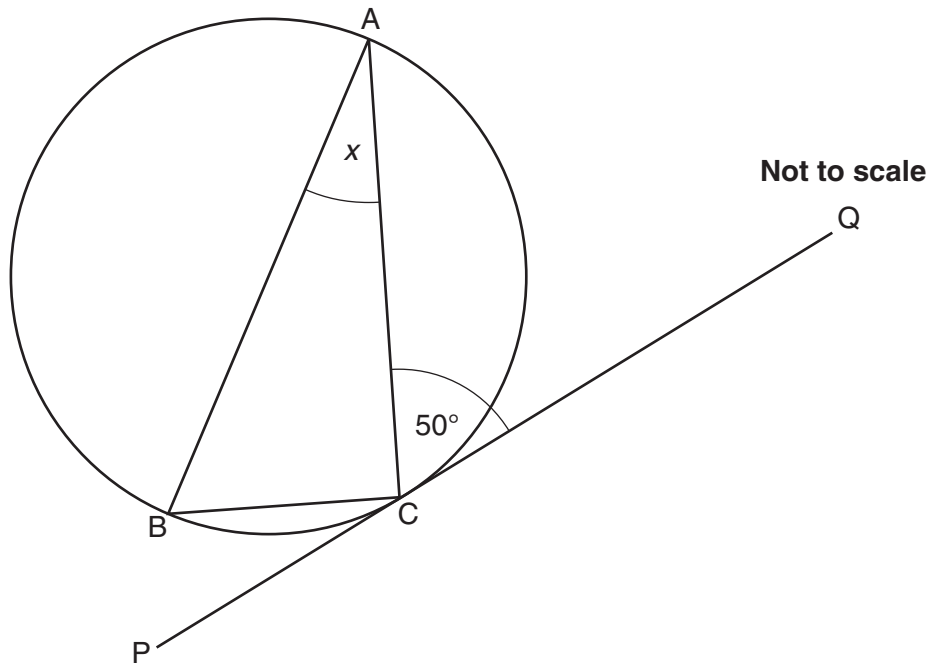
The block is removed from the tank.

Calculate the drop in the level of the water when the block is removed.

_____ cm [4]

8

10



AB is a diameter of the circle.
PQ is a tangent to the circle at C.
Angle ACQ = 50°.

Find angle x.
Give a reason for each step of your working.

[4]

- 9 These are the distances of some of the planets from the Sun.

Planet	Distance from the Sun (km)
Mercury	5.79×10^7
Earth	1.50×10^8
Saturn	1.43×10^9
Pluto	5.91×10^9

- (a) Write the distance of Pluto from the Sun as an ordinary number.

(a) _____ km [1]

- (b) Calculate how much further Saturn is from the Sun than Mercury is from the Sun. Give your answer in standard form.

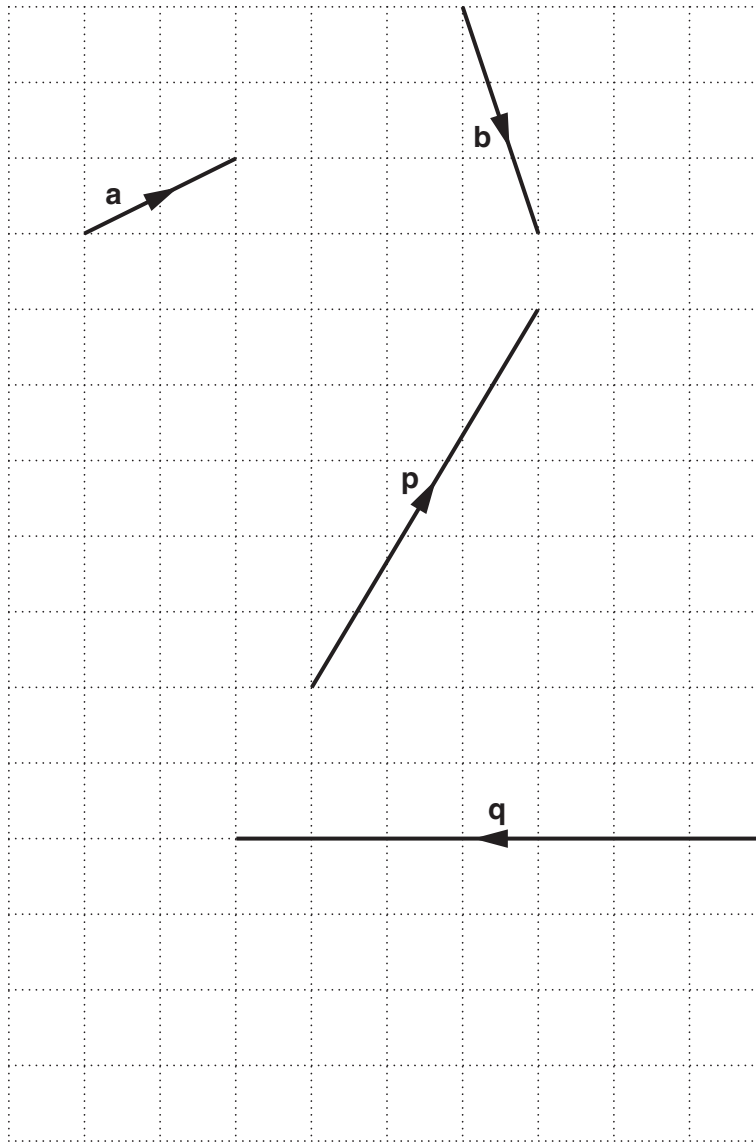
(b) _____ km [2]

- (c) Light travels at 2.998×10^5 kilometres per second.

Estimate the time taken for light from the Sun to reach Earth.

(c) _____ s [3]

10



Write these vectors in terms of **a** and **b**.

(a) **p**

(a) _____ [2]

(b) **q**

(b) _____ [2]

11 $x = \sqrt{3}$ and $y = 2 + \sqrt{3}$.

Calculate $x^2 + y^2$.

Write your answer in the form $a + b\sqrt{3}$ where a and b are integers.

_____ [3]

12 These are the equations of five straight lines.

$$y = 2x - 5$$

$$y + 2x = 5$$

$$9x + 3y = 10$$

$$2y + x = 3$$

$$3x + y = 7$$

- (a) Which two of these lines are parallel?
Justify your answer.

_____ and _____
because _____
_____ [2]

- (b) Which two of these lines are perpendicular?
Justify your answer.

_____ and _____
because _____
_____ [2]

- 13** In a pack of 52 playing cards, 13 are hearts.
One card is chosen at random from the pack and is not replaced.
A second card is then chosen at random.

What is the probability that both cards are hearts?

[2]

PLEASE DO NOT WRITE ON THIS PAGE



Copyright Information

OCR is committed to seeking permission to reproduce all third-party content that it uses in its assessment materials. OCR has attempted to identify and contact all copyright holders whose work is used in this paper. To avoid the issue of disclosure of answer-related information to candidates, all copyright acknowledgements are reproduced in the OCR Copyright Acknowledgements Booklet. This is produced for each series of examinations and is freely available to download from our public website (www.ocr.org.uk) after the live examination series.

If OCR has unwittingly failed to correctly acknowledge or clear any third-party content in this assessment material, OCR will be happy to correct its mistake at the earliest possible opportunity.

For queries or further information please contact the Copyright Team, First Floor, 9 Hills Road, Cambridge CB2 1GE.

OCR is part of the Cambridge Assessment Group; Cambridge Assessment is the brand name of University of Cambridge Local Examinations Syndicate (UCLES), which is itself a department of the University of Cambridge.