

OXFORD CAMBRIDGE AND RSA EXAMINATIONS  
**GCSE**

**B391/02**

**METHODS IN MATHEMATICS**

Methods in Mathematics 1

(Higher Tier)

**TUESDAY 10 NOVEMBER 2015:**

**Morning**

**DURATION:** 1 hour 15 minutes  
plus your additional time allowance

**MODIFIED ENLARGED 24pt**

Candidate forename						Candidate surname				
Centre number						Candidate number				

Candidates answer on the Question Paper.

**OCR SUPPLIED MATERIALS:**

None

**OTHER MATERIALS REQUIRED:**

Geometrical instruments

Tracing paper (optional)

<p><b>WARNING</b> <b>No calculator can be used</b> <b>for this paper</b></p>
--

**READ INSTRUCTIONS OVERLEAF**

## INSTRUCTIONS TO CANDIDATES

Write your name, centre number and candidate number in the boxes on the first page. Please write clearly and in capital letters.

Use black ink. HB pencil may be used for graphs and diagrams only.

Answer **ALL** the questions.

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).

## INFORMATION FOR CANDIDATES

The number of marks is given in brackets [ ] at the end of each question or part question.

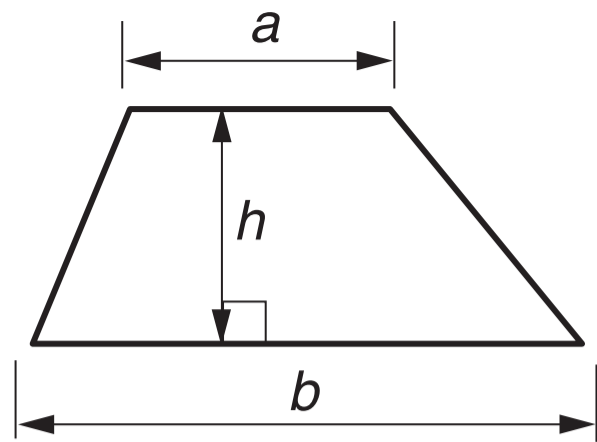
Your quality of written communication is assessed in questions marked with an asterisk (\*).

The total number of marks for this paper is **60**.

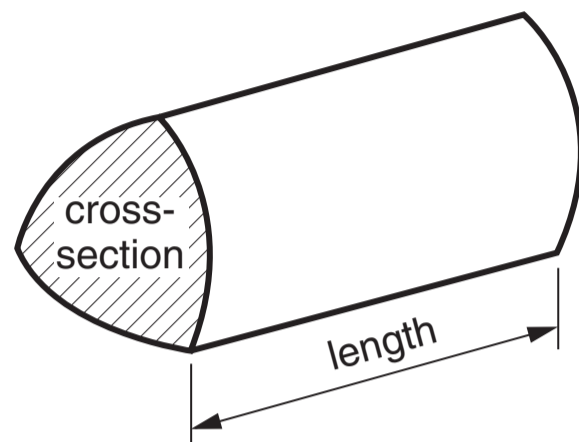
Any blank pages are indicated.

# FORMULAE SHEET: HIGHER TIER

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



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

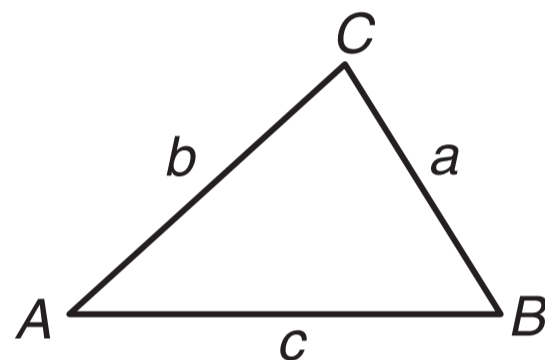


**In any triangle *ABC***

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

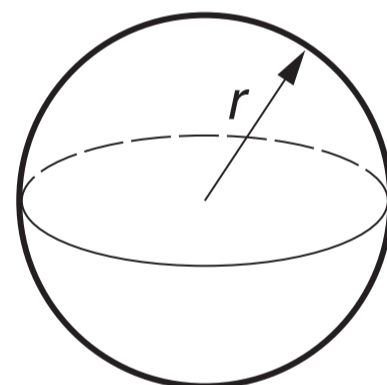
**Cosine rule**  $a^2 = b^2 + c^2 - 2bc \cos A$

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



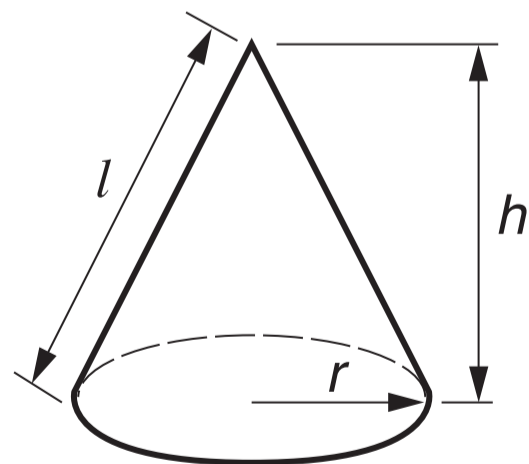
**Volume of sphere**  $= \frac{4}{3} \pi r^3$

**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

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

Answer **ALL** the questions.

1 (a) Work out.

(i)  $0.2 \times 0.3$

(a)(i) \_\_\_\_\_ [1]

(ii)  $\frac{88}{0.11}$

(ii) \_\_\_\_\_ [1]

(b) Work out.

$$\frac{3}{20} \div \frac{2}{5}$$

Give your answer as a fraction in its lowest terms.

(b) \_\_\_\_\_ [2]

**2** Expressed as the product of its prime factors

$$600 = 2^3 \times 3 \times 5^2.$$

**(a)** Express 420 as the product of its prime factors.

**(a)** \_\_\_\_\_ **[2]**

**(b)** Find, leaving your answers expressed as the **PRODUCT OF PRIME FACTORS**,

**(i)** the highest common factor (HCF) of 600 and 420,

**(b)(i)** \_\_\_\_\_ **[1]**

**(ii)** the lowest common multiple (LCM) of 600 and 420,

**(ii)** \_\_\_\_\_ **[1]**

**(iii)** the smallest value of  $k$  when  $600k$  is a cube number.

**(iii)** \_\_\_\_\_ **[1]**

3 Mario is doing a survey, in his town, about the number of people in cars during the rush hour.  
 From his observations he makes this table of relative frequencies.

<b>NUMBER OF PEOPLE</b>	1	2	3	4	5 or more
<b>RELATIVE FREQUENCY</b>	0.4	0.24	0.19	0.1	

(a) Find the relative frequency of a car having 5 or more people in it.

(a) \_\_\_\_\_ [2]

(b) Mario wants to use his results to estimate the probability that a car in his town during the rush hour will have 3 people in it.

Write down two things that Mario must have done, when he did his survey, to make sure that his estimate is a good one.

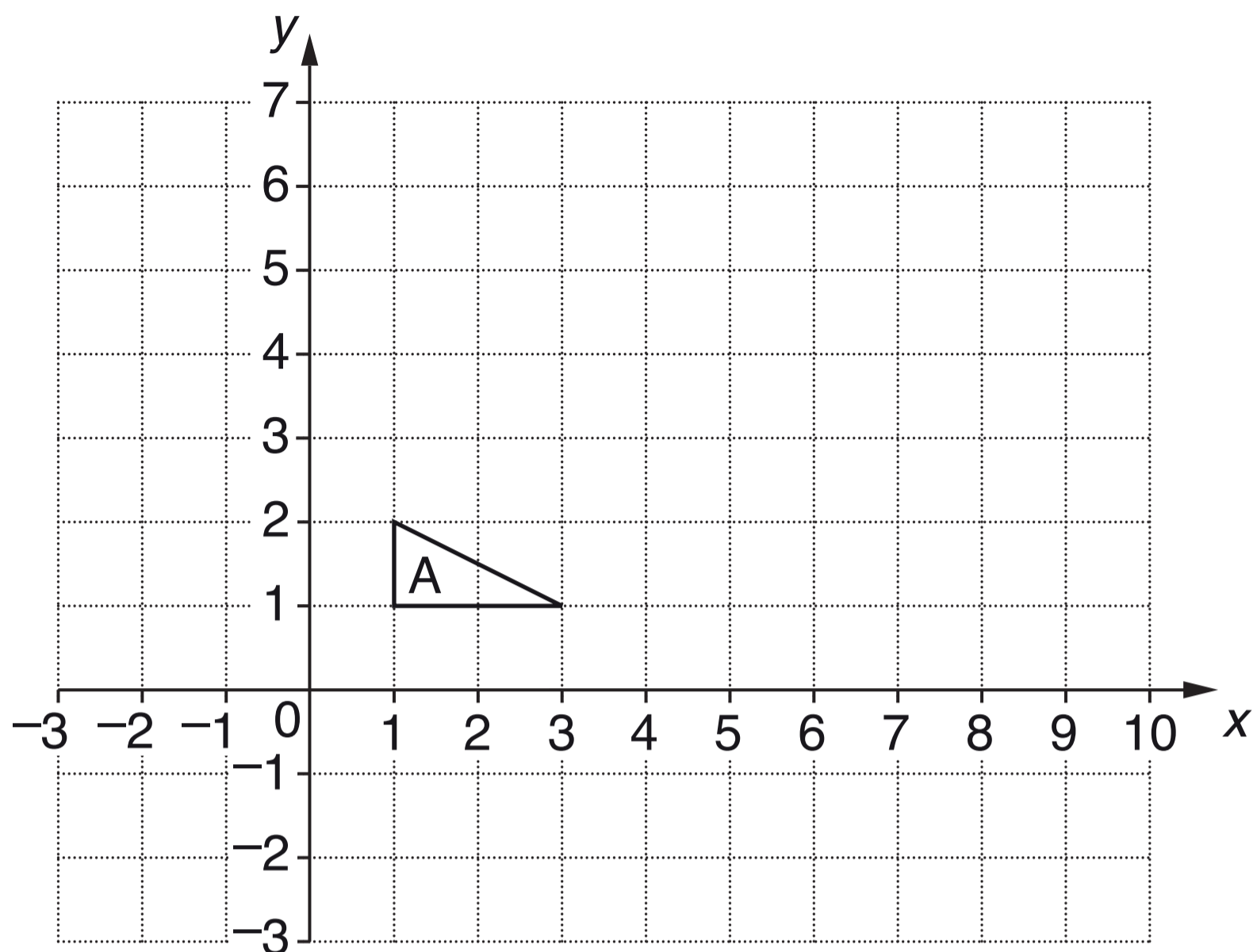
1 \_\_\_\_\_  
 \_\_\_\_\_

2 \_\_\_\_\_  
 \_\_\_\_\_ [2]

**(c)** There were 5000 cars using the roads in Mario's town during the rush hour.

Use Mario's results to estimate the number of these cars that had 1 person in.

**(c)** \_\_\_\_\_ **[2]**



- (a) (i) Translate triangle A using the vector  $\begin{pmatrix} -3 \\ 2 \end{pmatrix}$ .

Label the image B.

[2]

- (ii) Enlarge triangle A with scale factor 3 and centre (0, 0).

Label the image C.

[2]

- (iii) Describe fully the single transformation that maps triangle C onto triangle A.

---



---

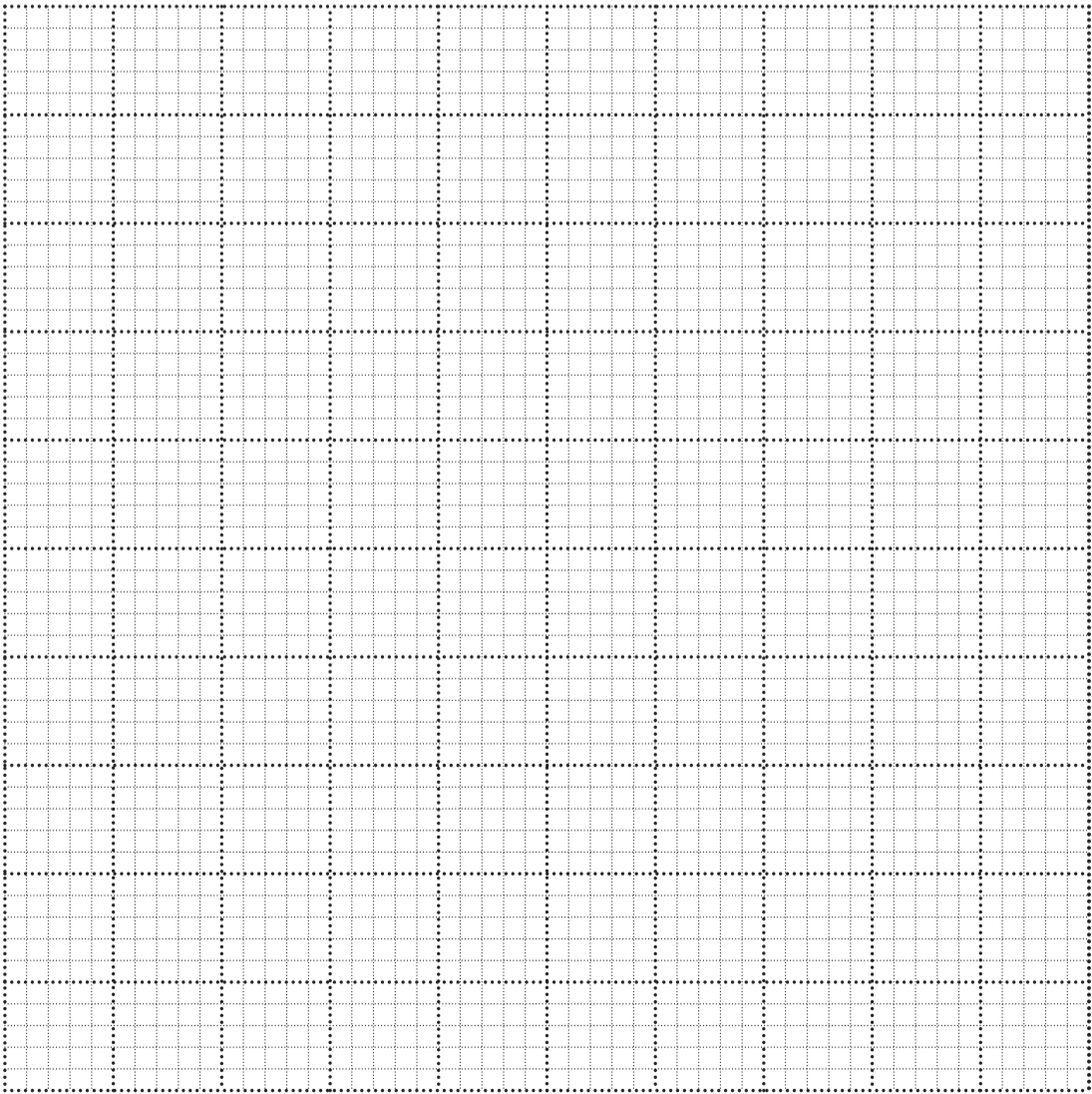
[2]

- (b) A triangle P is reflected to give triangle Q.  
 Triangle Q is rotated to give triangle R.  
 Triangle R is enlarged to give triangle S.  
 Triangle S is translated to give triangle T.

Complete this table.  
 Write Y if the triangles are **ALWAYS** congruent.  
 Write N if the triangles are **NOT ALWAYS** congruent.

TRIANGLES	CONGRUENT, Y OR N?
P and Q	
P and R	
P and S	
R and T	

You may use this grid if required.
 [3]



**5 (a)\*** Solve algebraically.

$$7(x + 2) - 2(2x + 3) = 20$$

**(a)** \_\_\_\_\_ [4]

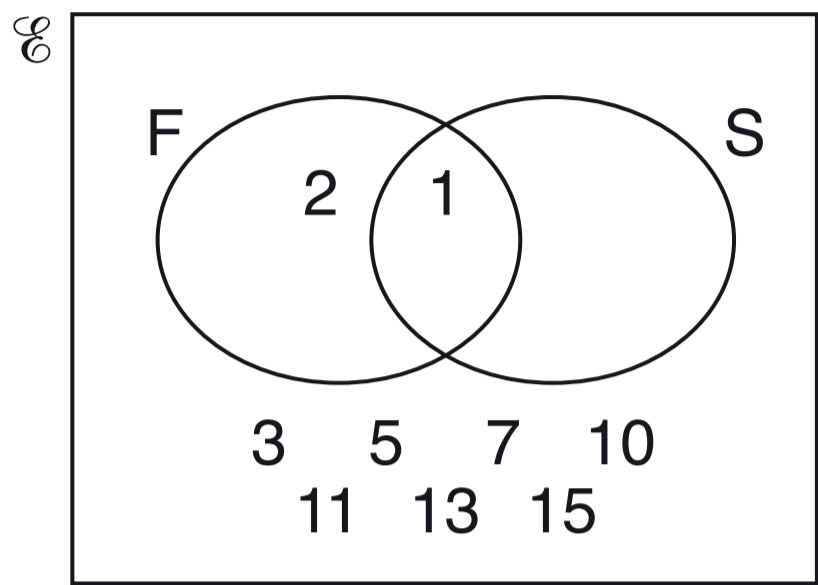
**(b)**  $a(5x^2 + 3x + b) = 20x^2 + cx - 8$

Find the values of  $a$ ,  $b$  and  $c$  so that the expansion of the brackets is correct.

**(b)**  $a =$  \_\_\_\_\_,  $b =$  \_\_\_\_\_,  $c =$  \_\_\_\_\_ [3]

- 6  $\mathcal{E} = \{\text{positive integers less than 17}\}$   
 $F = \{\text{factors of 16}\}$   
 $S = \{\text{square numbers}\}$

(i) Complete this Venn diagram to show the sets  $\mathcal{E}$ ,  $F$  and  $S$ .



[3]

(ii) List the members of  $F \cap S$ .

(a)(ii) \_\_\_\_\_ [1]

**(b)** In a group of students

35 study Geography

25 study History

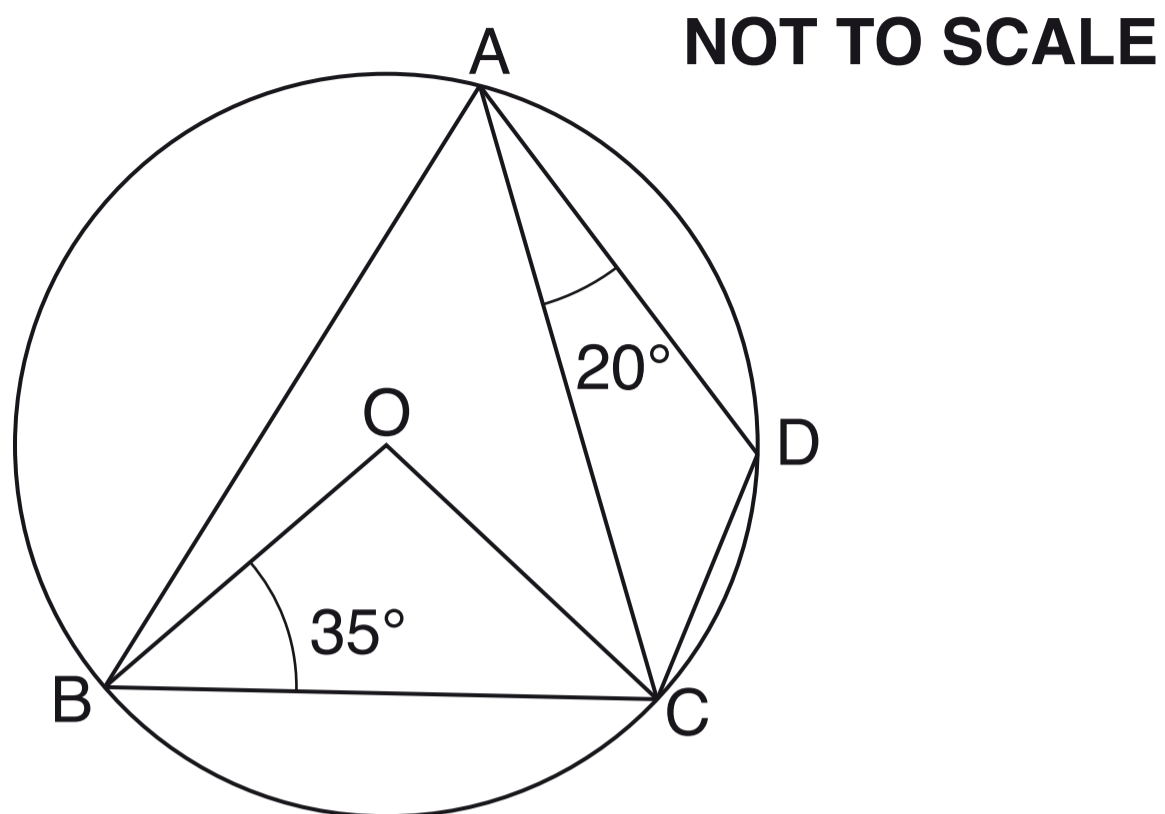
9 study neither Geography nor History.

Find the highest and lowest possible number of students in the group.

**(b)** highest \_\_\_\_\_

lowest \_\_\_\_\_ **[2]**

- 7 A, B, C and D are points on a circle, centre O.  
Angle  $OBC = 35^\circ$  and angle  $DAC = 20^\circ$ .



**(a)** Calculate the size of these angles.

**(i)** BOC

**(a)(i)** \_\_\_\_\_ $^\circ$  [1]

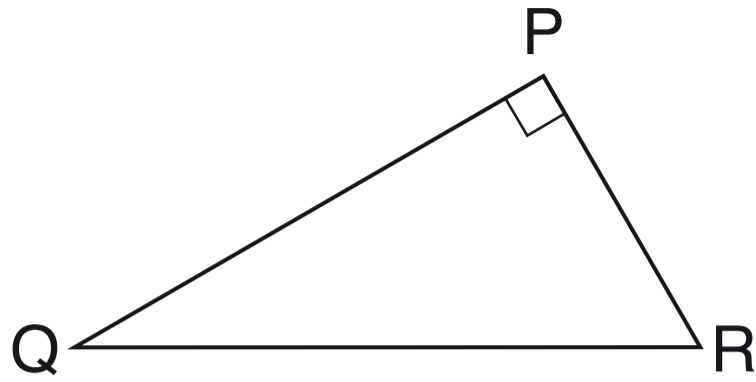
**(ii)** BAC

**(ii)** \_\_\_\_\_ $^\circ$  [1]

**(iii)** OCD

**(iii)** \_\_\_\_\_ $^\circ$  [2]

**(b)** PQR is a triangle with angle  $QPR = 90^\circ$ .



Explain why the circle that passes through P, Q and R has its centre at the midpoint of QR.

---

---

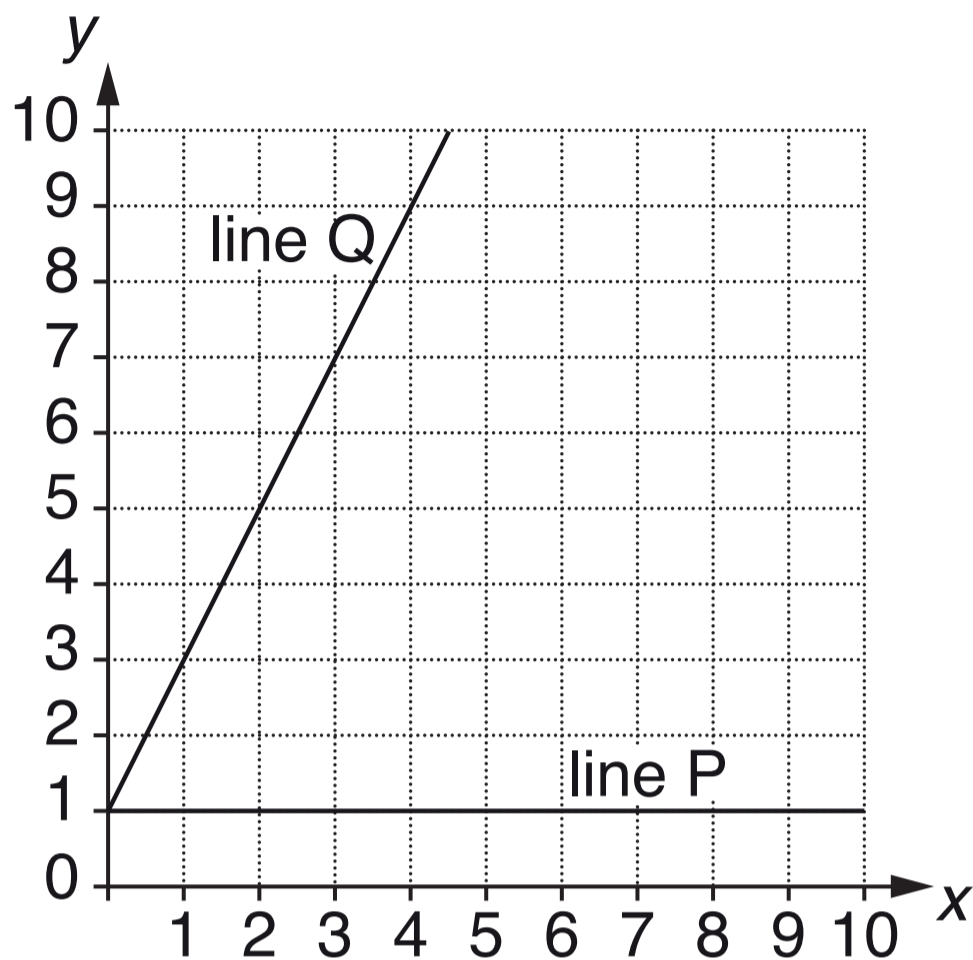
---

---

---

[2]

- 8 The graph shows the line P and the line Q drawn on a one-centimetre grid.  
The equation of line Q is  $y = 2x + 1$ .



(a) Write down the equation of line P.

(a) \_\_\_\_\_ [1]

- (b)** Line R goes through the point (6, 1).  
The area of the triangle enclosed by line P, line Q and line R is  $12\text{ cm}^2$ .

Draw line R.

**[2]**

- (c)** Write down the equation of line R.

**(c)** \_\_\_\_\_ **[1]**

- (d)** Line S is parallel to line Q.

It goes through the points (6, 5) and  $(a, a + 4)$ .

Find the value of  $a$ .

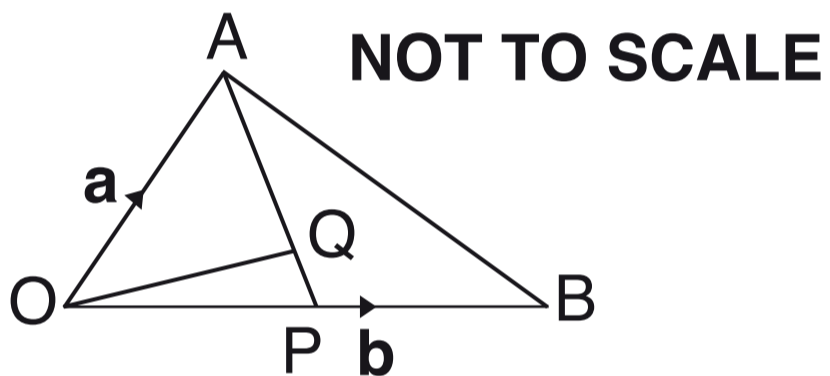
**(d)**  $a =$  \_\_\_\_\_ **[3]**

- 9 Rationalise the denominator and simplify this fraction.

$$\frac{14}{\sqrt{7}}$$

\_\_\_\_\_ [2]

- 10 In the diagram P is the midpoint of OB.  
Q divides  $\overline{AP}$  in the ratio 4:1.  
 $\overrightarrow{OA} = \mathbf{a}$  and  $\overrightarrow{OB} = \mathbf{b}$ .



Find these vectors, as simply as possible, in terms of **a** and **b**.

(a)  $\overrightarrow{AP}$

(a) \_\_\_\_\_ [1]

(b)  $\overrightarrow{OQ}$

(b) \_\_\_\_\_ [2]

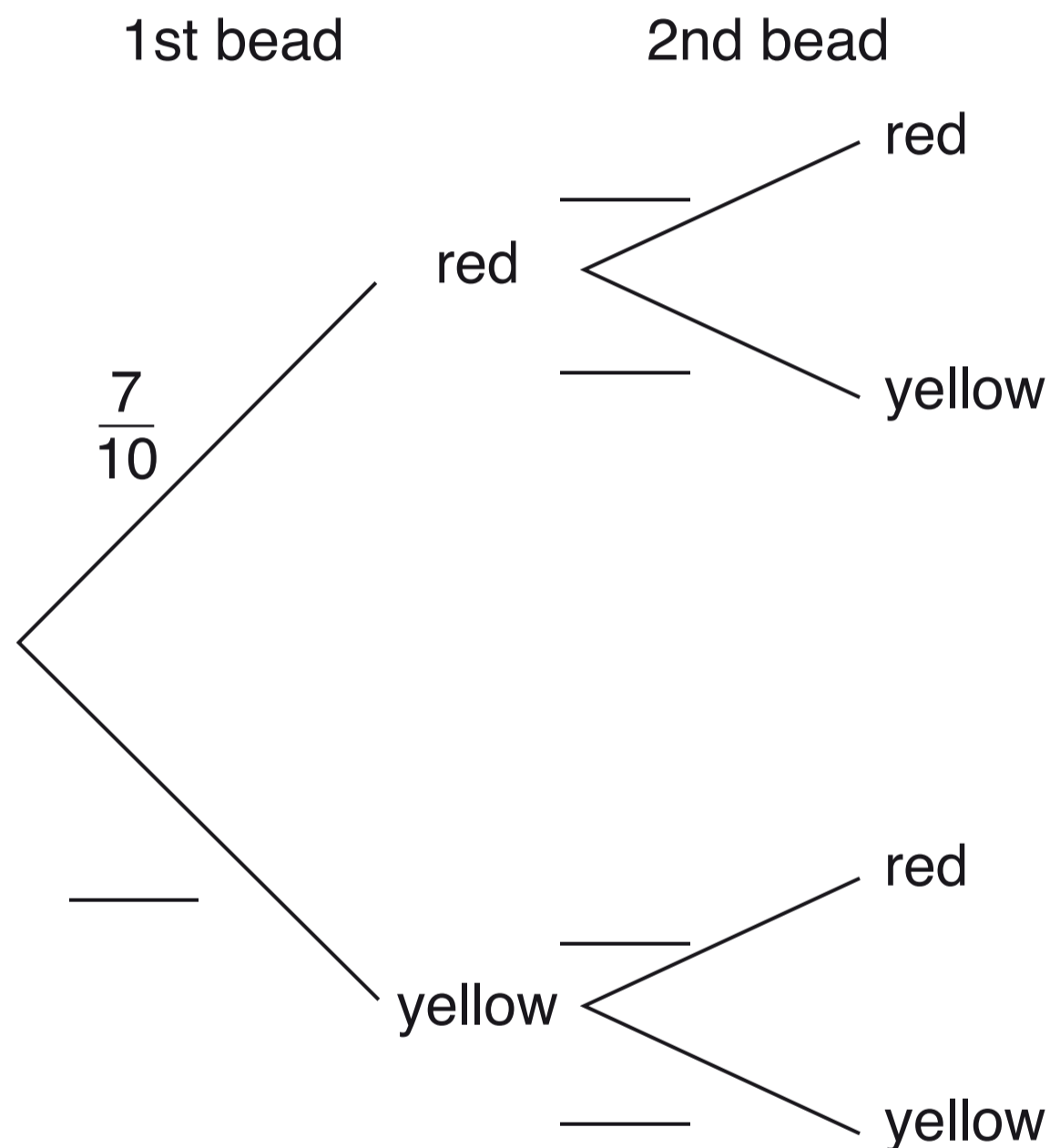
- 11** Jacqui has two bags. Each contains 10 beads of which 7 are red and 3 are yellow.

She picks a bead at random from the first bag.

If the bead is red she picks another bead at random from the remaining beads in the first bag.

If the first bead is yellow she puts it into the second bag. She then picks a bead at random from the second bag.

**(a)** Complete this probability tree diagram.



**[2]**

**(b)** Find the probability that the second bead Jacqui picks is yellow.

**(b)** \_\_\_\_\_ **[3]**

**END OF QUESTION PAPER**

### 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](http://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.

