AQA

NEW SPECIMEN PAPERS PUBLISHED JUNE 2015

GCSE

Mathematics Specification (8300/2H)

H

Paper 2 Higher tier

Date Morning 1 hour 30 minutes

Materials

For this paper you must have:
- a calculator
- mathematical instruments.

Instructions
- Use black ink or black ball-point pen. Draw diagrams in pencil.
- Fill in the boxes at the bottom of this page.
- Answer **all** questions.
- You must answer the questions in the spaces provided. Do not write outside the box around each page or on blank pages.
- Do all rough work in this book.
- In all calculations, show clearly how you work out your answer.

Information
- The marks for questions are shown in brackets.
- The maximum mark for this paper is 80.
- You may ask for more answer paper, graph paper and tracing paper. These must be tagged securely to this answer book.

Please write clearly, in block capitals, to allow character computer recognition.

Centre number ☐☐☐☐☐ Candidate number ☐☐☐☐

Surname ☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐

Forename(s) ☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐

Candidate signature _____

Answer **all** questions in the spaces provided.

1 Which sequence is a geometric progression?

Circle your answer.

[1 mark]

1 2 3 4 | 1 2 4 7

1 2 4 8 | 1 2 3 5

2 Which of these is **not** used to prove that triangles are congruent?

Circle your answer.

[1 mark]

SSS | SAS | AAA | RHS

3 Circle the expression that is equivalent to $2a + 5a \times 4a - a$

[1 mark]

$a + 20a^2$ | $21a^2$ | $28a^2 - a$ | $2a + 15a^2$

4 Circle the equation of a line that is parallel to $y = 5x - 2$

[1 mark]

$y = 2x - 5$ $y = 5x + 2$ $y = 3x - 2$ $y = -\frac{1}{5}x - 2$

5 In a sale, the original price of a bag was reduced by $\frac{1}{5}$

The sale price of the bag is £29.40

Work out the original price.

[3 marks]

Answer £ _____

Turn over for the next question

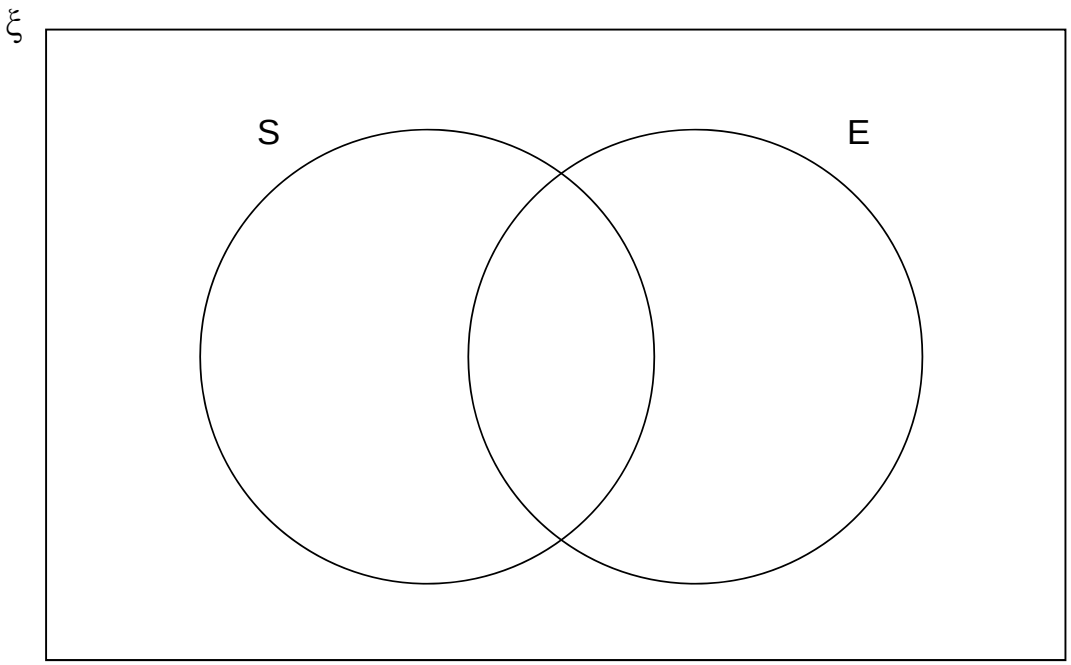
6 $\xi = \{1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12\}$

S = square numbers

E = even numbers

6 (a) Complete the Venn diagram.

[3 marks]



6 (b) One of the numbers is chosen at random.

Write down $P(S \cap E)$

[1 mark]

Answer _____

7 A coin is rolled onto a grid of squares.

It lands randomly on the grid.

To win, the coin must land completely within one of the squares.

Meera and John each roll the coin a number of times and record their results.

	Number of wins	**Number of losses**
Meera	6	44
John	28	72

7 (a) Work out **two** different estimates for the probability of winning.

[2 marks]

Answer _____ and _____

7 (b) Which of your estimates is the better estimate for the probability of winning?

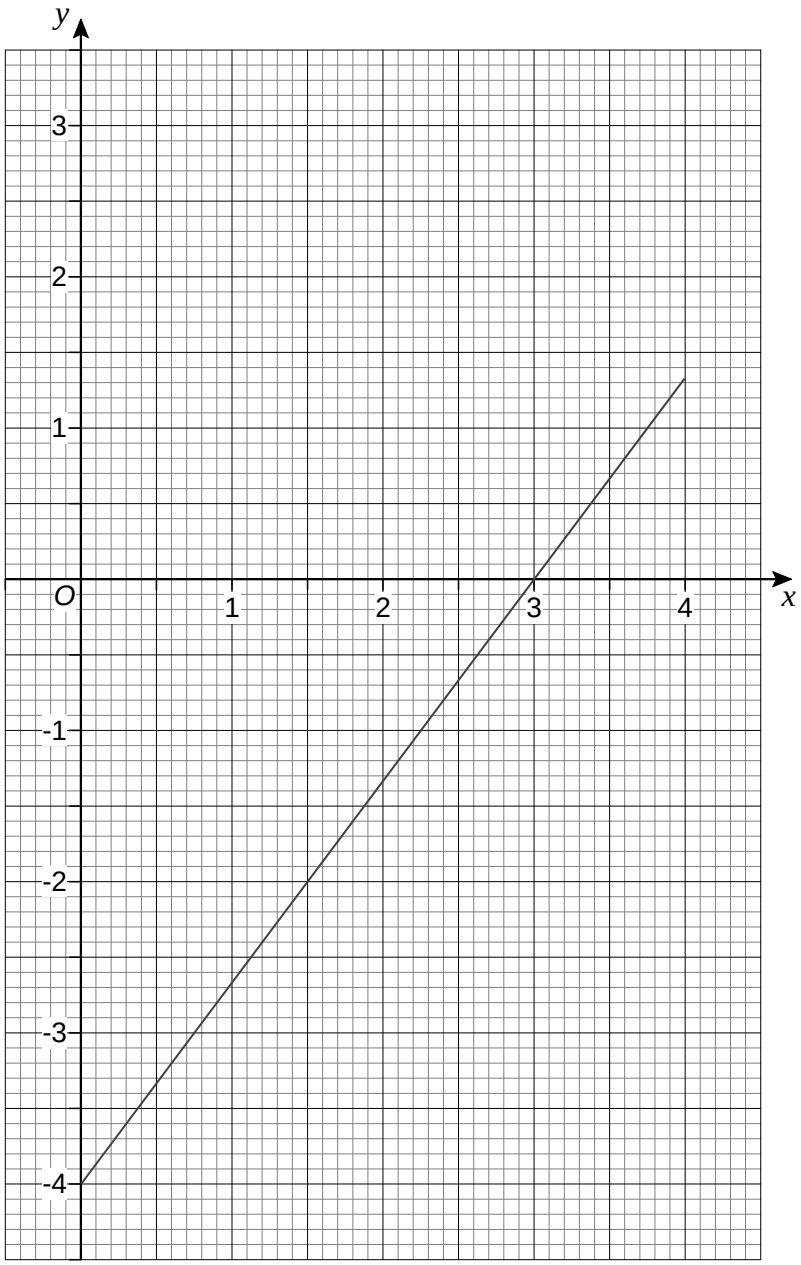
Give a reason for your answer.

[1 mark]

Answer _____

Reason _____

8 Here is the graph of $4x - 3y = 12$ for values of x from 0 to 4



By drawing a second graph on the grid,

work out an approximate solution to the simultaneous equations

$$4x - 3y = 12 \quad \text{and} \quad 3x + 2y = 6$$

[3 marks]

Answer _____

9 Written as the product of its prime factors

$672 = 2^5 \times 3 \times 7$

9 (a) Write 252 as the product of its prime factors.

[2 marks]

Answer _____

9 (b) Work out the value of the highest common factor of 672 and 252

[1 mark]

Answer _____

Turn over for the next question

10 At a school

number of boys : number of girls = 9 : 7

There are 116 **more** boys than girls.

Work out the total number of students at the school.

[3 marks]

Answer _____

11 Circle the equation with roots 4 and −8

[1 mark]

$4x(x - 8) = 0$ $(x - 4)(x + 8) = 0$

$x^2 - 32 = 0$ $(x + 4)(x - 8) = 0$

12 $R = \frac{x^2}{y}$

$x = 3.6 \times 10^5$

$y = 7.5 \times 10^4$

Work out the value of R.

Give your answer in standard form to an appropriate degree of accuracy.

[3 marks]

Answer _____

13 Two spheres have radii in the ratio 5 : 3

Circle the ratio of their volumes.

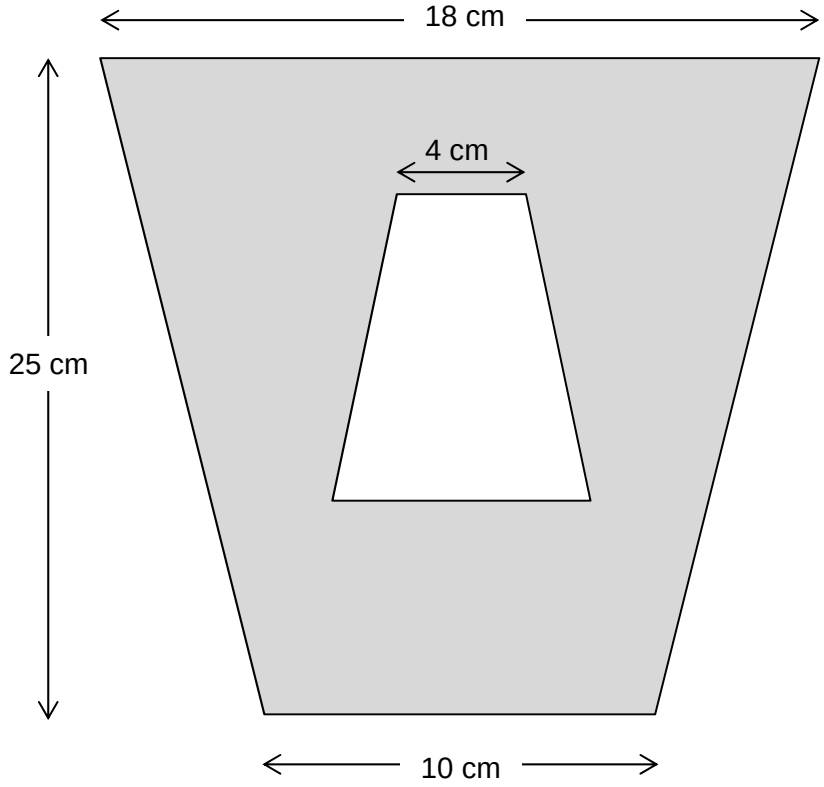
[1 mark]

5 : 3 15 : 9 25 : 9 125 : 27

Turn over for the next question

14 (a) A pattern is made from two **similar** trapeziums.

Not drawn accurately

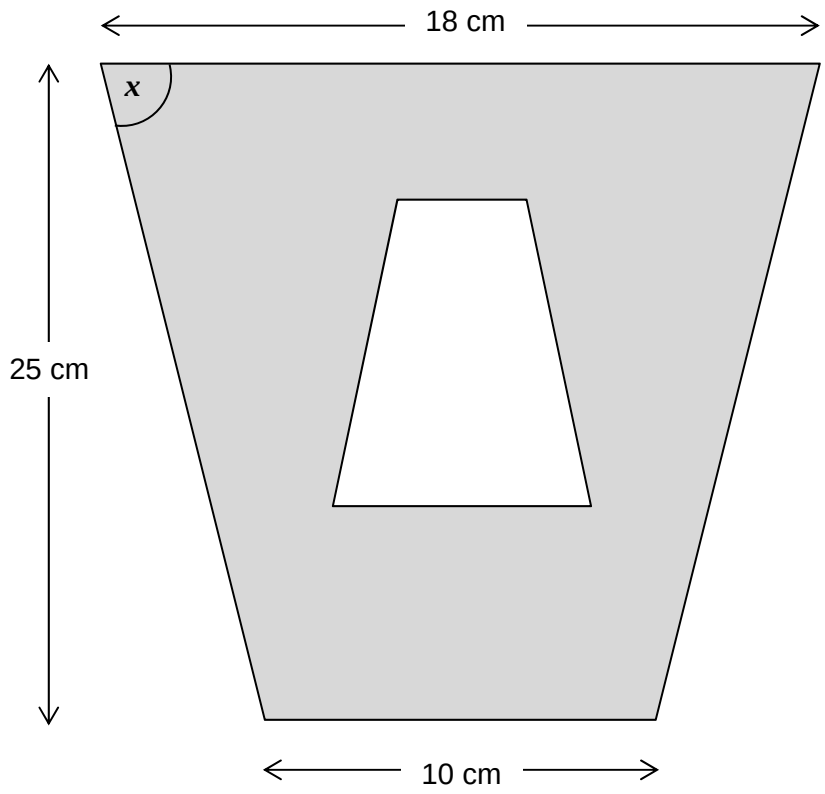


Show that the shaded area is 294 cm^2

[4 marks]

14 (b) The pattern has one line of symmetry.

Not drawn accurately



Work out the size of angle x.

[3 marks]

Answer _____ degrees

15 Ann picks a 4-digit number.

The first digit is **not** zero.

The 4-digit number is a multiple of 5

How many different 4-digit numbers could she pick?

[3 marks]

Answer _____

16 c is a positive integer.

Prove that $\frac{6c^3 + 30c}{3c^2 + 15}$ is an even number.

[3 marks]

17 The distance from the Earth to the Sun is 93 million miles.

Assume

it takes 365 days for the Earth to travel once around the Sun

the Earth travels in a circle with the Sun at the centre.

17 (a) Work out the average speed of the Earth in miles per hour.

[4 marks]

Answer _____ miles per hour

17 (b) It actually takes $365\frac{1}{4}$ days for the Earth to travel once around the Sun.

How does this affect your answer to part (a)?

[1 mark]

18 In the formula $T = (n - 6)^2 + 1$ n is a positive integer.

18 (a) Kim says,

"The value of T is always greater than 1
because $(n - 6)^2$ is always greater than 0"

Comment on her statement.

[1 mark]

18 (b) What is the only value of T that is a square number?

[1 mark]

Answer _____

19 $f(x) = 3x$

Circle the expression for $f^{-1}(x)$

[1 mark]

$-3x$ $\quad \frac{3}{x}$ $\quad \frac{1}{3x}$ $\quad \frac{x}{3}$

20 y is directly proportional to $\sqrt{x}$

x	36	a
y	2	5

Work out the value of a.

[4 marks]

Answer _____

21 A company makes boxes of cereal.

A box usually contains 450 grams of cereal.

Here are two options for a special offer.

Option A	**Option B**
20% more cereal	Usual amount of cereal
Price remains the same	15% off the price

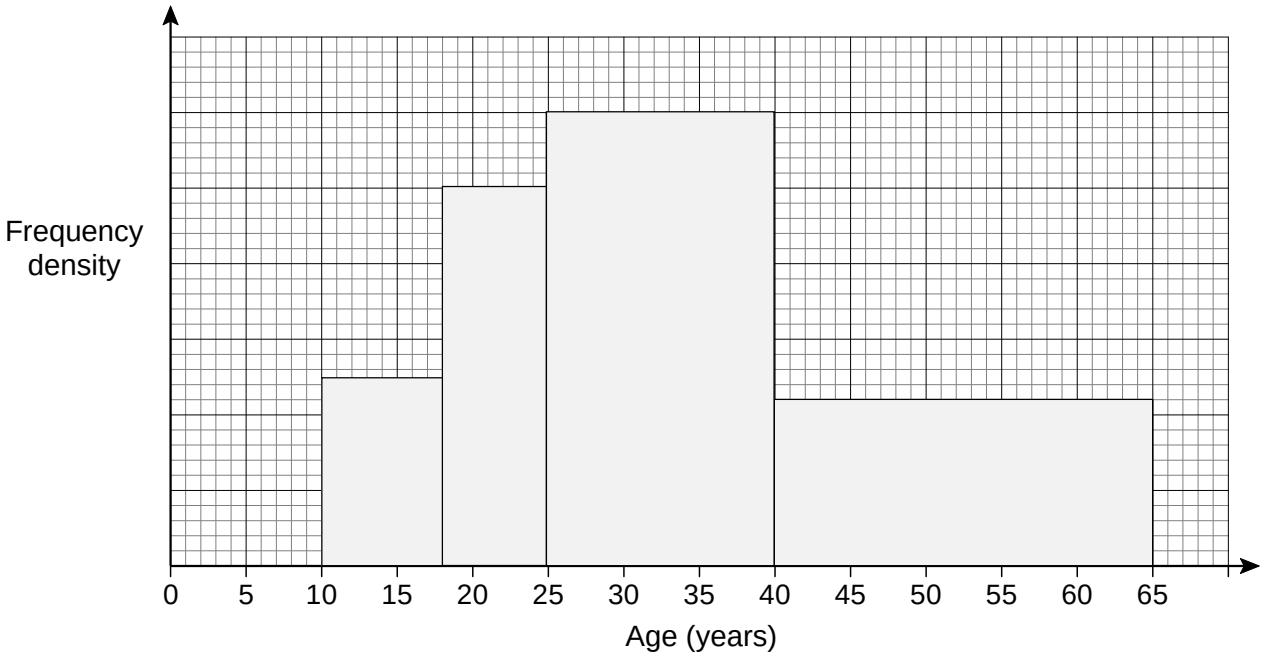
Which option is the better value for the customer?

You **must** show your working.

[3 marks]

Answer _____

22 The histogram shows the ages, in years, of members of a chess club.



There are 22 members with ages in the range $40 \leqslant \text{age} < 65$

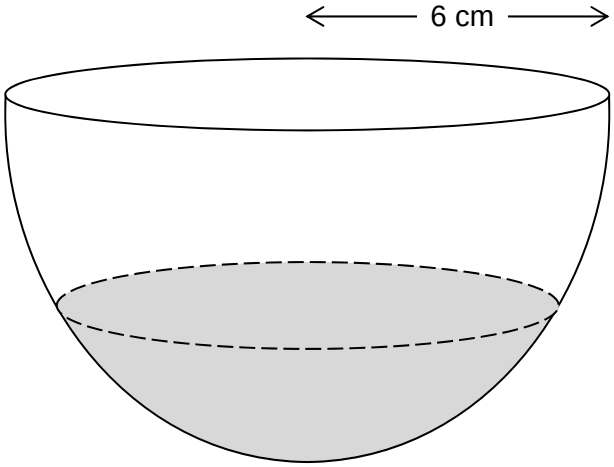
Work out the number of members with ages in the range $25 \leqslant \text{age} < 40$

[4 marks]

Answer _____

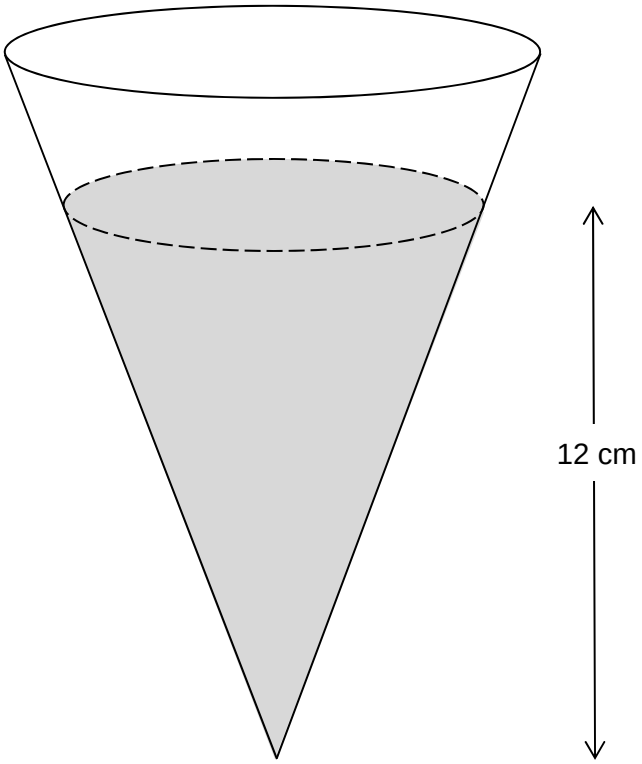
23 A bowl is a hemisphere with radius 6 cm

Water fills two-fifths of the volume of the bowl.



The water is poured into a hollow cone.

The depth of the water in the cone is 12 cm



Volume of a sphere $= \frac{4}{3}\pi r^3$	where r is the radius.
Volume of a cone $= \frac{1}{3}\pi r^2 h$	where r is the radius and h is the perpendicular height

Work out the radius of the surface of the water in the cone.

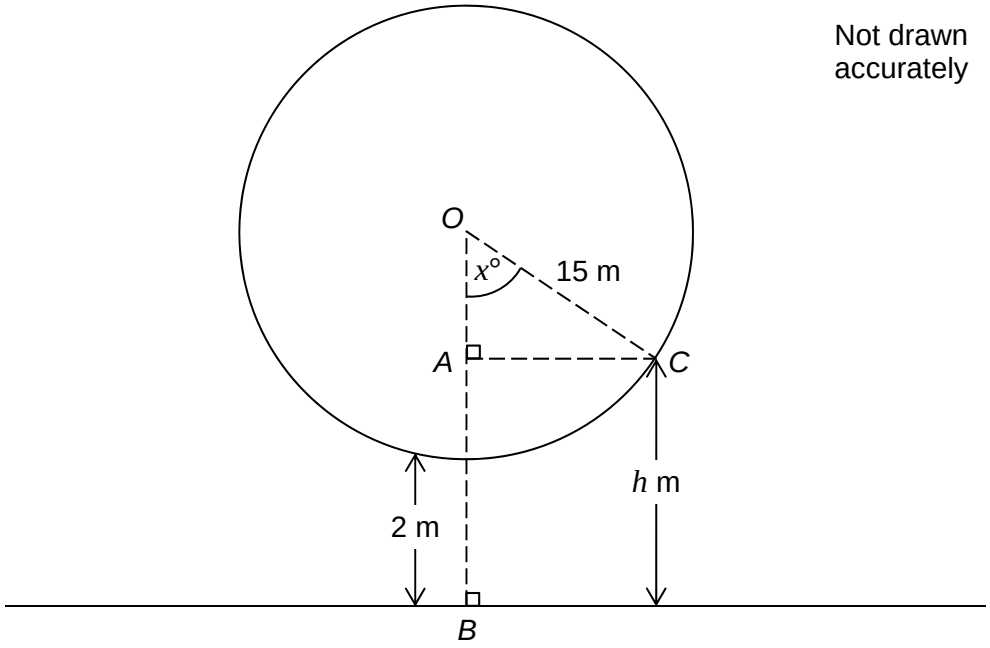
[4 marks]

Answer _____ cm

24 A Big Wheel is modelled as a circle with centre O and radius 15 metres.

The wheel turns in an anticlockwise direction.

The lowest point on the wheel is always 2 metres above horizontal ground.



24 (a) C is a point on the wheel, h metres above horizontal ground.

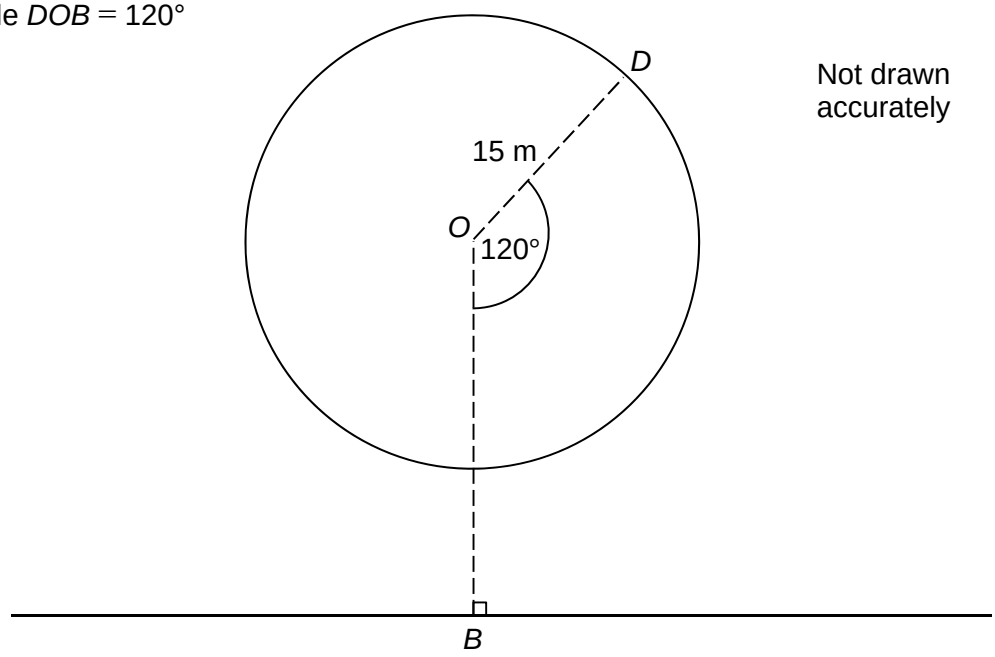
Angle $COB = x°$

Show that $h = 17 - 15 \cos x°$

[2 marks]

24 (b) *D* is a point on the wheel.

Angle *DOB* = 120°



Not drawn accurately

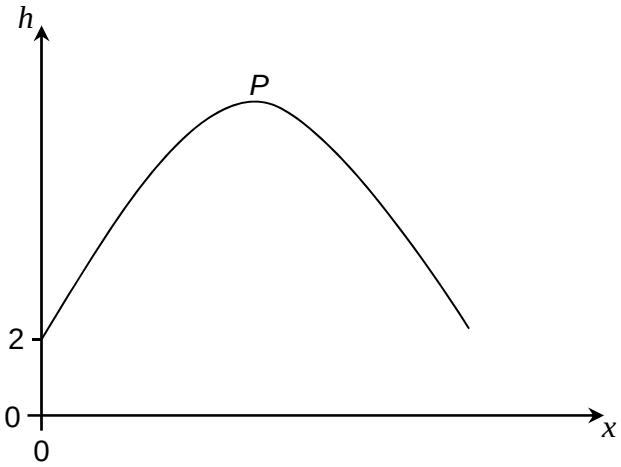
Work out the height of *D* above horizontal ground.

[2 marks]

Answer _____ metres

24 (c) Here is a sketch of the graph $h = 17 - 15\cos x°$ for one **complete** turn of the wheel.

P is the highest point on the graph.



Work out the coordinates of *P*.

[2 marks]

Answer (_____ , _____)

25 $2x^2 - 6x + 5$ can be written in the form $a(x - b)^2 + c$

where a, b and c are positive numbers.

25 (a) Work out the values of a, b and c.

[3 marks]

$a =$ _____

$b =$ _____

$c =$ _____

25 (b) Using your answer to part (a), or otherwise, solve $2x^2 - 6x + 5 = 8.5$

[3 marks]

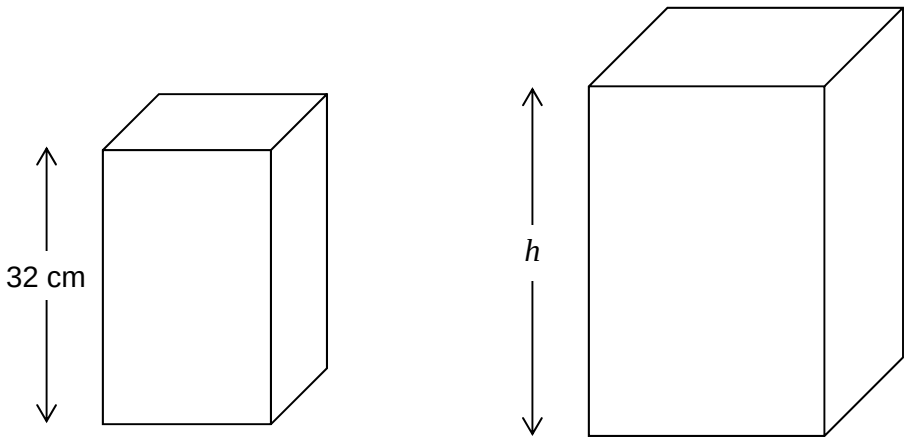
Answer _____

Turn over for the next question

26 Two boxes are made with card.

The boxes are similar cuboids.

The smaller box has height 32 cm



It takes 44% more card to make the larger box.

Work out the height, h, of the larger box.

[4 marks]

Answer _____ cm

END OF QUESTIONS

GCSE
MATHEMATICS

New Specimen Papers published June 2015
Paper 2 Higher - Mark Scheme

8300/2H

Version 1.0

Principal Examiners have prepared these mark schemes for specimen papers. These mark schemes have not, therefore, been through the normal process of standardising that would take place for live papers.

Further copies of this Mark Scheme are available from aqa.org.uk

Glossary for Mark Schemes

GCSE examinations are marked in such a way as to award positive achievement wherever possible. Thus, for GCSE Mathematics papers, marks are awarded under various categories.

If a student uses a method which is not explicitly covered by the mark scheme the same principles of marking should be applied. Credit should be given to any valid methods. Examiners should seek advice from their senior examiner if in any doubt.

M	Method marks are awarded for a correct method which could lead to a correct answer.
A	Accuracy marks are awarded when following on from a correct method. It is not necessary to always see the method. This can be implied.
B	Marks awarded independent of method.
ft	Follow through marks. Marks awarded for correct working following a mistake in an earlier step.
SC	Special case. Marks awarded within the scheme for a common misinterpretation which has some mathematical worth.
M dep	A method mark dependent on a previous method mark being awarded.
B dep	A mark that can only be awarded if a previous independent mark has been awarded.
oe	Or equivalent. Accept answers that are equivalent. eg accept 0.5 as well as $\frac{1}{2}$
[*a*, *b*]	Accept values between *a* and *b* inclusive.
3.14 …	Accept answers which begin 3.14 eg 3.14, 3.142, 3.1416
Use of brackets	It is not necessary to see the bracketed work to award the marks.

Examiners should consistently apply the following principles

Diagrams

Diagrams that have working on them should be treated like normal responses. If a diagram has been written on but the correct response is within the answer space, the work within the answer space should be marked. Working on diagrams that contradicts work within the answer space is not to be considered as choice but as working, and is not, therefore, penalised.

Responses which appear to come from incorrect methods

Whenever there is doubt as to whether a student has used an incorrect method to obtain an answer, as a general principle, the benefit of doubt must be given to the student. In cases where there is no doubt that the answer has come from incorrect working then the student should be penalised.

Questions which ask students to show working

Instructions on marking will be given but usually marks are not awarded to students who show no working.

Questions which do not ask students to show working

As a general principle, a correct response is awarded full marks.

Misread or miscopy

Students often copy values from a question incorrectly. If the examiner thinks that the student has made a genuine misread, then only the accuracy marks (A or B marks), up to a maximum of 2 marks are penalised. The method marks can still be awarded.

Further work

Once the correct answer has been seen, further working may be ignored unless it goes on to contradict the correct answer.

Choice

When a choice of answers and/or methods is given, mark each attempt. If both methods are valid then M marks can be awarded but any incorrect answer or method would result in marks being lost.

Work not replaced

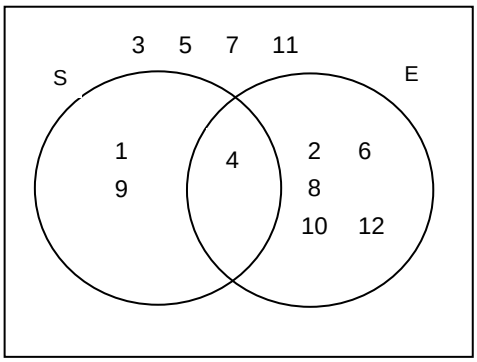
Erased or crossed out work that is still legible should be marked.

Work replaced

Erased or crossed out work that has been replaced is not awarded marks.

Premature approximation

Rounding off too early can lead to inaccuracy in the final answer. This should be penalised by 1 mark unless instructed otherwise.

Q	Answer	Mark	Comments
1	1 2 4 8	B1	
2	AAA	B1	
3	$a + 20a^2$	B1	
4	$y = 5x + 2$	B1	
5	$\frac{4}{5}$ or 80% seen or used	M1	oe May be implied
	29.4(0) × 5 ÷ 4 or 147 ÷ 4 or 29.4(0) ÷ 4 (× 5) or 7.35 (× 5) or 29.4(0) ÷ 0.8	M1	oe
	36.75	A1	
6(a)		B3	B2 Any 2 or 3 of the 4 sections correct B1 Any 1 of the 4 sections correct
6(b)	$\frac{1}{12}$	B1ft	oe ft their Venn diagram

Q	Answer	Mark	Comments
7(a)	Two of $\frac{6}{50}$ $\frac{28}{100}$ $\frac{34}{150}$	B2	oe fraction, decimal, percentage B1 One of $\frac{6}{50}$ $\frac{28}{100}$ $\frac{34}{150}$ with at most one incorrect answer
7(b)	Chooses their probability from the larger number of trials and reason given that more trials are involved	B1ft	Must have two probabilities in (a)
8	Draws $3x + 2y = 6$	B2	B1 Works out or plots at least two points satisfying $3x + 2y = 6$ eg (2, 0) and (0, 3)
	$x = 2.5$ and $y = -0.7$	B1ft	ft their graph $\pm\frac{1}{2}$ square
9(a)	Correct product using at least one prime factor	M1	For example 2 (×) 126 or 3 (×) 84 or 7 (×) 36 or 2 (×) 2 (×) 63 or 2 (×) 3 (×) 42 May be implied eg in a factor tree or repeated division
	$2 \times 2 \times 3 \times 3 \times 7$ or $2^2 \times 3^2 \times 7$	A1	
9(b)	84	B1	

Q	Answer	Mark	Comments
10	**Alternative method 1**		
	2 parts → 116	M1	oe
	116 ÷ 2 × 16	M1	oe
	928	A1	
	Alternative method 2		
	Writes at least 3 ratios or numbers of boys and girls equivalent to 9 : 7	M1	eg 18 : 14 and 180 : 140 and 360 : 280
	522 and 406	M1	
	928	A1	
11	$(x - 4)(x + 8) = 0$	B1	
12	1.7×10^6 or 2×10^6	B3	B2 $1.72(8) \times 10^6$ or 1.73×10^6 or 1 700 000 or 2 000 000 B1 1 728 000 or 1 730 000
13	125 : 27	B1	

Q	Answer	Mark	Comments
14(a)	**Alternative method 1**		
	10 ÷ 4 or 2.5 or 4 ÷ 10 or 0.4 or $\frac{1}{2} \times (18 + 10) \times 25$ or 350	M1	oe
	18 ÷ their 2.5 or 18 × their 0.4 or 7.2 or 25 ÷ their 2.5 or 25 × their 0.4 or 10	M1dep	oe
	$\frac{1}{2} \times (18 + 10) \times 25$ or 350 and $\frac{1}{2} \times$ (their 7.2 + 4) × their 10 or 56	M1dep	Must see working
	350 – 56 = 294	A1	Do not award without working seen
	Alternative method 2		
	10 ÷ 4 or 2.5 or 4 ÷ 10 or 0.4 or $\frac{1}{2} \times (18 + 10) \times 25$ or 350	M1	oe
	(Area scale factor =) (their 2.5)^2 or (their 0.4)^2	M1dep	
	their 350 ÷ (their 2.5)^2 or their 350 × (their 0.4)^2 or 56	M1dep	Must see working
	350 – 56 = 294	A1	Do not award without working seen
14(b)	$\frac{18 - 10}{2}$ or 4	B1	
	$\tan x = \frac{25}{\text{their } 4}$	M1	
	[80.9, 81]	A1	

Q	Answer	Mark	Comments
15	**Alternative method 1**		
	1800	B3	B2 a × b × c × d with at least 3 correct from 9, 10, 10 and 2 B1 a × b × c × d with at least 2 correct from 9, 10, 10 and 2 or identifies 9 possibilities for first digit or identifies 2 possibilities for final digit
	Alternative method 2		
	9000	M1	The number of digits between 1000 and 9999 inclusive
	their 9000 ÷ 5	M1dep	
	1800	A1	
16	$6c(c^2 + 5)$ or $3(c^2 + 5)$	M1	
	$\frac{6c(c^2+5)}{3(c^2+5)}$	M1	This mark implies first M1
	$2c$ and multiple of 2 so even	A1	oe statement Must see method

Q	Answer	Mark	Comments
17(a)	**Alternative method 1**		
	93 000 000 × 2π or 186 000 000π or [584 000 000 , 584 412 000]	M1	oe Allow working in millions
	365 × 24 or 8760	M1	
	their 186 000 000 π ÷ their 8760	M1	oe Allow working in millions Only allow if first M1 gained or if their circumference is 93 000 000 × π
	[6.6 × 10^4, 6.7 × 10^4]	A1	oe
	Alternative method 2		
	93 000 000 × 2π or 186 000 000π or [584 000 000, 584 412 000]	M1	oe Allow working in millions
	their 186 000 000π ÷ 365 or [1 598 904, 1 600 033]	M1	oe Allow working in millions Only allow if M1 gained or if their circumference is 93 000 000 × π their 365.25 can be 365.25 × 24 or 365.25 × 60
	their [1.6 × 10^6, 1.602 × 10^6] ÷ 24	M1	
	[6.6 × 10^4, 6.7 × 10^4]	A1	oe
17(b)	The average speed would be (slightly) lower	B1	oe

Q	Answer	Mark	Comments
18(a)	$(n-6)^2$ could be zero (so she is wrong) or The sixth term is 1	B1	oe
18(b)	1	B1	
19	$\frac{x}{3}$	B1	
20	**Alternative method 1**		
	$2 = k\sqrt{36}$ or $\sqrt{36} = 6$	M1	
	$(k =)$ 2 ÷ their 6 or $\frac{1}{3}$	M1dep	
	5 ÷ their $\frac{1}{3}$ or 15 $(\sqrt{a} =)$	M1	oe
	225	A1	
	Alternative method 2		
	$2k = \sqrt{36}$ or $\sqrt{36} = 6$	M1	
	$(k =)$ their 6 ÷ 2 or 3	M1dep	
	5 × their 3 or 15 $(\sqrt{a} =)$	M1	oe
	225	A1	
	Alternative method 3		
	$2k = \sqrt{36}$ or $\sqrt{36} = 6$	M1	
	5 ÷ 2 or 2.5	M1	
	their 6 × their 2.5 or 15 $(\sqrt{a} =)$	M1dep	dep on M1 M1
	225	A1	

Q	Answer	Mark	Comments
21	**Alternative method 1**		
	1.2 or 0.85	M1	
	1 ÷ 0.85 or 1.1(7...) or 1.18	M1	
	1.1(7…) or 1.18 and 1.2 and (Option) A	A1	
	Alternative method 2		
	1.2 or 0.85	M1	
	1 ÷ 1.2 or 0.83(…)	M1	
	0.83(…) and 0.85 and (Option) A	A1	
	Alternative method 3		
	450 × 1.2 or 540 or x × 0.85 or 0.85x	M1	x is the usual cost of the box and may be a numerical value
	x ÷ their 540 or their 0.85x ÷ 450	M1dep	
	0.00185(…)x and 0.00188(…)x and (Option) A	A1	oe
	Alternative method 4		
	450 × 1.2 or 540 or x × 0.85 or 0.85x	M1	x is the usual cost of the box and may be a numerical value
	their 540 ÷ x or 450 ÷ their 0.85x	M1dep	
	$\frac{540}{x}$ and $\frac{529.(...)}{x}$ and (Option) A	A1	oe

Alternative method 5 on next page

Q	Answer	Mark	Comments
21	**Alternative method 5**		
	$\frac{1}{6}$ (free for A)	M1	oe fraction or decimal or percentage
	$\frac{3}{18}$ (free for A) and $\frac{3}{20}$ (free for B)	M1	oe pairs of fractions or pairs of decimal or pairs of percentages
	$\frac{3}{18}$ (free for A) and $\frac{3}{20}$ (free for B) and (Option) A	A1	
22	**Alternative method 1**		
	25 × 11 or 275	M1	
	their 275 ÷ 22 or 12.5	M1dep	
	15 × 30 ÷ their 12.5	M1	
	36	A1	
	Alternative method 2		
	25 × 11 or 275	M1	
	15 × 30 ÷ their 275 or [1.6, 1.64]	M1dep	
	their [1.6, 1.64] × 22	M1	
	36	A1	
	Alternative method 3		
	11 squares or 275 squares	M1	
	22 ÷ 11 or 2 or 22 ÷ 275 or 0.08	M1dep	
	their 2 × 18 or their 0.08 × 450	M1	
	36	A1	

Q	Answer	Mark	Comments
22	**Alternative method 4**		
	$\frac{15}{25}$ or $\frac{30}{11}$	M1	
	$\frac{15}{25} \times \frac{30}{11}$ or $\frac{18}{11}$	M1dep	oe fraction
	their $\frac{18}{11} \times 22$	M1	
	36	A1	
	Alternative method 5		
	$25 \times h = 22$ or $\frac{22}{25}$ or 0.88	M1	oe
	$0.88 \div 11$ or 0.08	M1dep	oe eg frequency density axis labelled with correct scale
	their $0.08 \times 30 \times 15$	M1	
	36	A1	
23	$\frac{1}{2} \times \frac{4}{3} \times \pi \times 6^3$ or 144π	M1	oe eg [452, 452.45]
	$\frac{2}{5} \times$ their $144\pi = \frac{1}{3} \times \pi \times x^2 \times 12$ or $57.6\pi = 4\pi x^2$	M1	oe eg [180.8, 181] = [12.5, 12.6] x^2 Must equate two volumes in terms of π
	$3 \times \frac{2}{5} \times$ their $144\pi \div 12\pi$ or 14.4	M1dep	oe eg their [180.8, 181] ÷ their [12.5, 12.6] dep on 2nd M1 Correct working to isolate x^2
	[3.79, 3.8]	A1	

Q	Answer	Mark	Comments
24(a)	$\cos x = \frac{OA}{15}$ or $OA = 15 \cos x$	M1	
	$OA = 15 \cos x$ and $OB = 15 + 2$ and $h = OB - OA = 17 - 15 \cos x$	A1	
24(b)	$17 - 15 \cos 120$ or $15 \sin 30$ or 7.5	M1	
	24.5	A1	oe
24(c)	(180, 32)	B2	B1 one correct coordinate SC1 (32, 180)

25(a)	**Alternative method 1**		
	$a = 2$ or $2(x^2 - 3x + 2.5)$ or $2(x^2 - 3x) + 5$	M1	
	$x^2 - 3x = (x - 1.5)^2 - 1.5^2$	M1dep	oe ft their $x^2 - 3x$
	$a = 2$ and $b = 1.5$ and $c = 0.5$	A1	oe eg $2(x - 1.5)^2 + 0.5$
	Alternative method 2		
	$a = 2$	B1	
	$x^2 - bx - bx + b^2$ or $x^2 - 2bx + b^2$ or $-2ab = -6$ or $-ab = -3$ or $b = 1.5$	M1	oe
	$a = 2$ and $b = 1.5$ and $c = 0.5$	A1	oe eg $2(x - 1.5)^2 + 0.5$

Q	Answer	Mark	Comments
25(b)	**Alternative method 1**		
	their $2(x - 1.5)^2 = 8.5 -$ their 0.5	M1	
	their $(x - 1.5) = \pm \sqrt{\frac{8.5 - \text{their } 0.5}{2}}$	M1dep	oe
	3.5 and –0.5	A1	oe
	Alternative method 2		
	$2x^2 - 6x - 3.5 (= 0)$ or $4x^2 - 12x - 7 (= 0)$	M1	oe 3-term quadratic equation or expression
	Correct use of quadratic formula eg $\frac{--12 \pm \sqrt{(-12)^2 - 4 \times 4 \times -7}}{2 \times 4}$ or correct factorisation eg $(2x - 7)(2x + 1) = 0$	M1dep	oe
	3.5 and –0.5	A1	oe

26	144% or 1.44 seen	B1	
	$\sqrt{1.44}$ or 1.2	M1	oe
	their 1.2 × 32	M1dep	
	38.4	A1	

SP/02/15