AQA

GCSE
MATHEMATICS

H

Higher Tier   Paper 1 Non-Calculator
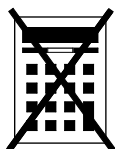
Thursday 2 November 2017   Morning   Time allowed: 1 hour 30 minutes

Materials

For this paper you must have:
• mathematical instruments

You must **not** use a calculator.

Instructions

• Use black ink or black ball-point pen. Draw diagrams in pencil.
• 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. Cross through any work you do not want to be marked.

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.

Advice

• In all calculations, show clearly how you work out your answer.

For Examiner's Use	
Pages	Mark
2–3	
4–5	
6–7	
8–9	
10–11	
12–13	
14–15	
16–17	
18–19	
20–21	
22–23	
24–25	
26–27	
TOTAL	

Answer **all** questions in the spaces provided

1   Work out $\sqrt{2^6 + 6^2}$

Circle your answer.

[1 mark]

10	14	50	100

2   What is   800 million   in standard form?

Circle your answer.

[1 mark]

800×10^6	8×10^8	8×10^9	0.8×10^{10}

3   Circle the expression that is equivalent to $\left(4a^5 \right)^2$

[1 mark]

$16a^{10}$	$16a^7$	$8a^{10}$	$8a^7$

4 $y = \dfrac{10}{x}$

If the value of x doubles, what happens to the value of y?

Circle your answer.

[1 mark]

÷ 2   × 2   ÷ 5   × 5

5 (a)   Factorise $x^2 - 100$

[1 mark]

Answer _____

5 (b)   Solve $7x + 6 > 1 + 2x$
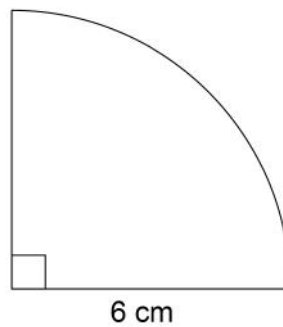
[2 marks]

Answer _____

6   Work out the value of $\left(\sqrt{3}\right)^2 \times \left(\sqrt{2}\right)^2$

[2 marks]

Answer _____

7   Here is a quarter circle of radius 6 cm

Not drawn accurately

Work out the area of the quarter circle.

Give your answer in terms of π.

[2 marks]

Answer _____ cm^2

8 Three **whole** numbers are each rounded to the nearest 10

The sum of the rounded numbers is 70

Work out the **maximum** possible sum for the original three numbers.

[2 marks]

Answer _____

9 Circle the expression for the range of n consecutive integers.

[1 mark]

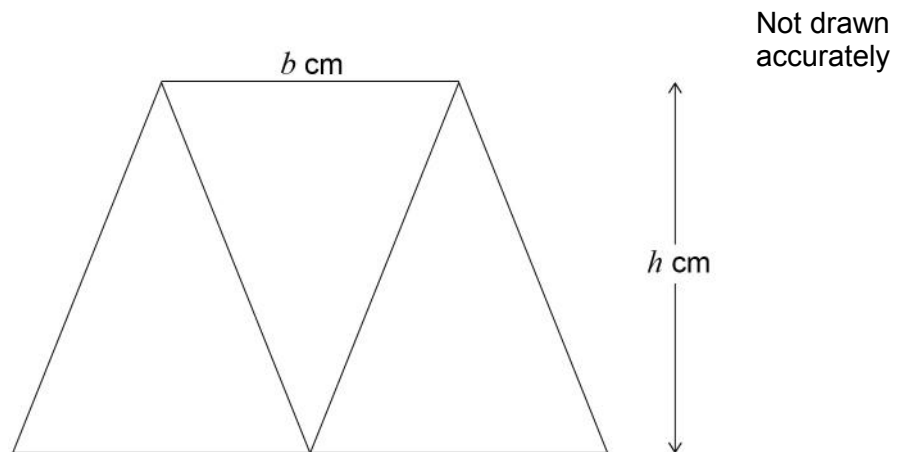$$\frac{n+1}{2} \qquad\qquad n-1 \qquad\qquad n \qquad\qquad n+1$$

Turn over for the next question

7

Turn over ▶

10 Three identical isosceles triangles are joined to make this trapezium.

Each triangle has base b cm and perpendicular height h cm

Not drawn accurately

b cm

h cm

10 (a) Work out an expression, in terms of b and h, for the area of the trapezium.

Give your answer in its simplest form.

[2 marks]

Answer _____ cm^2

10 (b) This diagram shows the same trapezium.

Not drawn accurately

b cm

s cm
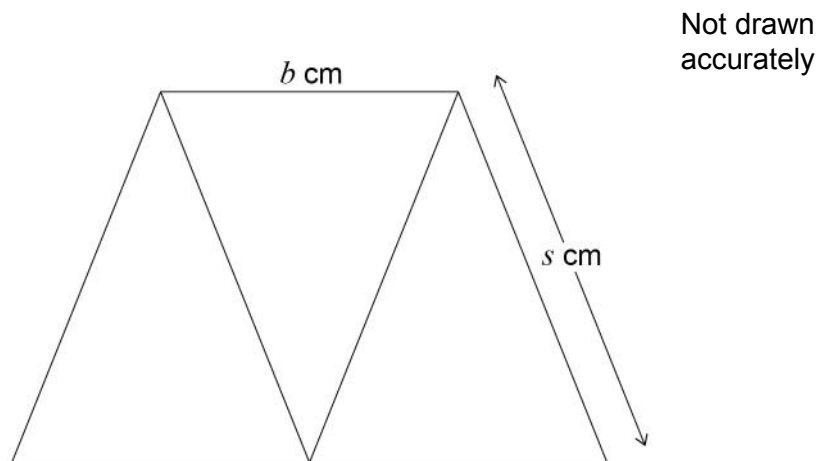
$b : s = 2 : 3$

Work out an expression, in terms of b, for the perimeter of the trapezium.

[2 marks]

Answer _____ cm

Turn over for the next question

Turn over ▶

11 The four candidates in an election were A, B, C and D.

The pie chart shows the proportion of votes for each candidate.

Proportion of votes

Not drawn accurately
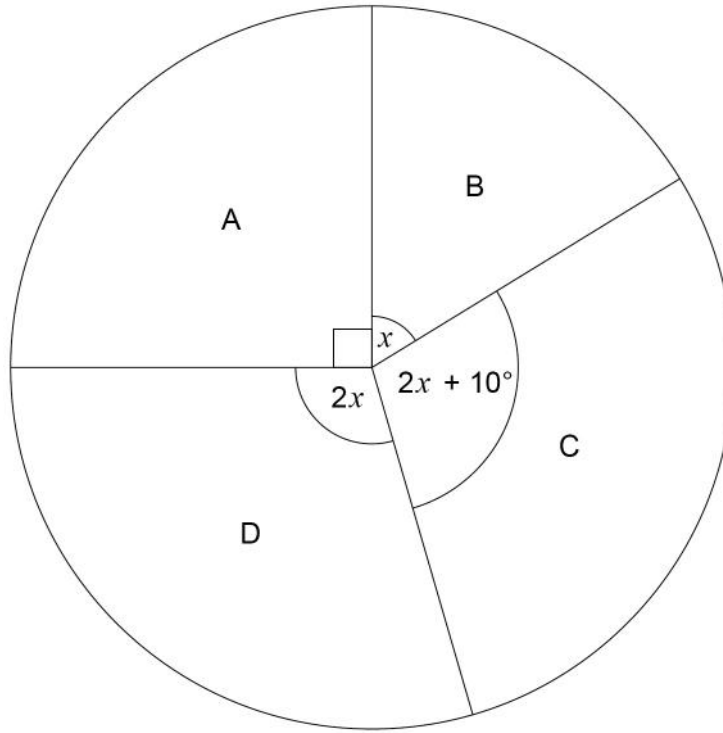
Work out the probability that a person who voted, chosen at random, voted for C.

[4 marks]

Answer _____

12 Use approximations to 1 significant figure to estimate the value of

$$\frac{0.526 \times 39.6^2}{\sqrt{97.65}}$$

You **must** show your working.

[3 marks]

Answer _____

Turn over for the next question

Turn over ▶

13 $x : y = 7 : 4$

$x + y = 88$

Work out the value of $x - y$

[3 marks]

_____

_____

_____

_____

_____

_____

Answer _____

14 Two congruent regular polygons are joined together.
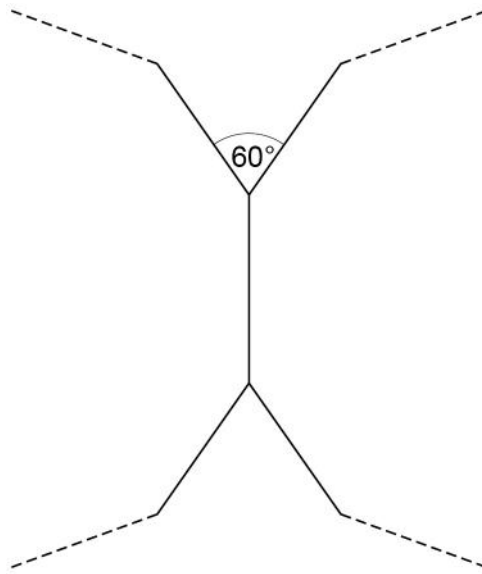
Not drawn accurately

Work out the number of sides on each polygon.

[3 marks]

_____

_____

_____

_____

_____

Answer _____

Turn over for the next question

6

Turn over ▶

15

Meal Deal
Choose one sandwich, one drink and one snack

There are

     7 different sandwiches

     5 different drinks

     and

     3 different snacks.

15 (a) How many different Meal Deal combinations are there?

[2 marks]

Answer _____

15 (b) Two of the sandwiches have cheese in them.

Three of the drinks are fizzy.

Eva picks a Meal Deal at random.

Work out the probability that the sandwich has cheese in it **and** the drink is fizzy.

Give your answer as a fraction.

[2 marks]

Answer _____

16 Water is poured into a tank.

The graph shows the number of litres of water in the tank.
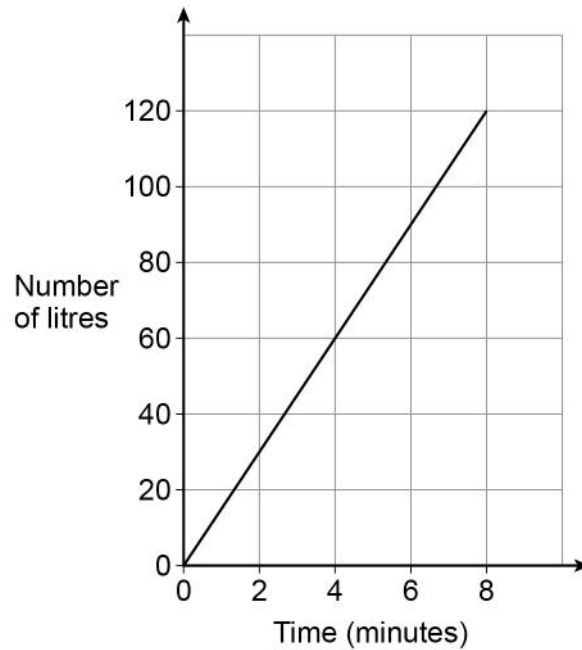
How much water is poured into the tank each minute?

Circle your answer.

[1 mark]

1.5 litres   15 litres   30 litres   120 litres

Turn over for the next question

5

Turn over ▶

17 A and B are **similar** solids.

Solid	length (cm)
A	l
B	$2l$

Alex says,

"The volume of B is double the volume of A

because the length of B is double the length of A."

Is he correct?

Tick a box.

Yes ☐ No ☐

Give a reason for your answer.

[1 mark]

_____

_____

18 Circle the **two** roots of $(2x + 3)(5x - 2) = 0$

[1 mark]

$$-\frac{3}{2} \qquad -\frac{2}{5} \qquad \frac{2}{5} \qquad \frac{3}{2}$$

19 The diagram shows a triangle and a trapezium.

Not drawn
accurately

b

65°

a

115° c
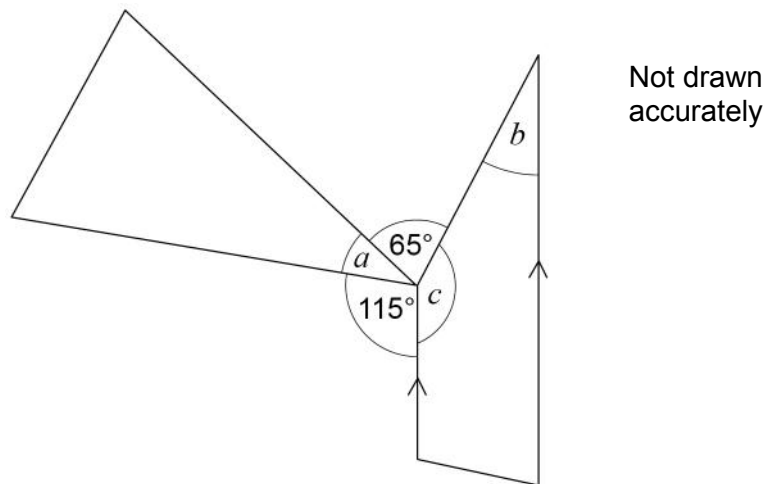
Prove that $\quad a = b$

[3 marks]

_____

_____

_____

_____

_____

_____

_____

Turn over for the next question

5

Turn over ▶

20 In one month, the number of hours of exercise taken by 10 people are

4   7   2   8   6   5   1   82   3   9

Which is the appropriate average to use in this situation?

Tick a box.

☐ Mean   ☐ Median   ☐ Mode

Give one reason for each of the other two averages as to why they are **not** appropriate.

[2 marks]

Reason 1 _____

_____

Reason 2 _____

_____

21 *A*, *B* and *C* are points on the axes as shown.
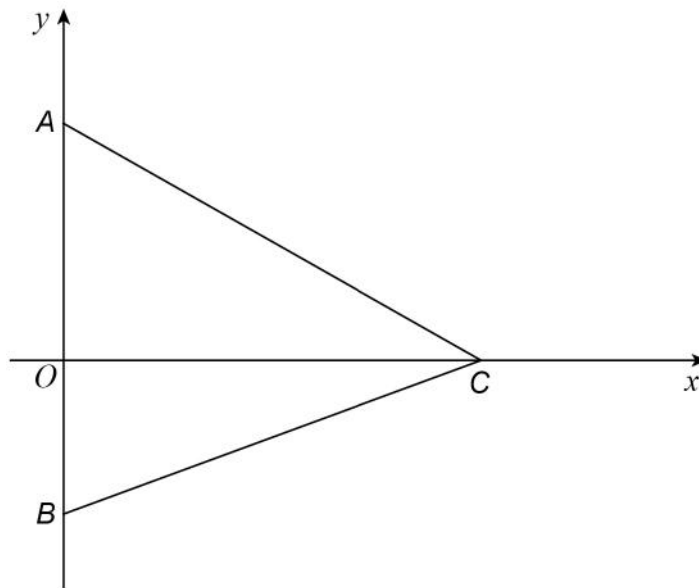
Not drawn accurately

The area of triangle *ABC* is 28 square units.

Work out possible coordinates for *A*, *B* and *C*.

[2 marks]

_____

_____

_____

_____

A (_____ , _____)   *B* (_____ , _____)   *C* (_____ , _____)

Turn over for the next question

Turn over ▶

22 Here is some information about the miles per gallon of 60 cars.

Miles per gallon, x	Frequency
$40 < x \leqslant 50$	6
$50 < x \leqslant 60$	16
$60 < x \leqslant 70$	28
$70 < x \leqslant 80$	10

22 (a) Draw a cumulative frequency graph.

[3 marks]

IB/M/Nov17/8300/1H
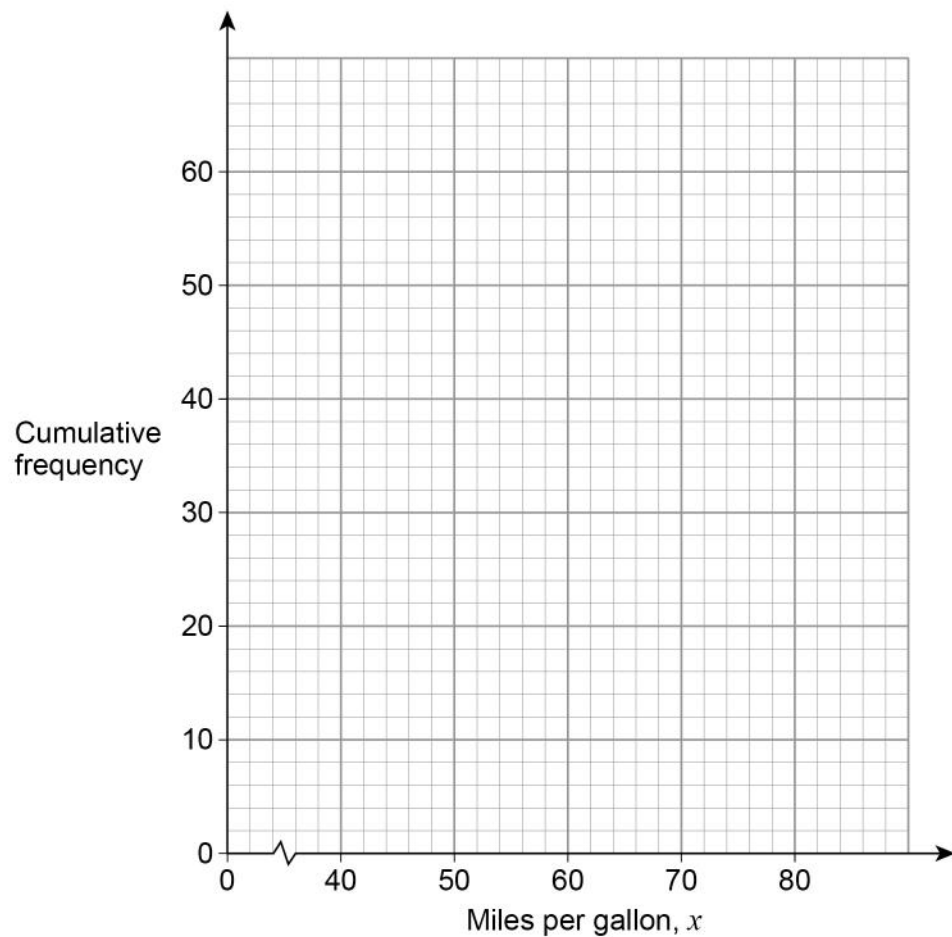
22 (b) Use the graph to work out the interquartile range.

[2 marks]

Answer _____ miles per gallon

23 The equation of a curve is $y = (x + 3)^2 + 5$

Circle the coordinates of the turning point.

[1 mark]

(5, 3) (5, –3) (3, 5) (–3, 5)

Turn over for the next question

6

Turn over ▶

24 Here is a cyclic quadrilateral.
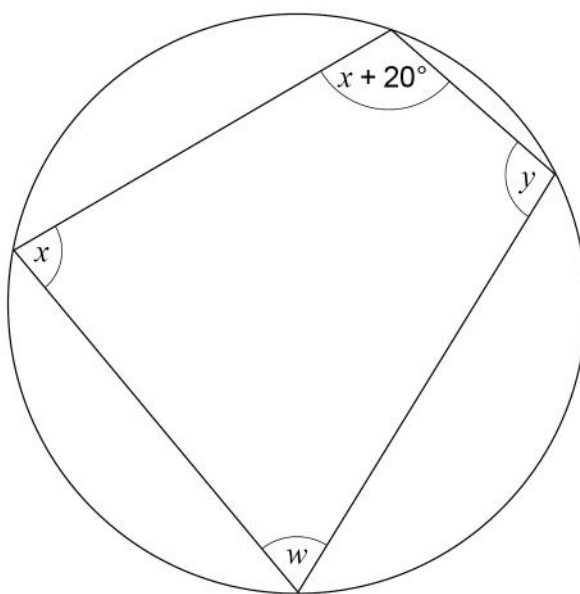
Not drawn
accurately

$x : y = 5 : 7$

Work out the size of angle w.

[4 marks]

Answer _____ degrees

25 15 machines work at the same rate.

Together, the 15 machines can complete an order in 8 hours.

3 of the machines break down after working for 6 hours.

The other machines carry on working until the order is complete.

In total, how many hours does **each** of the other machines work?

[3 marks]

Answer _____ hours

Turn over for the next question

Turn over ▶

26 (a) $0.\dot{7} = \dfrac{7}{9}$

Use this fact to show that $0.0\dot{7} = \dfrac{7}{90}$

[1 mark]

26 (b) Using part (a) or otherwise, convert $0.2\dot{7}$ to a fraction.

Give your answer in its simplest form.

[3 marks]

Answer _____

27 There are 11 pens in a box.

8 are black and 3 are red.

Two pens are taken out at random **without** replacement.

Work out the probability that the two pens are the **same** colour.

[4 marks]

Answer _____

8

IB/M/Nov17/8300/1H

28 *A, B* and *C* are points on the circle $x^2 + y^2 = 36$ as shown.

A is on the *y*-axis.

B is on the *x*-axis.

M is the midpoint of *AB*.

COM is a straight line.
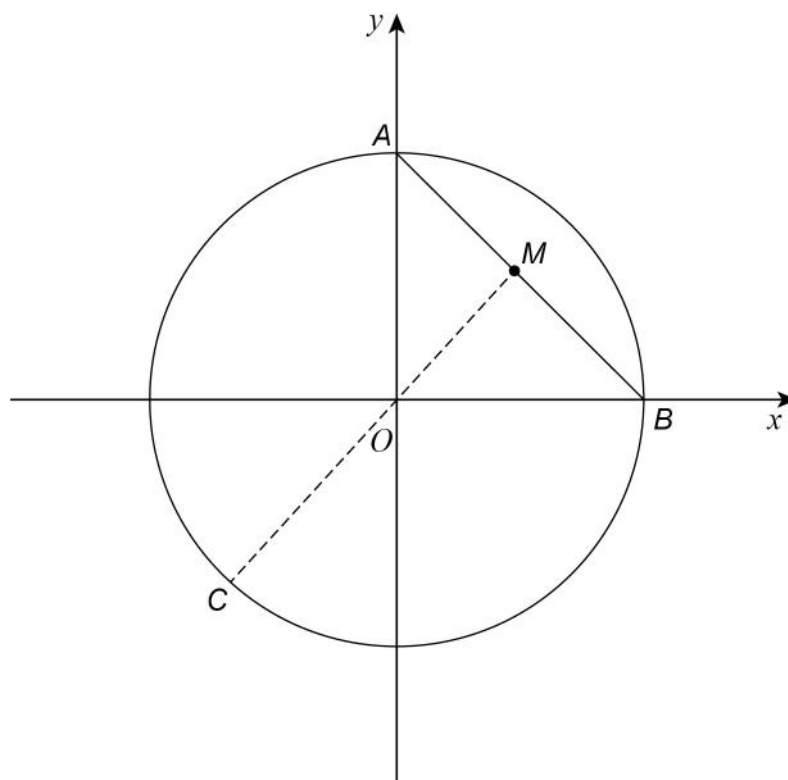
28 (a) Show that the coordinates of *A* are (0, 6)

[1 mark]

_____

_____

28 (b) Work out the coordinates of *B*.

[1 mark]

_____

_____

Answer (_____ , _____)

28 (c) Show that the equation of the straight line passing through *C*, *O* and *M* is $y = x$

[2 marks]

28 (d) Work out the coordinates of *C*.

Give your answers in surd form.

[3 marks]

Answer (_____ , _____)

Turn over for the next question

Turn over ▶

7

29 Here is a sketch of $y = \sin x°$ for $-360 \leqslant x \leqslant 360$
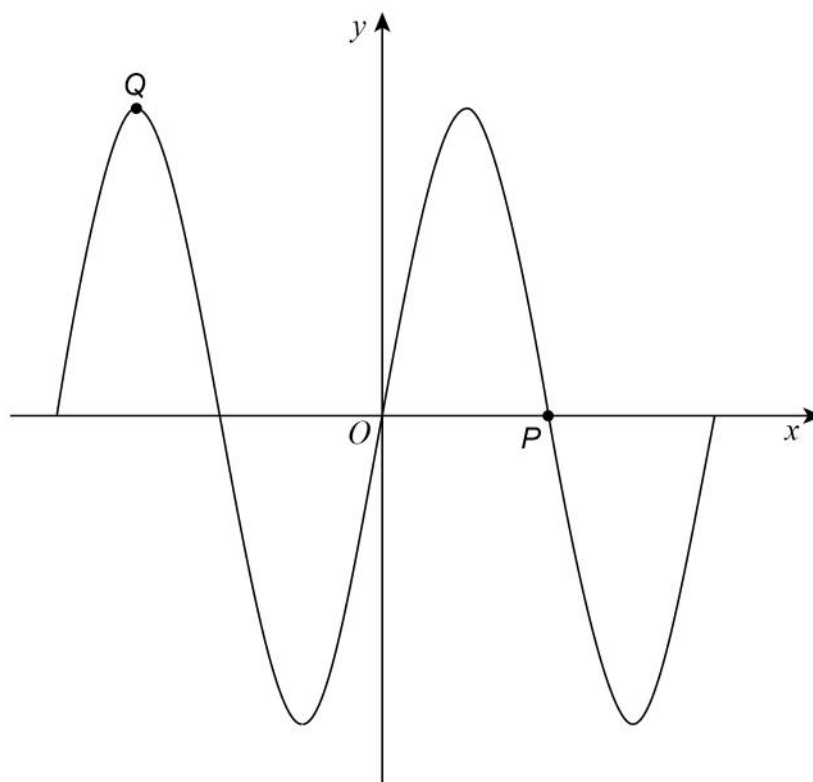
29 (a) Write down the coordinates of *P*.

[1 mark]

Answer (_____ , _____)

29 (b) Write down the coordinates of *Q*.

[1 mark]

Answer (_____ , _____)

30 (a) Work out the value of $81^{-\frac{1}{4}}$

[2 marks]

Answer _____

30 (b) Write 16×8^{2x} as a power of 2 in terms of x.

[3 marks]

Answer _____

END OF QUESTIONS

7

Do not write outside the box

There are no questions printed on this page

DO NOT WRITE ON THIS PAGE
ANSWER IN THE SPACES PROVIDED

AQA

GCSE
Mathematics

Paper 1 Higher Tier

Mark scheme

8300
November 2017

Version: 1.0 Final

Mark schemes are prepared by the Lead Assessment Writer and considered, together with the relevant questions, by a panel of subject teachers. This mark scheme includes any amendments made at the standardisation events which all associates participate in and is the scheme which was used by them in this examination. The standardisation process ensures that the mark scheme covers the students' responses to questions and that every associate understands and applies it in the same correct way. As preparation for standardisation each associate analyses a number of students' scripts. Alternative answers not already covered by the mark scheme are discussed and legislated for. If, after the standardisation process, associates encounter unusual answers which have not been raised they are required to refer these to the Lead Assessment Writer.

It must be stressed that a mark scheme is a working document, in many cases further developed and expanded on the basis of students' reactions to a particular paper. Assumptions about future mark schemes on the basis of one year's document should be avoided; whilst the guiding principles of assessment remain constant, details will change, depending on the content of a particular examination paper.

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 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.
[a, b)	Accept values a ≤ value < b
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.

Continental notation

Accept a comma used instead of a decimal point (for example, in measurements or currency), provided that it is clear to the examiner that the student intended it to be a decimal point.

Question	Answer	Mark	Comments
1	10	B1	
2	8×10^8	B1	
3	$16a^{10}$	B1	
4	÷ 2	B1	

5(a)	$(x - 10)(x + 10)$	B1	either order ignore fw

Additional Guidance	
$(x + 10)(x + -10)$	B1
Condone missing bracket at end only $(x - 10)(x + 10$ $(x - 10(x + 10)$	B1 B0
$(x - 10)(x + 10)$ followed by attempt to solve, eg answer $x = 10$, $x = -10$	B1
answer only $x = 10$, $x = -10$	B0

5(b)	$7x - 2x > 1 - 6$ or $5x > -5$ or $6 - 1 > 2x - 7x$ or $5 > -5x$ or $1 > -x$	M1	oe collecting terms
	$x > -1$ or $-1 < x$	A1	SC1 incorrect sign eg $x \geqslant -1$ or $x = -1$ or answer of –1

Additional Guidance	
Answer $x > \dfrac{-5}{5}$	M1A0
Answer only $\dfrac{-5}{5}$	SC0
$x > -1$ with –1 or 0, 1, 2 … as the answer	M1A0

Question	Answer	Mark	Comments
6	$((\sqrt{3})^2 =)\ 3$ and $((\sqrt{2})^2 =)\ 2$ or $(\sqrt{6})^2$ or $\sqrt{6^2}$ or $\sqrt{36}$ or $\sqrt{9} \times \sqrt{4}$ or $\sqrt{9 \times 4}$	M1	
	6	A1	

Additional Guidance

$3 \times 2 = 6$ with answer eg $\sqrt{6}$ or 6^4	M0A0
Condone $\sqrt{3} = 1.7,\ 1.7^2 = 3$ and $\sqrt{2} = 1.4,\ 1.4^2 = 2$, otherwise $\sqrt{3}$ or $\sqrt{2}$ or 3^2 or 2^2 incorrectly evaluated does not score, even if answer is 6 eg $\sqrt{3} = 1.5,\ 1.5^2 = 3$	M0A0
$\sqrt{2} = 1,\ 1^2 = 2$, answer 6	M0A0
$3^2 = 6,\ \sqrt{6} = 3$	M0
$\left(\sqrt{6}\right)^4$	M0A0
$\sqrt{2} = 1$	M0

Question	Answer	Mark	Comments
7	$\pi \times 6 \times 6$ or 36π or [113, 113.112] or $9 \times$ [3.14, 3.142] or [28.26, 28.3]	M1	oe accept [3.14, 3.142] for π
	9π or $9 \times \pi$ or $\pi 9$ or $\pi \times 9$	A1	

Additional Guidance

36π followed by an incorrect method eg $36\pi \div 2 = 18\pi$ with answer 18π	M1A0
Answer of 9π from $\pi \times 3^2$	M0A0
9π and [28.26, 28.3] given on answer line	M1A0
πr^2 stated but followed by 36 or 9	M0A0

Question	Answer	Mark	Comments
8	**Alternative method 1**		
	Three whole numbers that each are less than 80 and have units digit 4 or States that each number must have units digit 4	M1	
	82	A1	
	Alternative method 2		
	Correctly evaluated trial for three whole numbers, none of which are a multiple of 10, and that, when rounded, total 70	M1	eg 33 + 33 + 13 = 79
	82	A1	

Additional Guidance		
39 + 33 + 13 = 85 (40 + 30 + 10 = 80)	M0
Beware 82 from incorrect values, eg 39 + 24 + 19 = 82	M0A0
Ignore incorrectly evaluated trials that do not solely lead to the answer	

9	$n - 1$	B1	

Question	Answer	Mark	Comments
10(a)	$\frac{1}{2}(b + 2b)h$ or $3 \times \frac{1}{2}bh$	M1	oe
	$1.5bh$ or $\frac{3}{2}bh$ or $\frac{3bh}{2}$ or $1\frac{1}{2}bh$	A1	accept hb for bh
	Additional Guidance		
	Correct expression with ×, ÷ or brackets		M1A0
	Condone units within expressions for M1 only		
	Condone the expression given within a formula eg $A = 1.5hb$		M1A1
	Condone correct expression stated and then equated to a value or with values substituted		M1A1

Question	Answer	Mark	Comments
10(b)	$3b + 2s$ or $3b = 2s$ or $4s$	M1	oe
	$6b$	A1	oe eg $b + b + b + b + b + b$
	Additional Guidance		
	Condone the expression given within a formula eg $P = 6b$		M1A1

Question	Answer	Mark	Comments
	Alternative method 1		
	$x + 2x + 2x + 10$ or $5x + 10$ or $x + 2x + 2x + 10 + 90$ or $5x + 100$	M1	oe
	$x + 2x + 2x + 10 = 360 - 90$ or $5x + 10 = 270$ or $x + 2x + 2x + 10 + 90 = 360$ or $5x + 100 = 360$ or $5x = 260$	M1dep	oe
	$(x =)$ 52 or $2x = 104$ or $2x + 10 = 114$	A1	May be on diagram
	$\dfrac{114}{360}$ or $\dfrac{57}{180}$ or $\dfrac{38}{120}$ or $\dfrac{19}{60}$ or 0.31(6..) or 0.317 or 0.32 or 31(.6…)% or 31.7% or 32%	B1ft	ft $\dfrac{2 \times \text{their } 52 + 10}{360}$ or $\dfrac{\text{their angle for C}}{360}$
11	**Alternative method 2**		
	$\dfrac{90}{360} + \dfrac{x}{360} + \dfrac{2x}{360} + \text{P(C)} = 1$ or $\dfrac{90}{360} + \dfrac{x}{360} + \dfrac{2x}{360} + \dfrac{2x + 10}{360}$ or $\dfrac{2x + 10}{5x + 100}$	M1	oe
	$\dfrac{90}{360} + \dfrac{x}{360} + \dfrac{2x}{360} + \dfrac{2x + 10}{360} = 1$	M1dep	oe
	$(x =)$ 52 or $2x = 104$ or $2x + 10 = 114$	A1	May be on diagram
	$\dfrac{114}{360}$ or $\dfrac{57}{180}$ or $\dfrac{38}{120}$ or $\dfrac{19}{60}$ or 0.31(6..) or 0.317 or 0.32 or 31(.6…)% or 31.7% or 32%	B1ft	ft $\dfrac{2 \times \text{their } 52 + 10}{360}$ or $\dfrac{\text{their angle for C}}{360}$

		Additional Guidance	
11 cont		Ignore incorrect simplification or conversion after $\dfrac{114}{360}$ oe	M1M1A1B1
		$\dfrac{360 - 10 - 90}{5}$ oe	M1M1
		$x + 2x + 2x + 10$ followed by $6x + 10 = 270$	M1M0
		Do not accept decimal within fraction for final answer if correct fraction not seen	
		The follow through is not available if A1 awarded	

12	Any two of 0.5, 40 and 100	M1	1600 implies 40 10 implies 100
	$(40^2 =)$ 1600 or $(0.5 \times 40^2 =)$ 800 or $(\sqrt{100} =)$ 10	M1	
	80 with correct working	A1	
	Additional Guidance		
	$\dfrac{0.5 \times 1600}{\sqrt{100}}$ or $\dfrac{0.5 \times 40^2}{10}$ or $\dfrac{1 \times 1600}{10}$ or $\dfrac{800}{\sqrt{100}}$ or $\dfrac{800}{10}$		M1M1
	80 with no or incorrect working, eg attempt at actual calculation and then rounding to 80		M0M0A0
	Condone 0.50(0) for 0.5, 40.0(0) for 40 and 100.0(0) for 100 etc		
	Rounding 0.526 to 1, but otherwise correct, with answer 160		M1M1A0

Question	Answer		Mark	Comments
	Alternative method 1			
	$88 \div (7 + 4)$ or $88 \div 11$ or 8		M1	oe $11 \times 8 = 88$
	their 8×7 and their 8×4 or their 8×7 and $88 -$ their value or their 8×4 and $88 -$ their value or 56 and 32 or their $8 \times (7 - 4)$ or their 8×3		M1dep	oe eg $8 \times 7 = 63$ and $88 - 63$ eg $8 \times 4 = 30$ and $88 - 30$
	24		A1	
	Alternative method 2			
	One correctly evaluated trial for two numbers, other than 7 and 4, in the ratio 7 : 4		M1	eg $70 + 40 = 110$
13	56 and 32		M1dep	eg $56 + 32 = 88$
	24		A1	
	Alternative method 3 using $x : y = 7 : 4$ (correct)			
	$4x = 7y$ and $4x + 4y = 352$	$4x = 7y$ and $7x + 7y = 616$	M1	oe forming equation from ratio and equating coefficients
	$11y = 352$ or $y = 32$	$11x = 616$ or $x = 56$	M1dep	oe equation in one variable
	24		A1	
	Alternative method 4 using $x : y = 4 : 7$ (incorrect)			
	$7x = 4y$ and $4x + 4y = 352$	$7x = 4y$ and $7x + 7y = 616$	M1	oe forming equation from ratio and equating coefficients
	$11x = 352$ or $x = 32$	$11y = 616$ or $y = 56$	M1dep	oe equation in one variable
	their answer		A0	

13 cont	**Alternative method 5** using $x : y = 7 : 4$ (correct)			
	$x = \dfrac{7}{4}y$ or $y = \dfrac{4}{7}x$ or $x = 88 - y$ or $y = 88 - x$	M1		oe making one variable the subject
	$\dfrac{7y}{4} + y = 88$ or $\dfrac{11}{4}y = 88$ or $x + \dfrac{4}{7}x = 88$ or $\dfrac{11}{7}x = 88$	M1dep		oe equation in one variable
	24	A1		
	Alternative method 6 using $x : y = 4 : 7$ (incorrect)			
	$y = \dfrac{7}{4}x$ or $x = \dfrac{4}{7}y$ or $x = 88 - y$ or $y = 88 - x$	M1		oe making one variable the subject
	$\dfrac{7x}{4} + x = 88$ or $\dfrac{11}{4}x = 88$ or $y + \dfrac{4}{7}y = 88$ or $\dfrac{11}{7}y = 88$	M1dep		oe equation in one variable
	their answer	A0		
	Additional Guidance			
	–24 with no incorrect working implies 56 and 32			M1M1A0
	$x = 32$ and $y = 56$			M1M1A0

Question	Answer	Mark	Comments
	Alternative method 1		
	$60 \div 2$ or 30	M1	exterior angle may be on diagram
	$360 \div$ their 30	M1dep	
	12	A1	
	Alternative method 2		
	$\dfrac{360 - 60}{2}$ or $\dfrac{300}{2}$ or 150	M1	interior angle may be on diagram
14	$360 \div (180 -$ their 150) or $360 \div 30$	M1dep	
	12	A1	
	Alternative method 3		
	$\dfrac{360 - 60}{2}$ or $\dfrac{300}{2}$ or 150	M1	interior angle may be on diagram
	$180 \times (n - 2) =$ their $150 \times n$ or $180n -$ their $150n = 360$ or $30n = 360$	M1dep	oe equation
	12	A1	

Question	Answer	Mark	Comments
15(a)	7 × 5 × 3	M1	oe 35 × 3
	105	A1	

<div align="center">

Additional Guidance

</div>

105 given with further work	M1A0

Question	Answer	Mark	Comments
15(b)	**Alternative method 1**		
	$\frac{2}{7} \times \frac{3}{5}$ or $\frac{2 \times 3}{7 \times 5}$	M1	oe
	$\frac{6}{35}$	A1	oe
	Alternative method 2		
	$\frac{2 \times 3 \times 3}{\text{their } 105}$	M1	their 105 from (a)
	$\frac{18}{\text{their } 105}$ or $\frac{6}{35}$	A1ft	oe ft their 105 from (a) if 0 < probability < 1

<div align="center">

Additional Guidance

</div>

Ignore incorrect simplification or conversion after a correct fraction	M1A1
$\frac{2}{7} \times \frac{3}{5}$ or $\frac{6}{35}$ with further work other than simplification or conversion	M1A0
$\frac{2}{7} + \frac{3}{5}$	M0A0

16	15 litres	B1	

Question	Answer	Mark	Comments

17	Ticks No and gives correct reason
	or
	ticks No and gives numerical counter-example for any solid
		B1	eg1 (volume of) A is 8 times bigger
			eg2 (volume) sf = 2^3
			eg3 if A and B are cubes and l = 3,
			    volume of A = 27
			    volume of B = 216
			    216 is not 27 × 2

<div style="text-align:center">Additional Guidance</div>

Condone 8l^3	B1
No, as the height/width is (also) doubled/different	B1
No, as the length/volume is cubed	B0
No, volume is l^3	B0
No, as the height could be different	B0
No, it would be 3 times as big	B0
Doubling the length doesn't double the volume	B0

Question	Answer	Mark	Comments
18	$-\dfrac{3}{2}$ and $\dfrac{2}{5}$	B1	

Question	Answer	Mark	Comments
19	$a + 65 + 115 + c = 360$ or $b + c = 180$	M1	oe oe

	$a + c = 180$
	and $b + c = 180$
	and $a = b$
		A1	oe eg $c = 180 - a$
			    $b = 180 - (180 - a)$
			      $= a$

	angles at a point and (co)interior angles	A1	

<div style="text-align:center">Additional Guidance</div>

Accept angles round a point for angles at a point	
Accept allied angles for interior angles	

Question	Answer	Mark	Comments
	Median ticked and a valid reason for not using mode (eg there is no mode) and a valid reason for not using mean (eg 82 will affect the mean disproportionately)	B2	B1 median ticked or valid reason to reject mean or valid reason to reject mode with any box or no box ticked

Additional Guidance		
Accept any indication in place of a tick		
Ignore non-contradictory statements alongside a correct reason		
Median ticked with reasons "There is no mode" and "82 would skew the mean"	B2	
No box or mode ticked with reason "Not mean, because of the 82"	B1	
No box or mean ticked with reason "Not mode, all the numbers are different"	B1	
No box or mode ticked with statement that 82 is very large	B0	
Condone "one number" oe for "82" in reason for mean if intention is clear, eg "One of the numbers is far bigger than the others"		
Do not accept reasons for the mean indicating that 12.7 is too high unless 82 is also mentioned		
Do not accept reasons given with the wrong measure eg "It cannot be the mean as they're all different"		
Do not accept a reason which simply defines mean and mode		
Giving reasons for mode and mean does not imply a selection of median – the box must be ticked to achieve both marks		
Median ticked with two valid reasons which are not attributed to median and mode eg median ticked and "There is not a repeated number" and "82 is far too high to calculate the average"	B2	
Otherwise, reasons must be attributed		

Question **20**

Question	Answer	Mark	Comments
21	Set of 3 points that give area 28 and *A* on positive *y*-axis and *B* on negative *y*-axis and *C* on positive *x*-axis	B2	eg1 *A*(0, 10) *B*(0, –4) *C*(4, 0) eg2 *A*(0, 18) *B*(0, –10) *C*(2, 0) B1 diagram labelled with numbers that give area 28 eg *A* labelled 20, *B* labelled –8, C labelled 2 or calculation of form $\dfrac{b \times h}{2}$ seen that equals 28 or *b* × *h* that equals 2 × 28 eg $\dfrac{8 \times 7}{2}$ (= 28) or 8 × 7 (= 56)

22(a)	(6) 22 50 60	B1	cumulative frequency values may be implied by points plotted (± 0.5 square)
	Points plotted with upper class boundaries and cf values (± 0.5 square)	B1ft	ft their cumulative frequencies must be increasing
	Smooth curve or polygon (± 0.5 square)	B1ft	ft their cumulative frequencies must be increasing and not a single straight line

Additional Guidance		
Graphs may start from their first plotted point or from (40, 0) If the points are plotted at mid-points, with a point at (45, 6), the graph may start at (35, 0) (± 0.5 square) If the points are plotted at the lower bounds, with a point at (40, 6), the graph may start at (0, 0)		
Graph starting at (0, 0), but otherwise correct		B1B1B0
Graph plotted at mid-points or lower class boundaries, but otherwise correct		B1B0B1
Graph ascends or descends after *x* = 80		B0 for 3rd mark
Bars drawn as well as correct graph		B1B1B0
Bars drawn without correct graph		max B1

Question	Answer	Mark	Comments
22(b)	One correct mpg reading for their graph from cf of 15(.25) or 45(.75) or horizontal lines from 15(.25) and 45(.75) only to their graph or 15(.25) and 45(.75) indicated as the cf values for the quartiles	M1	± 0.5 square ft their increasing graph may be on table
	Correct value for their increasing graph	A1ft	

23	(−3, 5)	B1	

24	**Alternative method 1**		
	$180 \div (5 + 7)$ or $180 \div 12$ or 15	M1	oe
	$5 \times$ their 15 or $180 - 7 \times$ their 15 or 75	M1dep	oe
	$180 -$ their $75 - 20$ or $180 - 95$	M1dep	oe
	85	A1	
	Alternative method 2		
	$x + \dfrac{7x}{5} = 180$ or $\dfrac{5y}{7} + y = 180$ or $y = 105$	M1	oe correct elimination of a variable from equations $x + y = 180$ and $7x = 5y$
	$(x =) \ 180 \times \dfrac{5}{12}$ or $(x =)$ 75	M1dep	oe
	$180 -$ their $75 - 20$ or $180 - 95$	M1dep	oe
	85	A1	

Question	Answer	Mark	Comments
	Alternative method 1		
	15 × 8 or 120 or 3 × 6 or 18	M1	oe total number of hours needed oe total number of hours worked by the 3 machines
	15 × 8 – 3 × 6 or 102	M1dep	oe total number of hours worked by the other 12 machines
	8.5	A1	
	Alternative method 2		
	3 × (8 – 6) or 3 × 2 or 6	M1	oe total number of hours not worked by the three machines
25	their 6 ÷ 12 or 0.5	M1dep	oe that number divided by the other 12 machines
	8.5	A1	
	Alternative method 3		
	15 × 8 or 120 or 15 × 6 or 90	M1	oe total number of hours needed oe total number of hours worked in the first 6 hours
	$\dfrac{15 \times 8 - 15 \times 6}{12}$ or 2.5	M1dep	oe number of remaining hours divided by the other 12 machines
	8.5	A1	
	Additional Guidance		
	Note that 15 ÷ 6 is not a correct method to get 2.5 (unless simplified from 30 ÷ 12), so does not score		

Question	Answer	Mark	Comments
26(a)	$0.\dot{7} \div 10 = 0.0\dot{7}$ and $\dfrac{7}{9} \div 10 = \dfrac{7}{90}$ or $0.0\dot{7} \times 10 = 0.\dot{7}$ and $\dfrac{7}{90} \times 10 = \dfrac{7}{9}$ or $0.\dot{7} \div 10 = 0.0\dot{7}$ and $\dfrac{7}{90} \times 10 = \dfrac{7}{9}$ or because the decimal is divided by 10 the 9 has to be multiplied by 10	B1	oe

Additional Guidance		
Algebraic methods		B0
Division of 7 by 90		B0

Question	Answer	Mark	Comments
26(b)	**Alternative method 1**		
	$0.2 + 0.0\dot{7}$ or $\dfrac{2}{10} + \dfrac{7}{90}$	M1	
	$\dfrac{18}{90} + \dfrac{7}{90}$ or $\dfrac{25}{90}$	M1dep	
	$\dfrac{5}{18}$	A1	
	Alternative method 2		
	$10x = 2.777...$ or $100x = 27.777...$	M1	Any letter
	$10x - x = 2.777... - 0.277...$ or $9x = 2.5$ or $\dfrac{2.5}{9}$ or $100x - x = 27.777... - 0.277...$ or $99x = 27.5$ or $\dfrac{27.5}{99}$ or $100x - 10x = 27.777... - 2.777...$ or $90x = 25$ or $\dfrac{25}{90}$	M1dep	oe
	$\dfrac{5}{18}$	A1	

Question	Answer	Mark	Comments
	Alternative method 1		
	(B, B) $\dfrac{8}{11}$ and $\dfrac{7}{10}$ or (R, R) $\dfrac{3}{11}$ and $\dfrac{2}{10}$	M1	oe may be seen on tree diagram
	(B, B) $\dfrac{8}{11} \times \dfrac{7}{10}$ or $\dfrac{56}{110}$ or (R, R) $\dfrac{3}{11} \times \dfrac{2}{10}$ or $\dfrac{6}{110}$	M1dep	oe may be seen on tree diagram
	$\dfrac{8}{11} \times \dfrac{7}{10} + \dfrac{3}{11} \times \dfrac{2}{10}$	M1dep	$\dfrac{56}{110} + \dfrac{6}{110}$
	$\dfrac{62}{110}$ or $\dfrac{31}{55}$	A1	oe fraction accept 0.56(…) or 56.(…)%
	Alternative method 2		
27	(B, R) $\dfrac{8}{11}$ and $\dfrac{3}{10}$ or (R, B) $\dfrac{3}{11}$ and $\dfrac{8}{10}$	M1	oe may be seen on tree diagram
	(B, R) $\dfrac{8}{11} \times \dfrac{3}{10}$ or (R, B) $\dfrac{3}{11} \times \dfrac{8}{10}$ or $\dfrac{24}{110}$	M1dep	oe may be seen on tree diagram
	$1 - \dfrac{8}{11} \times \dfrac{3}{10} - \dfrac{3}{11} \times \dfrac{8}{10}$	M1dep	$1 - \dfrac{24}{110} - \dfrac{24}{110}$
	$\dfrac{62}{110}$ or $\dfrac{31}{55}$	A1	oe fraction accept 0.56(…) or 56.(…)%
	Additional Guidance		
	Ignore incorrect simplification or conversion after a correct fraction		M3A1
	$\dfrac{6820}{12\,100}$		M3A1

Question	Answer	Mark	Comments
28(a)	$(0^2 +) \, 6^2 = 36$ or $(OA =)$ radius = 6 or $\sqrt{36} = 6$	B1	oe
	Additional Guidance		
	$0 + 36 = 36$		B0

28(b)	(6, 0)	B1	

Question	Answer	Mark	Comments
28(c)	**Alternative method 1**		
	$\dfrac{6 - \text{their } 0}{0 - \text{their } 6}$ or $\dfrac{\text{their } 0 - 6}{\text{their } 6 - 0}$ or $\dfrac{6}{-6}$ or $\dfrac{-6}{6}$ or -1	M1	gradient AB
	gradient $OM \times$ gradient $AB = -1$ and gradient $OM = 1$ (and $y = x$)	A1	must see correct working for M1
	Alternative method 2		
	$\left(\dfrac{6+0}{2}, \dfrac{0+6}{2}\right)$ or (3, 3)	M1	coordinates of M
	gradient $OM = 1$ (and $y = x$) or (0, 0) and (3, 3) (and $y = x$)	A1	must see correct working for M1

Question	Answer	Mark	Comments
28(d)	$x^2 + x^2 = 36$ or $2x^2 = 36$ or $y^2 + y^2 = 36$ or $2y^2 = 36$ or $(-)6 \cos 45°$ or $(-)6 \sin 45°$	M1	oe equation
	$(-)\sqrt{\dfrac{36}{2}}$ or $(-)\sqrt{18}$ or $(-)3\sqrt{2}$ or $(-)\dfrac{6\sqrt{2}}{2}$ or $(-)\dfrac{6}{\sqrt{2}}$	M1	
	$(-\sqrt{18}, -\sqrt{18})$ or $(-3\sqrt{2}, -3\sqrt{2})$ or $(-\dfrac{6\sqrt{2}}{2}, -\dfrac{6\sqrt{2}}{2})$ or $(-\dfrac{6}{\sqrt{2}}, -\dfrac{6}{\sqrt{2}})$	A1	oe surd form

Question			
29(a)	(180, 0)	B1	
	Additional Guidance		
	Condone degrees symbol on 180		
	Condone (π, 0)		B1

Question			
29(b)	(–270, 1)	B1	
	Additional Guidance		
	Condone degrees symbol on 270		
	Condone ($\dfrac{-3\pi}{2}$, 1)		B1

Question	Answer	Mark	Comments
30(a)	$\dfrac{1}{81^{\frac{1}{4}}}$ or $\dfrac{1}{\sqrt[4]{81}}$ or $\sqrt[4]{\dfrac{1}{81}}$ or 3^{-1} or $9^{-\frac{1}{2}}$ or $81^{\frac{1}{4}} = 3$ or $\sqrt[4]{81} = 3$ or $3^4 = 81$	M1	
	$\dfrac{1}{3}$	A1	
	Additional Guidance		
	3 without $81^{\frac{1}{4}}$ or $\sqrt[4]{81}$		M0A0

Question	Answer	Mark	Comments
30(b)	**Alternative method 1**		
	$(16 =) 2^4$ or $(2^3)^{2x}$ or 2^{6x}	M1	oe with consistent base 2
	$(16 =) 2^4$ and $(2^3)^{2x}$ or 2^{6x}	M1dep	
	2^{4+6x} or $2^{2(2+3x)}$	A1	
	Alternative method 2		
	$((4 \times 8^x)^2 =)\ (2^2 \times 2^{3x})^2$	M1	
	$(2^{2+3x})^2$	M1dep	
	2^{4+6x} or $2^{2(2+3x)}$	A1	oe index