

8300

GCSE MATHEMATICS

Foundation and Higher tier – Questions by Topic – Mark Scheme

Ratio, Proportion and Rates of Change

Writing and simplifying ratios

v1.0

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. e.g. accept 0.5 as well as $\frac{1}{2}$
[a, b]	Accept values between a and b inclusive.
3.14...	Allow answers which begin 3.14 e.g. 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.

Q1.

20 or 12 or 10 : 6

oe ratio

check diagram for area counting to 20 or 12

B1

5 : 3

ft if B0 awarded, a correct and full simplification of any unsimplified ratio

condone $\frac{5}{3}$: 1 or 1.6 : 1

or $1 : \frac{3}{5}$ or 1 : 0.6

SC1 3 : 5

B1ft

Additional Guidance

5 : 3 with no working

B2

Ignore any units given with the answer

18 : 16 = 9 : 8 (perimeter)

B0B1ft

Poor unit notation can score a maximum of B1 unless recovered

20² or 12² or 5² : 3²

B1B0

[2]

Q2.

1 : 3 : 2

B1 5 : 15 : 10 oe ratio not in its simplest form

or

their 3-term ratio written in its simplest form

B2

Additional Guidance

5 : 15 : 30 simplified to 1 : 3 : 6

B1

5 15 30 simplified to 1 : 3 : 6

B0

[2]

Q3.

(a) 1 : 2

B1

(b) $\frac{15}{15+5} (\times 100)$ or $\frac{15}{20} (\times 100)$
or $\frac{3}{4} (\times 100)$

M1

75

A1

[3]

Q4.

10 + 2 + 10 + 2 or 24

or

10 + 6 + 10 + 6 or 32

oe

may be seen in a ratio

M1

10 + 2 + 10 + 2 or 24

and

10 + 6 + 10 + 6 or 32

oe

may be seen in a ratio

A1

3 : 4

ft correct and full simplification of any unsimplified ratio except

answer 4 : 3 with M1A1 scored

SC2 6 : 7

SC1 12 : 14

B1ft

Additional Guidance

Ignore any units given

Answer 3 : 4 with no incorrect working

M1A1B1

1 : 1.3

M1A1B0

Working with half perimeter consistently

12 : 16 = 3 : 4

M1A1B1

answer 12 : 16 or 6 : 8

M1A1B0

24 and 32 then 32 : 24 = 4 : 3 cannot be awarded B1ft as this would be full marks for an incorrect final answer

M1A1B0

32 : 24

M1A1B0

24 : 42 = 4 : 7

M1A0B1ft

10 : 6 = 5 : 3

M0A0B1ft

20 : 12 = 10 : 6 (not fully simplified)

M0A0B0ft

20 : 60 = 1 : 3

M0A0B1ft

14 : 22 = 6 : 10 = 3 : 5

(6 : 10 is an error, then simplifying this to 3 : 5 is not B1ft)

M0A0B0ft

[3]

Q5.

y intercepts at 1 and - 1

oe eg 1 and (-) 1 marked on diagram

B1

(y =) 7 (at B) and (y =) - 4 (at D)

oe eg 7 and (-) 4 on diagram or in working

B1

1 - - 1 (= 2) **or** 7 - - 4 (= 11)

Using their coordinates

M1

2 : 11 *oe*

A1

[4]

Q6.

Alternative method 1

2 × 5 : 3 × 5 or 10 : 15

and

5 × 3 : 4 × 3 or 15 : 12

oe common value for f

eg 10 : 15 : 12 or $\frac{2}{3} : 1 : \frac{4}{5}$

10 : 12

oe unsimplified ratio

condone fractions or decimals

M1dep

5 : 6

A1

Alternative method 2

3e = 2f and 4f = 5g

oe equations

M1

6e = 5g

oe equation

M1dep

5 : 6

A1

Additional Guidance

Variables in an otherwise correct answer:

the same variable scores 2 marks, eg 5f : 6f

M1M1A0

different variables do not score, unless earlier marks can be awarded,

eg 5e : 6g with no working worth M1 or M1M1

M0M0A0

[3]

Q7.

Alternative method 1

$$\frac{200 - 60}{2} \text{ or } \frac{140}{2} \text{ or } 70$$

oe eg $\frac{200}{2} - \frac{60}{2}$

may be seen or implied in a ratio

eg $n : 70$ or $70 : n$

M1

130 : 70

must be in correct order

A1

13 : 7

ft a correct and full simplification of any unsimplified ratio

condone $\frac{13}{7} : 1$ or $1 : \frac{7}{13}$

SC2 7 : 13

B1ft

Alternative method 2

$$\frac{200 + 60}{2} \text{ or } \frac{260}{2} \text{ or } 130$$

oe eg $\frac{200}{2} + \frac{60}{2}$

may be seen or implied in a ratio

eg $130 : n$ or $n : 130$

M1

130 : 70

must be in correct order

A1

13 : 7

B1ft

ft a correct and full simplification of any unsimplified ratio

condone $\frac{13}{7} : 1$ or $1 : \frac{7}{13}$

SC2 7 : 13

Alternative method 3

200 + 60 and 200 – 60
or 260 and 140

M1

260 : 140

must be in correct order

A1

13 : 7

ft a correct and full simplification of any unsimplified ratio

condone $\frac{13}{7} : 1$ or $1 : \frac{7}{13}$

SC2 7 : 13

B1ft**Additional Guidance**

70 : 130 with answer 7 : 13

M1A0B1ft

Accept 0.53(846...) or 0.54 for $\frac{7}{13}$ or 1.85(714...) or 1.86 for $\frac{13}{7}$

For the M1 in Alt1, 70 must come from working towards a ratio of 130 : 70 or 70 : 130, not from a simplification of 140 : 60

200 – 60 = 140, 140 : 60, 70 : 30

M0A0B0ft

200 – 60 = 140, 140 : 60, 70 : 30, 7 : 3

M0A0B1ft

Ignore any units given in the answer

Algebraic approach may be seen but no marks scored until

$\frac{200 - 60}{2}$

$x = \frac{200 - 60}{2}$ reached oe

For any ratio, condone correct simplification to 1 : n or n : 1

B1ft**[3]****Q8.****Alternative method 1: substitutes 2f for d**

$$\frac{e - f}{2f - e} = \frac{1}{4} \text{ or } 2f - e = 4(e - f)$$

oe equation in e and f

M1

$$6f = 5e$$

or

$$\frac{e}{f} = \frac{6}{5}$$

oe with variables collected

$$\text{eg } 1.5f = 1.25e$$

oe with single fractions eg $\frac{f}{5} = \frac{e}{6}$

M1dep

6 : 5

oe ratio

A1

Alternative method 2: substitutes $\frac{d}{2}$ for f

$$d - e = 4\left(e - \frac{d}{2}\right) \text{ or } 3d = 5e$$

oe equation in d and e

M1

$$6f = 5e$$

or

$$\frac{e}{f} = \frac{6}{5}$$

oe with variables collected
eg $1.5f = 1.25e$

oe with single fractions eg $\frac{e}{f} = \frac{6}{5}$

M1dep

$$6 : 5$$

oe ratio

A1

Alternative method 3: substitutes $2f$ for d and forms simultaneous equations

$$e - f = 1$$

and

$$2f - e = 4$$

oe with rhs in the ratio 1 : 4
eg $e - f = 2$
and
 $2f - e = 8$

M1

$$f = 5$$

or

$$e = 6$$

correct solution for one unknown from their correct simultaneous equations
eg $f = 10$ or $e = 12$ from above equations

M1dep

$$6 : 5$$

oe ratio

A1

Additional Guidance

5 : 6 with no method marks awarded

MOMOA0

[3]

Q9.

Alternative method 1: using different time periods

$450 \div 30$ or 15

or

$250 \div 10$ or 25

oe for any section of the basic rate or the overtime rate

$$\frac{450 - 150}{30 - 10}$$

eg

M1

15 and 25

implied by any ratio equivalent to 3 : 5

do not allow as a ratio in the wrong order eg 25 : 15

A1

3 : 5 or $\frac{3}{5} : 1$ or $1 : \frac{5}{3}$

oe fully simplified

ft full simplification of their two values

B1ft

Alternative method 2: using equal time periods

Four correct readings from equal time periods of at least 5 hours from the two sections of the graph

eg

at 5 and 10 hours and at 35 and 40 hours

if a reading from 30 is used, there may only be 3 readings

a reading of 0 from 0 may be implied

M1

15 and 25

or

correct totals for their equal time periods

eg 10 hours = 150 and 10 hours = 250

implied by any ratio equivalent to 3 : 5

must not be seen as a ratio in the wrong order eg 250 : 150

A1

3 : 5 or $\frac{3}{5} : 1$ or $1 : \frac{5}{3}$

oe fully simplified

ft full simplification of their two values

B1ft

Additional Guidance

In alt 2, only three readings are needed if a reading from 30 hours is included in both time periods or a reading of 0 is used

eg readings of 300 from 20, 450 from 30 and 700 from 40

M1

Readings from 10, 20, 30 and 40 should be 150, 300, 450 and 700

For readings from other numbers of hours not giving a multiple of £10 allow the multiple of 10 above or below the reading or any value between, which can then be used to score all three marks

eg allow [220, 230] for a reading at 15 hours

eg alt 1 readings of 70 at 5 hours, 380 at 25 hours, 450 at 30 hours and 700 at 40 hours, followed by hourly rates of 15.50 and 25 and an answer of 31 : 50

M1A1B1ft

eg alt 2 readings of 370 at 25 hours, 450 at 30 hours, 580 at 35 hours and 700 at 40 hours, followed by totals of 80 and 120 or hourly rates of 16 and 24 and an answer of 2 : 3

M1A1B1ft

For 1 $\frac{2}{3}$ allow 1.67 or better with correct rounding

450 : 250 = 45 : 25 does not get the mark for 25, but gets the final mark if simplified to 9 : 5

Ignore units throughout eg answer £3 : £5

M1A1B1

15 : 25

M1A1B0

25 : 15 or 25 : 10 not simplified

M1A0B0

25 : 15 with answer 5 : 3 or 25 : 10 with answer 5 : 2

M1A0B1ft

Answer 5 : 3 without working implies

M1A0B1ft

15 : 17.5

M1A0B0

15 : 17.5 followed by 6 : 7

M1A0B1ft

20 : 25

M1A0B0

20 : 25 followed by 4 : 5

M1A0B1ft

3 : 5 in working with answer 1.5 : 2.5

M1A1B0

30 : 10 = 3 : 1

M0A0B1ft

[3]

Q10.

Alternative method 1 – expressions in x

$4\pi x^2 \div 2$ or $2\pi x^2$

or πx^2

or $\pi(3x)^2$ or $9\pi x^2$

or $2 \times \pi(3x)^2$ or $18\pi x^2$

or $2\pi x(3x)$ or $6\pi x^2$

oe area of curved face of hemisphere

oe area of flat face of hemisphere

oe area of one flat face of cylinder

oe area of both flat faces of cylinder

oe area of curved face of cylinder

M1

$4\pi x^2 \div 2 + \pi x^2$ or $3\pi x^2$

or

$\pi(3x)^2 + \pi(3x)^2 + 2\pi x(3x)$

or $9\pi x^2 + 9\pi x^2 + 6\pi x^2$

or $24\pi x^2$

oe total surface area of the hemisphere

oe total surface area of the cylinder

M1dep

$3\pi x^2$ and $24\pi x^2$ and $1 : 8$

either order

A1

Alternative method 2 – substituting a value for x

Substitutes a value for x and works out the area of at least one of

area of curved face of hemisphere

area of flat face of hemisphere

area of one flat face of cylinder

area of both flat faces of cylinder

area of curved face of cylinder

eg using $x = 5$, at least one of

50π

25π

225π

450π

150π

M1

Substitutes a value for x and works out an expression for the total surface area of the hemisphere or the cylinder

eg using $x = 5$

total surface area of hemisphere =

$25\pi + 50\pi$ or 75π

or

total surface area of cylinder =

$225\pi + 225\pi + 150\pi$ or 600π

M1dep

Both correct total surface areas for their value of x and $1 : 8$

either order

A1

Additional Guidance

1 : 8 or 8 : 1 without correct working or values

M0M0A0

Condone π missing consistently for all marks

Allow 'correct' and consistent values of π throughout (eg 3, 3.14, $\frac{22}{7}$)

Condone use of r for x throughout

Do not allow $3\pi x^2$ from $3x \times \pi \times x$ oe

[3]

Q11.

Alternative method 1: using algebra

$\frac{1}{2}$

$\times k \times 12$ or $6k$

or

$2 \times k + 3 \times m$ or $2k + 3m$

oe correct expression for either area

eg $2(k - 3) + 3(m + 2)$

or $k(m + 2) - m(k - 3)$

M1

$\frac{1}{2}$

$\times k \times 12 = 2 \times k + 3 \times m$

or

$4k = 3m$

oe equation

M1dep

3 : 4

oe ratio

A1

Alternative method 2: substituting a value for k

Substitutes a value for k

and gives

correct method or value for area of triangle

or correct area in m for L-shape

eg

$k = 5$ and area of triangle is 30

or

$k = 5$ and area of L-shape is $10 + 3m$

M1

Correct equation connecting the two areas

or

correct value of m for their k

eg

$k = 5$ and $30 = 10 + 3m$

or

$k = 6$ and $m = 8$

M1dep

3 : 4

oe ratio

A1

[3]

Q12.

$$20\pi \div 2\pi \text{ or } 10$$

oe

may be seen on diagram

implied by diameter = 20

M1

$$x^2 + x^2 = (\text{their } 10)^2$$

$$\text{or } 2x^2 = 100$$

$$\text{or } x^2 = 50$$

$$\text{or their } 10 \times \sin 45$$

$$\text{or their } 10 \times \cos 45$$

$$\text{or their } 10 \times \frac{1}{\sqrt{2}}$$

oe any letter (condone a)

their 10 is their length OQ (the radius of the circle)

M1

$$\sqrt{\text{their } 10^2 \div 2}$$

$$\text{or } \sqrt{50} \text{ or } 5\sqrt{2}$$

$$\text{or } 4 \times \sqrt{50}$$

or

$$4 \times \text{their } 10 \times \sin 45$$

$$\text{or } 4 \times \text{their } 10 \times \cos 45$$

$$\text{or } 40 \times \frac{1}{\sqrt{2}} \text{ or } \frac{40\sqrt{2}}{2}$$

$$\text{or } 40$$

$$\text{or } 20\sqrt{2}$$

oe value for the length of one side of the square or the perimeter of the square

$$\text{eg } \frac{10}{\sqrt{2}}$$

dep on previous mark

M1dep

2 with full working seen for M3

A1

Alternative method 2

$$20\pi \div 2\pi \text{ or } 10$$

or

$$\text{side length of square} = 5\sqrt{a}$$

oe

may be seen on diagram

implied by diameter = 20

M1

(Perimeter of square = $20\sqrt{a}$ and)

$$\text{side length of square} = 5\sqrt{a}$$

and

$$(5\sqrt{a})^2 + (5\sqrt{a})^2 = (\text{their } 10)^2$$

oe

their 10 is their length OQ (the radius of the circle)

condone missing brackets if recovered

M1

$$25a + 25a = (\text{their } 10)^2$$

$$\text{or } 50a = 100$$

dep on M1M1

M1dep

2 with full working seen for M3

A1

Additional Guidance

2 with no working

M0M0M0A0

$\sqrt{2}$ on answer line (may score method marks)

A0

[4]

Q13.

$$1 : 2 : 5$$

B2 For any ratio that is one step away from the answer

e.g. $\sqrt{12} : 2\sqrt{12} : 5\sqrt{12}$

$$\sqrt{1} : \sqrt{4} : \sqrt{25}$$

$$2 : 4 : 10$$

B1 For at least two of the three terms in their simplest form

i.e. two of $2\sqrt{3} : 4\sqrt{3} : 10\sqrt{3}$

B1 For any correct equivalent ratio

e.g. $\sqrt{2} : \sqrt{8} : \sqrt{50}$

$$\sqrt{3} : \sqrt{12} : \sqrt{75}$$

B3

[3]

Q14.

$$6 : 8$$

B1

[1]

Q15.

Alternative method 1

30×8 or 240

M1

440 – their 240 or 200

*implied by 10 (medium) and 5 (large)
or numbers of sweets in medium and in large totalling 200*

M1dep

$12m + 16l$ where m and l are integers with $m = 2l$

or

$12 \times 2 + 16$

or

120 (sweets in medium) and 80 (sweets in large)

or

10 medium or 5 large

*eg $12 \times 6 + 16 \times 3$
or $72 + 48$ with 6 (medium) and 3 (large) shown
medium or large may be implied*

M1

30 : 10 : 5

oe ratio eg 6 : 2 : 1

A1

Alternative method 2

30×8 or 240

M1

440 – their 240 or 200

*implied by 10 (medium) and 5 (large)
or numbers of sweets in medium and in large totalling 200*

M1dep

$12 \times 2x + 16x = \text{their } 200$

or $x = 5$

or

$12y + 16 \times \frac{1}{2}y = \text{their } 200$

or $y = 10$

*oe equation in terms of large bags any letter
oe equation in terms of medium bags any letter*

M1dep

30 : 10 : 5

oe ratio eg 6 : 2 : 1

A1

Additional Guidance

Ignore incorrect simplification if 30 : 10 : 5 seen

Answer 240 : 120 : 80

M1M1M1A0

Award up to M3 even if working not subsequently used

[4]

Q16.

Obtains an equivalent ratio

or

writes out two or more multiples of 11

eg 6 : 16

9 : 24

11, 22, ...

22

M1

A1

[2]

Q17.

Perimeter A = 20 (cm) or

Perimeter B = 14 (cm)

20 : 14

M1

A1

10 : 7

ft simplifying their ratio

B1ft

[3]

Q18.

Alternative method 1

$$0.49 \times (250 + 50)$$

or

$$0.49 \times 300 \text{ or } 147$$

oe

M1

their 147 – 128 or 19

M1dep

19 : 31

SC2 answer 31 : 19

A1

Alternative method 2

$$(1 - 0.49) \times (250 + 50)$$

or

$$0.51 \times 300 \text{ or } 153$$

oe

M1

their 153 – 122 or 31

M1dep

19 : 31

SC2 answer 31 : 19

A1

Additional Guidance

Up to M2 may be awarded for correct work, with no or incorrect answer, even if this is seen amongst multiple attempts

147 : 153 or 153 : 147

M1M0A0

0.49 : 0.51

M0M0A0

Beware of 147 and 153 from incorrect working

$$122 + 25 = 147$$

M0

$$128 + 25 = 153$$

M0

[3]

Q19.

$$45 \times 8 \text{ or } 360$$

oe
number of 2p coins
may be embedded

M1

$$45 \times 8 \times 2$$

$$\text{or } 360 \times 2$$

$$\text{or } 720 \text{ or } 7.2(0)$$

oe
value of 2p coins
implied by 1170 or 11.7(0)

M1dep

$$17.7(0) - \text{their } 7.2(0) - 45 \times 0.1(0)$$

or

$$1770 - \text{their } 720 - 45 \times 10$$

or

$$6(.00) \text{ or } 600$$

oe
value of 5p coins
implied by 7.2 : 6 oe ratio not in simplest form
or 6 : 7.2 oe ratio

M1dep

$$6 : 5$$

accept $1.2 : 1$ or $\frac{6}{5} : 1$ or $1\frac{1}{5} : 1$
or $1 : 0.83(\dots)$ or $1 : \frac{5}{6}$

A1

Additional Guidance

Up to M3 may be awarded for correct work with no answer or incorrect answer, even if this is seen amongst multiple attempts

Allow working in pence or pounds throughout

Must work consistently in pence or pounds for the third mark (or recover)

Ignore units in the ratio eg 6p : 5p or £1.20 : £1

M3A1

720 may be seen in a ratio with the value of the 10p coins

eg $720 : 450$ or $7.2 : 4.5$

M2

600 may be seen in a ratio with the value of the 10p coins

eg $600 : 450$ or $6 : 4.5$

M3

For information:

Coin	10p	2p	5p
Number	45	360	120
Value	£4.50	£7.20	£6.00

[4]

Q20.

Ticks Both of them
and
gives valid reason for Kai eg references both values being divided (or multiplied) **by 3**
and
gives valid reason for Jo
eg references both values being
divided (or multiplied) **by 6**

oe valid reason

eg1 $9 \div 3 \times 2 = 6$ and $9 \div 1.5 \times 1 = 6$

or

eg2 $9 \div 6 = 1.5$ and $3 \div 2 = 1.5$

and $1.5 \div 1 = 1.5$

B1

ticks Kai only

and gives valid reason for Kai

or

ticks Jo only

and gives valid reason for Jo

or

ticks Both of them

*and gives valid reason for Jo **or** Kai*

B2

Additional Guidance

Ticks Both of them
and gives correct reason for Kai or Jo
and refs both values being divided (or multiplied) **by 2** (to link Jo and Kai)

B2

Accept a build-up method to imply multiplying by 3 or by 6
eg all three of $3 : 2$ and $6 : 4$ and $9 : 6$
or all six of $1.5 : 1$ and $3 : 2$ and $4.5 : 3$ and $6 : 4$ and $7.5 : 5$ and $9 : 6$
Condone eg $3 : 2 \times 3 = 9 : 6$ to imply both values are multiplied by 3
If evaluating $6 \div 9 = 0.66$ and $2 \div 3 = 0.66$ and $1 \div 1.5 = 0.66$, accept 0.66(...) or 0.67
3 is a factor of 9 and 2 is a factor of 6 (with no reference to $\times 3$)

B0

$9 : 6 = 3 : 2$ or $\frac{9}{6} = \frac{3}{2}$ (not evaluated to 1.5 or shown $\div 3$)

B0

$9 : 6$ simplifies to $3 : 2$ and $1.5 : 1$ (with no reference to $\div 3$ or $\div 6$)

B0

$3 : 2$ and $1.5 : 1$ are both equivalent to $9 : 6$ (with no reference to $\times 3$ or $\times 6$)

B0

[2]

Q21.

$$(x =) 4 \times 2 \text{ or } (x =) 8$$

or

area of top right rectangle is 12×2 or $12 \div 4 \times \text{their } 8$ or 24

or

area of bottom left rectangle is $56 \div 2$ or $4 \times 56 \div \text{their } 8$ or 28

may be on diagram

implied by length of bottom left or bottom right vertical section is 7

M1

Area of top right rectangle is 12×2 or $12 \div 4 \times \text{their } 8$ or 24

and

area of bottom left rectangle is $56 \div 2$ or $4 \times 56 \div \text{their } 8$ or 28

or

Total area is

$$(4 + \text{their } 8) \times (12 \div 4 + 56 \div \text{their } 8) \text{ or } 12 \times 10 \text{ or } 120$$

may be on diagram

M1dep

(Total shaded area is) 52

implied by 52 : 68

A1

$$13 : 17 \text{ or } 1 : \frac{17}{13} \text{ or } \frac{13}{17} : 1$$

ft simplification of their ratio or conversion into the form 1 : n or n : 1 with M2A0 or M1M0A0 scored

B1ft

Additional Guidance

If their ratio cannot be simplified by dividing by a common factor they can only score B1ft by converting into the form 1 : n or n : 1

$$\frac{52}{120} : \frac{68}{120}$$

M1M1A1B0

68 : 52 simplified to 17 : 13

M1M1A0B1ft

$$13 \text{ cm}^2 : 17 \text{ cm}^2$$

M1M1A1B0

For B1, accept values as decimals rounded or truncated to 2 dp or better

eg 1 : 1.31 or 0.76 : 1

B1

[4]

Q22.

$$1 : 16 \text{ or } 1^2 : 4^2$$

oe ratio

B1

Additional Guidance

$$1r : 16w$$

B0

[1]

Q23.

1 : 1.3

B1

[1]

Q24.

Alternative method 1

$$4a = 9b$$

oe

$$\frac{a}{b} = \frac{9}{4}$$

M1

$$4a = 9 \times \frac{7c}{10}$$

$$\text{or } 40a = 63c$$

$$40a = 90b$$

$$\text{and } 90b = 63c$$

oe

$$9 : \frac{40}{7}$$

M1dep

63 : 40

$$\text{Accept } \frac{63}{40} : 1 \text{ or } 1.575 : 1$$
$$\text{or } 1 : \frac{40}{63}$$

A1

Alternative method 2

$$b : c = 7 : 10$$

M1

$$a : b = 63 : 90 \text{ and } b : c = 90 : 40 \text{ or } 63 : 90 : 40$$

oe common value for b

M1dep

63 : 40

$$\text{Accept } \frac{63}{40} : 1 \text{ or } 1.575 : 1$$
$$\text{or } 1 : \frac{40}{63}$$

A1

Alternative method 3

$$a = \frac{9b}{4} \text{ or } c = \frac{10b}{7}$$

M1

$$\frac{9b}{4} : \frac{10b}{7} \text{ or } \frac{9}{4} : \frac{10}{7}$$

oe

M1dep

63 : 40

$$\text{Accept } \frac{63}{40} : 1 \text{ or } 1.575 : 1$$
$$\text{or } 1 : \frac{40}{63}$$

A1

Alternative method 4

$$c = \frac{10}{7}b$$

$$\text{eg } a : c = a : \frac{10}{7}b$$

M1

$$9 : \frac{10}{7} \times 4 \text{ or } 9 : \frac{40}{7}$$

oe

M1dep

63 : 40

$$\text{Accept } \frac{63}{40} : 1 \text{ or } 1.575 : 1$$

$$\text{or } 1 : \frac{40}{63}$$

A1**Additional Guidance**

2nd method mark is for a link between a and c or a correct ratio in an unsimplified form
40 : 63 on answer line

M1M1A0**[3]****Q25.****Alternative method 1**

$$a : b = 28 : 36$$

$$\text{and } b : c = 36 : 15$$

$$\text{or } a : b : c = 28 : 36 : 15$$

oe

$$\text{eg } \frac{a}{b} = \frac{28}{36}, \frac{b}{c} = \frac{36}{15}$$

Two correct ratios with a common value for b or one ratio with
a common value for b

M1

79

A1**Alternative method 2**

$$c = \frac{(5 \times 9)a}{(7 \times 12)} \text{ or } c = \frac{45a}{84}$$

oe

Must have a link between a and c

M1

79

A1**Additional Guidance**

$$\text{Note } b = \frac{9a}{7} \text{ and } c = \frac{5b}{12}$$

[2]

Q26.

12 : 18

*oe eg 6 : 9
may be implied by correct answer*

B1

2 : 3 or 1 : 1.5 or $1 : \frac{3}{2}$ or $\frac{2}{3} : 1$

ft their ratio

B1ft

Additional Guidance

Accept [0.66, 0.67] for $\frac{2}{3}$
2 : 3

B1B1

Answer $1 : \frac{6}{4}$

B1B0

12 : 30 followed by 2 : 5

B0B1ft

[2]

Q27.

(a) (8, 8) plotted

Need not be labelled

B1

(b) isosceles and right-angled

*B1 both correct and 1 incorrect
or
1 correct (and 1 incorrect)*

B2

(c) 1 : 2 or 0.5 : 1

B1 3 : 6

B2

[5]

Q28.

3 : 5

*B1 equivalent of 3 : 5 eg 45 : 75
B1 5 : 3
B1 3 : 8*

B2

[2]

Q29.

(a) $\frac{1}{2}$ or 0.5 or 50%
oe

B1

(b) 10×6 or 60
or 5×3 or 15

M1

60 and 15

$2^2 : 1^2$

States Area A is four times Area B oe

A1

4 : 1 SC2 for 1 : 4

A1

Additional Guidance

Units given alongside answer, eg 4 cm : 1 cm

M1 A1 A0

60 : 15

M1 A1 A0

15 : 60

M1 A1 A0

[4]

Q30.

$$2(3x - 9) = 5x - 11$$

oe Must be correct and have x on both sides

M1

$$6x - 18 = 5x - 11$$

oe their bracket(s) expanded correctly

M1

$$x = 7$$

A1

2 × their 7 + 4 or 18

And 5 × their 7 - 11 or 24

Substitutes their value of x in

$2x + 4$ and $5x - 11$

M1

18 : 24 and 3 : 4

oe eg $\frac{18}{24}$ and $\frac{3}{4}$

A1

Additional Guidance

$$3x - 9 = 2(5x - 11)$$

M0

$$3x - 9 = 10x - 22$$

M1

$$x = \frac{13}{7}$$

A0

$$2 \times \frac{13}{7} + 4 \text{ and } 5 \times \frac{13}{7} - 11$$

M1 A0

T & I leading to $x = 7$

M1 M1 A1

[5]

Q31.

$$20^2 - 16^2 (= 144) \text{ or}$$

$$20^2 = PX^2 + 16^2 \text{ or}$$

$$34^2 - 16^2 (= 900) \text{ or}$$

$$34^2 = XQ^2 + 16^2$$

Uses trigonometry

$$\text{e.g. } \cos^{-1} \frac{16}{20}$$

(= [36.86989765, 36.9])

3, 4, 5 triangle or 8, 15, 17 triangle identified

$$\sqrt{20^2 - 16^2} \text{ or } \sqrt{34^2 - 16^2}$$

e.g. 20 × sin their 36.9

3 × 4 or 15 × 2

M1

12 and 30

M1dep

2 : 5

A1

Allow 1 : 2.5

ft from M2 A0 if their ratio needs simplifying

A1ft

[4]

Q32.

$$\frac{1}{4}x + 15 + \frac{2}{3}x - 44 = 180$$

oe equation

M1

$$\frac{1}{4}x + \frac{2}{3}x = 180 - 15 + 44$$

or

$$3x + 180 + 8x - 528 = 2160$$

oe equation with terms collected

$$\text{eg } \frac{11}{12}x = 209$$

or

oe equation with fractions eliminated

$$\text{eg } 11x = 2508$$

M1dep

$$(x =) 209 \div \frac{11}{12}$$

or (x =) 228

oe calculation that leads to (x =) 228

eg (x =) 2508 ÷ 11

implied by 72 and 108

M1dep

72 : 108

oe ratio

$$\text{eg } 2:3 \text{ or } 1:1.5 \text{ or } \frac{2}{3} : 1$$

A1

Additional Guidance

Ignore simplification attempt after correct ratio seen
eg 72 : 108 in working with answer 36 : 52

M3A1

Accept [0.66, 0.67] for $\frac{2}{3}$

Accept [0.91, 0.92] for $\frac{11}{12}$

Accept [1.09, 1.1] for $\frac{12}{11}$

[4]**Q33.**

$$\frac{4}{3} \pi (2x)^3$$

or $\frac{1}{3} \pi (3x)^2 h$

oe

M1

$$\frac{4}{3} \pi (2x)^3 = \frac{1}{3} \pi (3x)^2 h$$

or

$$\frac{4}{3} \pi 8x^3 = \frac{1}{3} \pi 9x^2 h$$

oe

Sets up equation

M1dep

$$32x = 9h \text{ or } x = \frac{9}{32} h$$

or $h = \frac{32}{9} x$

or

$$\frac{32}{3} r = 9h \text{ or } r = \frac{27}{32} h$$

or $h = \frac{32}{27} r$ or $27h = 32r$

or

$$\frac{27}{32} h : h \text{ or } 3x : \frac{9}{32} x$$

or $\frac{27}{32} : 1$ or $3 : \frac{32}{9} x$

or 0.84... : 1 or 3 : 3.55...

oe linear equation or ratio

M1dep

$$27 : 32$$

A1**Additional Guidance**

$$32 : 27$$

M1M1M1A0

Note $\frac{4}{3} \pi (2)^3 = [33.49, 33.52]$

$$\frac{1}{3} \pi (3)^2 h = [9.42h, 9.43h]$$

[4]

Q34.

- (a) 3×5 or 15 (children) or 20 (children)
eg 3 : 15

M1

15 and 20 and No

oe No, they had 5 extra children

A1

Alternative method

$20 \div 5$ or 20 (children) or 4 (adults)

eg 4 : 20

M1

4 and No

oe No, they needed 1 more adult

A1

Additional Guidance

Allow misreads for the other sports on Saturday or walking on Sunday or walking on Saturday and Sunday:

$27 \div 5$ or 5.4 (adults) M1A0

$18 \div 5$ or 3.6 (adults) M1A0

$30 \div 5$ or 6 (adults) M1A0

$50 \div 5$ or 10 (adults) M1A0

- (b) $\frac{1}{3}$ or $\frac{9}{27}$ or $\frac{8}{24}$

oe ***fraction***

B1

- (c) $12 \div 3$ or
 $30 \div 5$ or
 $16 \div 2$

4 adults (archery) or

6 adults (walking) or

8 adults (sailing)

NB 4, 6, 3 implies M0

M1

$12 \div 3$ and

$30 \div 5$ and

$16 \div 2$

4 adults (archery) and

6 adults (walking) and

8 adults (sailing)

Condoned misread of **one** bar height if number of adults rounded up

M1

18

Must be from 12, 30 and 16

A1

Additional Guidance

Condone all M marks for misread of Saturday for any bar:

Archery : $27 \div 3 = 9$

Walking : $20 \div 5 = 4$

Sailing : $18 \div 2 = 9$ (Total = 22)

Condone all M marks for misread of both days for any bar:

Archery : $39 \div 3 = 13$

Walking : $50 \div 5 = 10$

Sailing : $34 \div 2 = 17$ (Total = 40)

NB $1 + 3 = 4$

M0

NB $1 + 5 = 6$

M0

$12 \div 3 + 30 \div 5 + 15 \div 2 = 4 + 6 + 8 = 18$ (the 8 is from wrong working but one misread of a bar height is allowed)

M1M1A0

[6]

Q35.

(a)

$$\frac{4}{3}\pi r^3 = \pi r^2 h$$

M1

$$\frac{4}{3}r = h$$

or

$$4r = 3h$$

oe equation with π and r^2 cancelled

M1dep

3 : 4 with M2 awarded

oe ratio eg $\frac{3}{4} : 1$ or $1 : \frac{4}{3}$

accept 1.33 or better for $\frac{4}{3}$

A1

Additional Guidance

Accept $h : r = 4 : 3$ for A mark with M2 awarded

(b) $(\pi)(3r)^2(2h)$

or

$$3^2 \times 2$$

oe

ft their formula for a cylinder from part (a) in the form $k\pi r^2 h$ with k as a positive constant

M1

18

A1

Additional Guidance

Answer 18 from choosing values for r and h

eg $\pi \times 3^2 \times 4 = 36\pi$ and $\pi \times 9^2 \times 8 = 648\pi$ and $648\pi \div 36\pi = 18$

M1A1

Answer 18 from rounding a decimal

M0A0

[5]

Q36.

$4 \times \pi \times 6^2$ or 144π
or $452.(...)$

oe

M1

$2 \times \pi \times 9^2$ or 162π
or $[508, 509]$

oe

M1

$\pi \times 9^2$ or 81π
or $254.(...)$
or $3 \times \pi \times 9^2$ or 243π
or $763.(...)$

oe

M1

$144\pi : 243\pi$

oe

e.g.

$452.(...) : 763.(...)$

$4 \times 6 \times 6 : 3 \times 9 \times 9$

M1

$16 : 27$

A1

Additional Guidance

243π alone implies

M0 M1 M1 M0 A0

[5]

Q37.

$g = 180 - 63$ or 117

may be seen on diagram

M1

$f = \text{their } 117 \div 3 \times 2$ or 78

oe

may be seen on diagram

M1dep

$h = 180 - \text{their } 78$ or 102

may be seen on diagram

equivalent ratios to $13 : 17$ implies M3

M1dep

$13 : 17$

accept $1 : \frac{17}{13}$ or $\frac{13}{17} : 1$

A1

Additional Guidance

Up to M3 may be awarded for correct work with no answer or incorrect answer,
even if this is seen amongst multiple attempts

Ignore reasons

[4]