

8300

GCSE MATHEMATICS

Foundation and Higher tier – Questions by Topic – Mark Scheme

Geometry

Angles – Angles on a straight line and about a point &

Vertically opposite angles

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.

35

B1

[1]

Q2.

$360 - (35 + 160)$

oe

M1

165

A1

[2]

Q3.

Alternative method 1: working separately

$180 - 127$ or 53

implied by 106

M1

$360 - 90 - 163$ or 107

oe

implied by 53.5

M1

No and 106 and 107

or No and 53 and 53.5

or No and 53 and $107 - 53 = 54$

A1

Alternative method 2: starting with y

$180 - 127$ or 53

implied by 106

M1

$360 - 90 - 2 \times \text{their } 53$ or 164

or

$360 - 163 - 2 \times \text{their } 53$ or 91

or

$2 \times \text{their } 53 + 90 + 163$ or 359

oe

M1dep

No and 164

or No and 91

or No and 359

A1

Alternative method 3: starting with x

$360 - 90 - 163$ or 107

oe

implied by 53.5

M1

$180 - \text{their } 107 \div 2$ or 126.5

or

$127 + \text{their } 107 \div 2$ or 180.5

oe

M1dep

No and 126.5

or No and 180.5

A1

[3]

Q4.	43		B1	
				[1]
Q5.	118		B1	
				[1]
Q6.	250°		B1	
				[1]
Q7.	180 – 103 – 49			
	oe		M1	
	28		A1	
				[2]
Q8.	360 – (21 + 36 + 160 + 90)			
	or 360 – 307			
	or 270 – (21 + 36 + 160)			
	or 270 – 217			
	oe		M1	
	53		A1	
	Additional Guidance			
	53 (may be on diagram) with no incorrect working or no working			
			M1A1	
	53 on diagram with different answer on answer line		A0	
	360 – (21 + 36 + 160) or 360 – 217 or 143 (ignoring 90°)		M0A0	
			M0A0	
	180 – (90 + 36) = 54			[2]

Q9.

(a) $360 - 108 - 90$

oe

162

M1

A1

(b) Correct reason

eg $137 + 43 = 180$

$180 - 137 = 43$

$180 - 43 = 137$

or Angles (on a straight line) add up to 180

or Supplementary

B1

[3]

Q10.

(a) 55°

B1

(b) $360 - (150 + 70)$

Allow invisible brackets

140

M1

A1

[3]

Q11.

(a) 105

B1

(b) $360 - (100 + 150)$

oe

Condone invisible brackets

110

M1

A1

[3]

Q12.

(a) 132

B1

(b) $360 - (142 + 115)$ *oe*

103

M1

A1

[3]

Q13.

(a) $180 - 156$

24

M1

A1

(b) $360 - 90 - 149$ oe

M1

121

A1

[4]

Q14.

Alternative method 1 – numerical

1 and 5 and 3 or 9 (parts)

or

numbers in the ratio 1 : 5 : 3

or

(angle sum on a straight line $\Rightarrow$) 180

oe may be seen in a ratio

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

numbers can be in any order

eg 30, 10, 50

M1

$180 \div (1 + 5 + 3)$ or 20

or $180 \div \frac{9}{5}$

oe

M1dep

100

A1

Alternative method 2 – algebraic

x and $5x$ and $3x$ or $9x$

or

(angle sum on a straight line $\Rightarrow$) 180

oe correct terms with any angle as x

any letter, any order

may be seen on diagram

M1

Correct equation with correct method to solve for one angle

eg $x + 5x + 3x = 180$

and $180 \div (1 + 5 + 3)$

M1dep

100

A1

Additional Guidance

$x + 5x + 3x = 360$ or $360 \div 9$

M1M0A0

$\frac{1}{5}x + x + \frac{3}{5}x = 180$ and $180 \div \left(\frac{1}{5} + 1 + \frac{3}{5}\right)$

M1M1

$\frac{1}{3}x + \frac{5}{3}x + x = 180$ and $180 \div \left(\frac{1}{3} + \frac{5}{3} + 1\right)$

M1M1

Angle EBD marked as 100 on the diagram with answer line blank

M1M1A1

20 and 100 in working with no or incorrect answer chosen

M1M1A0

[3]

Q15.

Alternative method 1

5 : 1 or 1 : 5

may be implied by second mark

$\frac{5}{6}$ or $\frac{1}{6}$
or 6 (parts)

may be seen on diagram

180 ÷ 6 or 30

M1

150

M1dep

A1

Alternative method 2

5x + x = 180

any letter

or 6x = 180

may be implied by second mark

180 ÷ 6 or 30

M1dep

150

A1

Additional Guidance

If Trial and Improvement used, 30 seen is M2 but 150 must be chosen as the answer for M2A1

360 ÷ 6

M1M0A0

[3]

Q16.

$360 \div 9 (= 40)$ and $40 \times 7 = 280$

or

$360 \div 9 (= 40)$ and $40 \times 2 (= 80)$ and $80 + 280 = 360$

or

$40 \times 2 (= 80)$ and $40 \times 7 (= 280)$ and $80 + 280 = 360$

or

$280 \div 7 (= 40)$ and $40 \times 9 = 360$

or

$2 : 7 = 80 : 280$ and $80 + 280 = 360$

or

$360 - 280 (= 80)$ and $80 : 280 = 2 : 7$

oe

B1 $360 \div 9$ or $280 \div 7$ or 40 oe

or

$\frac{2}{9}$ or $\frac{7}{9}$

or

$360 - 280$ or 80 oe

B2

Additional Guidance

80 and 280 shown on the diagram is not oe for $80 + 280 = 360$

$360 \div 9 \times 7 = 280$

B2

$360 \div 9$ and 40×2 and $2 : 7 = 80 : 280$

B2

$360 \div 9 = 40$ and $2 : 7 = 80 : 280$ (40×2 or 40×7 missing)

B1

$40 \times 7 = 280$ without $360 \div 9$

eg $40 \times 7 = 280$ and $80 + 280 = 360$ ($360 \div 9 = 40$ or 40×2 missing)

B1

$80 : 280$ and $80 + 280 = 360$ ($2 : 7 = 80 : 280$ missing)

B1

$360 \div 9 = 40$ and $80 + 280 = 360$ (40×2 or 40×7 missing)

B1

$280 \div 7 = 40$ and $360 - 280 = 80$ (40×2 or 40×9 missing)

B1

$280 \div 7$ and 40×2 and $80 : 280 = 2 : 7$ ($80 + 280 = 360$ missing)

B1

$80 + 280 = 360$

B1

[2]

Q17.

$$x + 35 + x - 23 = 180$$

$$\text{oe } 2x + 12 = 180$$

M1

$$2x = 180 - 12$$

$$(180 - 12) \div 2 \text{ or } 84$$

$$\text{or } 2x = 168$$

Terms collected

M1dep

$$119$$

A1

$$x = 84 \text{ and}$$

Strand (ii)

an algebraic equation with both method marks awarded for correct algebra

Q1

[4]

Q18.

$$(a) \quad 360 - (145 + 136) \text{ or } 360 - 281$$

oe

Brackets needed

M1

$$79$$

A1

$$(b) \quad 360 - (2y + 3y) \text{ or } 5y \text{ seen}$$

oe

Brackets needed or } 360 - 2y - 3y

M1

$$360 - 5y$$

Ignore further working

A1

[4]

Q19.

$$2x + 3x + 4x = 180$$

$$180 \div (2 + 3 + 4)$$

or 180 seen and one trial worked out correctly

$$\text{eg } 2 \times 5 + 3 \times 5 + 4 \times 5 = 45$$

M1

$$9x = 180 \text{ or } x = 20$$

$$180 \div 9 (\times 2)$$

or a different trial worked out correctly

M1 dep

$$40$$

A1

Steps in setting up and solving equation clearly shown

Strand (ii)

Dependent on both method marks scored from an algebraic method

Q1

[4]

Q20.

- (a) $60 \div 2 (= 30)$
or 90 seen

$$360 \div (2 + 3 + 7)$$

or 210 seen

or 12 (parts) seen

M1

$$60 \div 2 \times 12$$

$$\text{oe } 360 \div 12 (= 30)$$

$$\text{or } 60 + 90 + 210$$

M1

$$360$$

$$2 \times 30 = 60$$

A1

- (b) $180 - (x + 30)$ oe
or $180 - x - 30$

Do not condone missing brackets unless recovered

M1

$$150 - x \text{ or } -x + 150$$

A1

[5]

Q21.

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

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

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

$$\text{or } (x =) 228$$

oe calculation that leads to (x =) 228

$$\text{eg } (x =) 2508 \div 11$$

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]