

8300

GCSE MATHEMATICS

Foundation and Higher tier – Questions by Topic – Mark Scheme

Geometry

Circles – Finding the circumference of circles

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.

$$2 \times \pi \times 4.2 \text{ or } 2 \times 3.14(\dots) \times 4.2$$

M1

$$[26.3, 26.4]$$

A1

$$26.4$$

*ft their 2 d.p. or more answer
SC1 for 55.4*

B1ft

[3]

Q2.

$$2 \times \pi \times 9.15 \text{ or } 57.4 \text{ or } 57.5(0)$$

oe

M1

$$18.3\pi \text{ or } [57.46, 57.5]$$

Accept 57 if correct method seen

A1

[2]

Q3.

$$2 \times \pi \times 37 \text{ or } \pi \times 74$$

$$\text{or } 8 \times 37 \text{ or } 296$$

Accept [3.14, 3.142] for π

M1

$$[232, 233] \text{ or } 74\pi$$

May be implied by e.g. $74\pi + \dots$

A1

$$[528, 529] \text{ or } 74\pi + 296$$

A1

Additional Guidance

$$360 - 37 \times 8$$

M1A0A0

37×8 or 296 seen and then e.g. halved or doubled

M1

[3]

Q4.

$$2 \times \pi \times 3 \text{ or } 6\pi$$

oe

M1

$$18.(...) \text{ and yes}$$

A1

[2]

Q5.

- (a) $\pi \times 0.7$
or $2 \times \pi \times 0.35$
or 2.19

M1

[2.198, 2.2]

Accept 0.7π

A1

- (b) Consistent units seen or implied
e.g. 1600 or [0.002 198, 0.002 2] seen

B1

their $1600 \div$ their [2.198, 2.2]

oe

Units need not be consistent

M1

727.(...)

A1

727

Strand (i) Rounding down their answer

Q1ft

Additional Guidance

$160 \div 0.7\pi = 72.8$ so 72

B0M1A0Q1ft

[6]

Q6.

(Diameter or side of square =) $\sqrt{36}$ or 6 or (radius =) 3

$6 \times 6 (= 36)$

M1

$\pi \times 6$
or $2 \times \pi \times 3$

M1dep

[18.8, 18.9] or 6π

Accept 19 with working shown

A1

Additional Guidance

Accept [3.14, 3.142] for π

Ignore further working after 6π , that is if they incorrectly work 6π out award full marks

Do not accept $\pi 6$ for the A mark

6 or 3 may be on diagram but must be correct, e.g. radius must be 3, not 6

[3]

Q7.

- (a) $2 \times 4.2 \times \pi$ or 8.4π
oe allow [3.14, 3.142] for π

M1

[26.376, 26.393]
may be implied by 26.4 as answer

A1

26.4
ft their value to at least 2 dp rounded correctly to 1 dp

B1ft

Additional Guidance

26.4

M1A1B1ft

26.3 only

M0A0B0ft

55.4 only

M0A0B0ft

- (b) Sector drawn correctly
two radii joined at the centre of the circle

B1

Additional Guidance

Mark intention

Diameter drawn

B1

Any number of sectors (eg diameter and radius drawn)

B1

Ends of radii joined to form segment with whole sector shaded

B1

Ends of radii joined to form segment without whole sector shaded

B0

[4]

Q8.

(a) **Alternative method 1**

$$93\,000\,000 \times 2\pi$$

$$\text{or } 186\,000\,000\pi$$

$$\text{or } [584\,000\,000, 584\,412\,000]$$

oe

Allow working in millions

M1

$$365 \times 24$$

$$\text{or } 8760$$

M1

$$\text{their } 186\,000\,000\pi \div$$

$$\text{their } 8760$$

oe

Allow working in millions

Only allow if first M1 gained or if their circumference is $93\,000$

$$000 \times \pi$$

M1

$$[6.6 \times 10^4, 6.7 \times 10^4]$$

oe

A1

Alternative method 2

$$93\,000\,000 \times 2\pi$$

$$\text{or } 186\,000\,000\pi$$

$$\text{or } [584\,000\,000, 584\,412\,000]$$

oe

Allow working in millions

M1

$$\text{their } 186\,000\,000\pi \div 365$$

$$\text{or } [1\,598\,904, 1\,600\,033]$$

oe

Allow working in millions

Only allow if first M1 gained or if their circumference is $93\,000$

$$000 \times \pi$$

$$\text{their } 365.25 \text{ can be } 365.25 \times 24$$

$$\text{or } 365.25 \times 60$$

M1

$$\text{their } [1.6 \times 10^6, 1.602 \times 10^6] \div 24$$

M1

$$[6.6 \times 10^4, 6.7 \times 10^4]$$

oe

A1

(b) The average speed would be (slightly) lower

oe

B1

[5]