

8300

GCSE MATHEMATICS

Foundation and Higher tier – Questions by Topic – Mark Scheme

Geometry

Constructing bisectors, perpendiculars, and triangles

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

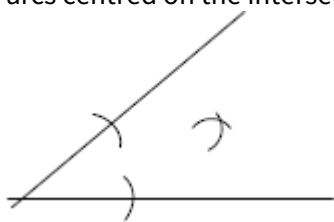
Erased or crossed out work that has been replaced is not awarded marks.

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.

Arc(s) centred on A of lengths within 1 cm of each other crossing both lines, and intersecting arcs centred on the intersection points



Angle bisector from A within tolerance

Must score the M to get the A

M1

A1

Additional Guidance

Must see arcs on rays, ie no dots as can be measured with a ruler

Note that using bottom ray as length of arc will have just one arc about 2mm from end of oblique ray. This is same as 'two arcs'.

Q2.

A pair of intersecting arcs of equal radii from ends of line with two intersections

oe

Perpendicular line drawn through points of intersection

1 mm tolerance

M1

A1

[2]

Q3.

Please note, actual measurements may have changed slightly on export/printing.

Line AB extended and two equal intersecting construction arcs from B

or

Arc from B cutting AB and two intersections with this arc above B

Perpendicular drawn from B with all construction arcs seen

Fully correct triangle with AC = 9 cm and angle B = 90°

Tolerance ± 0.1 cm

SC1 for correct triangle without construction arcs

M1

A1

A1

[3]

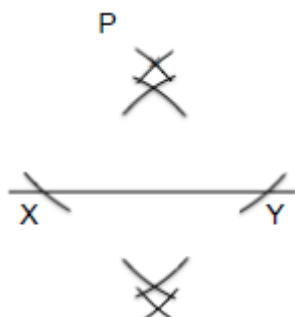
Q4.

Alternative method 1



Two arcs of equal radius centred on P, crossing L.

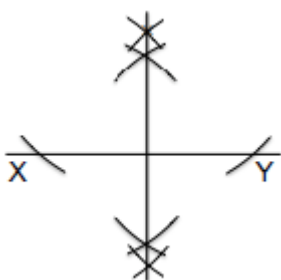
M1



Arcs on other side of L measured from X and Y with same radius.

Arcs on other side of L measured from X and Y with radius XP (effectively reflection of P), arcs need not be drawn at P. or arcs for perpendicular bisector of XY drawn on both sides of L.

M1dep



Line within tolerance. Line does not have to go below L.

A1

Additional Guidance

This method requires starting at P and establishing two points on L from which to work. Only arcs on the other side of the line from L need be shown, although arcs on both sides often are.

Use the overlay to establish if points X and Y are equidistant (± 1 mm) from centre.

Use measuring tool if necessary to establish if radii of arcs drawn are equal.

Use the 'contrast slider' to darken the image if necessary as pencil does not show up well under scanning.

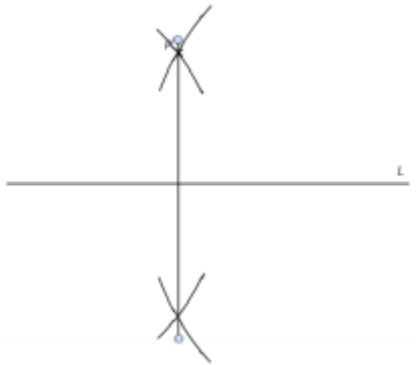
If the second pair of arcs intersect on same side of L as P, above or below P, this is not an accurate method, however, allow if perpendicular within tolerance (± 1 mm from centre)

Alternative method 2



*Intersecting arcs centred on each end of L with radii equal to the distance to P, drawn on other side of L.
Intersecting arcs centred on two points on L with radii equal to the distance to P, drawn on other side of L.
The arcs need not be drawn through P.*

M2



Line within tolerance. Line does not have to go below L.

A1

Additional Guidance

This is a common method. Measuring from P from either end and drawing arcs on other side gives a reflection of P . Both arcs must be drawn to get M2. Use overlay to establish if the radii are accurate ± 1 mm

Another method combining elements of Alt 1 and 2, is to draw arcs through P from either end that intersect L . Then use these points to establish the radii to P to draw arcs on the other side. This (rare) method can be checked using the overlay on the drawing tools. Use the 'contrast slider' to darken the image if necessary as pencil does not show up well under scanning.

[3]

Q5.

Fully correct construction with circle in tolerance and all arcs shown

B3 Fully correct except using one pair of arcs and midpoint to construct perpendiculars

B3 Perpendiculars fully correct with arcs intersecting in two places and no circle or circle out of tolerance

B2 Using one pair of arcs and midpoint to construct perpendiculars, no circle or circle out of tolerance

B2 No arcs, two perpendiculars correct and circle in tolerance

B2 One perpendicular fully correct with arcs intersecting in two places

B1 No arcs, two perpendiculars correct and no circle or circle out of tolerance

B4

[4]