REVISE
.wales

2.14 — Geometric drawing & loci

Mark schemes for the 2.14 question pack

Spec 3.2.1, 3.2.2, 3.2.3 — Unit 3

SOLUTIONS · 2025 SPECIFICATION

Mark schemes for the 12 questions in the corresponding revise.wales question pack (44 marks total). Sources: legacy WJEC GCSE papers, WJEC SAM, and custom-authored mark schemes. Pack layout © revise.wales.

3. Perpendicular bisector drawn: Wrexham and Aberporth Caernarfon and Swansea Circle with radius 2cm ±2mm (20 miles) centred at the intersection of the perpendicular bisectors Correct region in Wales identified, from arc radius equivalent to 2cm ±2mm (20 miles)	 B1 B1 B1 B1	 Tolerance ±2mm and ±2° Tolerance ±2mm and ±2° Independent mark FT from the intersection of 'their 2 straight lines', i.e. following previous B0 B0 Independent mark FT provided 'their region' (arc of a circle) spans Wales **and** England to give a similar region which excludes England The region should not include England, shading or indicating the full circle is B0 (Common incorrect response: A circle of the correct radius drawn with the centre at the intersection of straight lines joining Wrexham with Aberporth and Caernarfon with Swansea is awarded B0 B0 B1 B0)

Final		
1(a) Midpoints 2.5, 7.5, 15, (25,) 40	B1	Midpoint of $20 \leq s < 30$ (25) is not required for B1
$10\times2.5 + 16\times7.5 + 4\times15 + 1\times40$	M1	25 + 120 + 60 + 40 (= 245) FT their midpoints, including bounds, provided they fall within the classes including upper bounds. FT if 1 slip in one of 'their midpoints', (and only one, including 25) used outside the tolerance of bounds for M1, m1 only
Intention their $\sum fx / 31$	m1	(245/31)
7.9(0…cm)	A1	Following correct working Accept 8 cm from correct working
1(b) FALSE FALSE TRUE TRUE	B2	B1 for any 3 correct
1(c) $(28 \times 9 - 63) \div 27$ or equivalent	M2	M1 for sight of 28×9 or 252
7 (cm)	A1	Allow M2, A1 for an unsupported answer of 7(cm) Award M0, A0 for an answer of 7(cm) from sight of $63 \div 9$

		e.g. $40·8 \times 10^{4}$ or 408 000.
6. Arc, <u>centre P</u>, intersecting AB at two points. (B may be one of the points with no arc seen at point B)	M1	[Note to markers: These arcs may be identified by the fact that they will 'cross the line AB at an acute angle'. Arcs 'crossing the line at 90°' is evidence of an inappropriate method.]
Intersecting arcs (equal radii) using the above two points as centres.	m1	
Line drawn	A1	M1 and m1 must be gained before A1 is awarded. *<u>Alternative method</u>* *Using the properties of a kite.* *Intersecting arcs whose centres are any two points on the line AB and respective radii equal in length to the distance from the points to the point P.* *M2* *[Note to markers: The arcs will always intersect at a point that is a 'reflection of point P' in the line AB.]* *Line drawn* *A1*

8. Correct construction of perpendicular bisector of line AB.	B2	*Allow ± 2° and ± 2 mm.* B1 for a perpendicular bisector with no arcs or only one pair of intersecting arcs (above or below) shown. B1 for two sets of correct arcs, with no line or an incorrect line.
Correct construction of 60° at A.	B1	Must show relevant arcs.
Arc of radius 6 cm, centre A.	B1	Must be of sufficient length so as not to be considered a 'point' or a 'notch'.
Correct region identified.	B1	FT for similar viable region (*a straight line intersecting AB, an angle at point A and an arc with centre A*) even if no previous marks gained.

2. Angle BAC bisected OR Unique point P shown within tolerance of angle bisector	B1	*Allow ± 2° and ± 2mm* Accept correct construction or use of protractor.
Arc, radius 6 cm, centre B OR Unique point P shown 6 cm (± 2mm) from B	B1	Of sufficient length to be identified.
Correct point P shown.	B1	Allow F.T. from any previous B0 if equivalent decision required for identifying position of P i.e. an arc, centre B, intersects a straight line drawn from A at two points, with only one of these points over 10 cm from A. A correct point P gains all 3 marks.

		(at least two common prime factors).
2. −13	B1	
Scale on y-axis '2cm square ≡ 10 units'.	B1	
At least 7 correct plots and no incorrect plots.	P1	FT 'their (−2, −13)' AND 'their uniform scale' if possible. Allow ± '½ a small square'.
A smooth curve drawn through their plots.	C1	FT 'their 8 plots'. (Only if an uniform scale used.) OR a curve through the 7 given plots and (−2, −13). Allow intention to pass through their plots (within 1 small square, either horizontally **or** vertically of the point).

14. *EBC* or *ECB* = (180 – 58) / 2 = 61(°)	 M1 A1	Check diagram. Angles in an isosceles triangle.
BAC = 61(°)	B1	Alternate segment theorem. FT 'their *EBC* or *ECB*'.
ABC (= 180 – 35 – 61) = 84(°)	B1	FT 180 – 35 – 'their *BAC*'.
Alternative method 1 *EBC or ECB = (180 – 58) / 2* *= 61(°)*	*Check diagram.* *M1* *A1*	*Angles in an isosceles triangle.*
DBA = 35(°)	*B1*	*Alternate segment theorem.*
ABC (= 180 – 35 – 61) = 84(°)	*B1*	*Angles on a straight line* *FT 180 – 'their EBC' – 'their DBA'.*
Alternative method 2 *EBC or ECB = (180 – 58) / 2* *= 61(°)*	*Check diagram.* *M1* *A1*	*Angles in an isosceles triangle.*
ACF (=180 – 35 – 61) = 84(°)	*B1*	*Angles on a straight line.* *FT 180 – 35 – 'their ECB'.*
ABC = 84(°)	*B1*	*Alternate segment theorem.* *FT 'their ACF'.*
Alternative method 3 *(using isosceles triangle BOC, where O is the centre of the circle)* *BOC = 360 – 90 – 90 – 58* *= 122*	*Check diagram.* *M1* *A1*	*Angles in kite BOCE*
BAC = 61	*B1*	*Use of angle in the centre* *FT 'their BOC' ÷ 2*
ABC (= 180 – 35 – 61) = 84(°	*B1*	*FT 180 – 35 – 'their BAC'*
15. *(a)* $3\sqrt{5}$	B1	
15. *(b)* $4 \times \sqrt{49} - 2\sqrt{7 \times 3} - 2\sqrt{7 \times 3} + \sqrt{9}$ or $4 \times 7 - 2\sqrt{21} - 2\sqrt{21} + 3$ or equivalent	M1	Allow one incorrect term. $\sqrt{7}\sqrt{7}$ is insufficient for $\sqrt{49}$. $\sqrt{3}\sqrt{3}$ is insufficient for $\sqrt{9}$. Allow $\sqrt{7}\sqrt{3}$ or $\sqrt{3}\sqrt{7}$ for $\sqrt{21}$.
$31 - 4\sqrt{21}$	A1	$\sqrt{7}\sqrt{3}$ or $\sqrt{3}\sqrt{7}$ is insufficient for $\sqrt{21}$.
16. $\frac{4\pi R^3}{3} = \frac{\pi r^3}{6}$	M2	Equating volumes Award M1 for sight of: (Volume of cylinder =) $\pi r^2 \times r/6$ or equivalent $\frac{4\pi r^3}{3} = \frac{\pi r^3}{6}$ is awarded M1.
$24R^3 = 3r^3$ or $R = \sqrt[3]{(\pi r^3/6)/(4\pi/3)}$ or $R^3 = (\pi r^3/6)/(4\pi/3)$ or equivalent	m1	Award m1 for clearing fractions AND cancelling π or for isolating R or for isolating R^3. FT if M1 awarded and if equivalent difficulty
$R = \frac{r}{2}$	A1	CAO
17. *(a)* $y = f(x) + 2$	B1	
17. *(b)* $y = f(-x)$	B1	

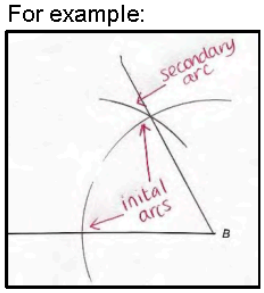
4. Correct construction <u>method</u> for perpendicular bisector with line drawn. Correct construction <u>method</u> for 60° at point A. Correct construction <u>method</u> for bisecting an angle with line drawn. Point P clearly identified	 B1 B1 B1 B1	*Correct construction arcs must be seen for the first three B1 marks.* Two pairs of intersecting arcs (centres at A and B). Allow if drawn at point B. Allow B1 for correct method (tolerance will be penalised with final B0). FT 'their angle of 60°' drawn at point A or point B. C.A.O. within tolerance. Intersecting lines alone with no indication that this is point P is <u>not sufficient</u> for this B1. Do not penalise if both possible positions shown. Final B1 may be awarded after B0B0B0.
<u>4. Alternative method</u> *Correct construction method for 60° at point A (or B).* *Correct construction method for bisecting the angle at A (or B) with line drawn.* *Repeating the above two stages at B (or A)* *Point P clearly identified*	 *B1* *B1* *B1* *B1*	*Correct construction arcs must be seen for the first three B1 marks* *Allow B1 for correct method (tolerance will be penalised with final B0).* *C.A.O. within tolerance.* *Intersecting lines alone with no indication that this is point P is <u>not sufficient</u> for this B1.* *Do not penalise if both possible positions shown.* *Final B1 may be awarded after B0B0B0.*

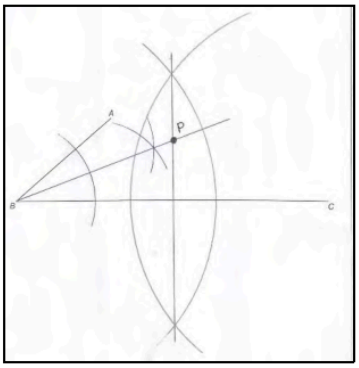
WJEC GCSE MATHEMATICS

AUTUMN 2019 MARK SCHEME

GCSE MATHEMATICS Unit 1: Higher Tier	Mark	Comments
1.(a) (Number of sides =) $\frac{360}{36}$ $= 10$	M1 A1	
1.(b) $(180 - 36) \times 10$ or equivalent $= 1440(°)$	M1 A1	F.T. 'their number of sides' if >2.
Alternative method. *$(10 - 2) \times 180$ or equivalent* *$= 1440(°)$*	*M1* *A1*	*F.T. 'their number of sides' if >2.*
2.(a) Reflection in (the line) $x = -2$	B2	B1 for 'reflection' or 'reflected'. B1 for sight of '$x = -2$' or equivalent e.g. $x + 2 = 0$ (**written**, not simply drawn).
2.(b) (i) Correct translation.	B2	B1 for translation '5 right'. B1 for translation '6 down'. SC1 for 2 correct vertices.
2.(b) (ii) $\begin{pmatrix}-5\\6\end{pmatrix}$	B1	B0 for -5 (missing brackets) OR $(-5,6)$ 6 B0 for $-\frac{5}{6}$ with or without brackets. No FT from part (b)(i).
3.(a) -5 -2 3	B2	B1 for two correct (in correct position) OR B1 for -6, -5, -2
3.(b) $6n - 1$ or equivalent	B2	B1 for sight of $6n$. Mark final answer.
4.(a) 3^4	B1	
4.(b) 40·84101	B1	
4.(c) 3·6	B1	
5.(a) Correct construction of PQR = 60°. Correct triangle PQR drawn.	M1 A1	Correct construction arcs must be seen and angle drawn. PQ = 7 cm (±2mm) and triangle drawn. Allow non labelling of point P (unless position contradicted). Ignore extension of line QP if correct triangle drawn.
5.(b) Arc, centre A, intersecting LM at two points AND Intersecting arcs (equal radii) using the above two points as centres. Line drawn	M1 A1	[Note to markers: These arcs may be identified by the fact that they will 'cross the line LM at an acute angle'. Arcs 'crossing the line at 90°' is evidence of an inappropriate method.]
Alternative method. *Using the properties of a kite.* *Intersecting arcs whose centres are any two points on the line LM and respective radii equal in length to the distance from the points to the point A.* *Line drawn.*	*M1* *A1*	*[Note to markers: The arcs will always intersect at a point that is a 'reflection of point A' in the line LM.]*

2.		Treat reversed angles at A and C MR-1. Correct construction arcs must be seen and angle drawn. If B3, penalise -1 if triangle not completed.
Correct construction of 60° at A	B1	
Correct construction of angle 45° at C	B2	Award B1 for one of the following: • correct construction of angle 90° at C • correct bisection of 90° at C, but their own perpendicular line at C drawn • any correct bisection of 90° seen.

4.(a) Correct construction of 60°	B1	Must be at point *B*. Correct construction arcs (two or three) must be seen (initial and secondary). B0 if 60° and 30° drawn. Ignore additional lines provided intended 60° is clear (e.g any triangle, including equilateral *ABC*). For example: 
4.(b) Correct construction of 90°	B1	Must be at point *R* above or below *LM*. Correct construction arcs (initial and secondary) **must** be seen.
4.(c) All correct construction arcs shown	M1	Arc, centre P, intersecting *XY* at two points. (*X* may be one of the points with no arc seen at point *X*.) [Note to markers: These arcs may be identified by the fact that they will 'cross the line *XY* at an acute angle'. Arcs 'crossing the line at 90°' is evidence of an inappropriate method.] **AND** Intersecting arcs (equal radii) using the above two points as centres. Ignore line extended above *XY* for M1.
Line drawn	A1	Ignore line extended above *XY* for M1A1.
4.(c) *Alternative method* *(Using the properties of a kite.)* *All correct construction arcs shown.*	*M1*	*Intersecting arcs whose centres are **any** two points on the line XY and respective radii equal in length to the distance from the points to the point P.* *[Note to markers: The arcs will always intersect at a point that is a 'reflection of point P' in the line XY.]*
Line drawn	*A1*	

3. Correct construction of bisector of angle ABC.	B1	Correct construction arcs (initial and secondary) and a line joining B to the point of intersection of the arcs must be seen or an alternative valid method.
Correct construction of perpendicular bisector of BC.	B1	Two correct pairs of intersecting construction arcs and a line joining both of these points of intersection must be seen.
Correct position of point P  	B1	CAO. Award B1 for the correct point of intersection and not labelled *P*, provided no other incorrect points are indicated. (May be awarded from previous B0B0.)

6.		Allow a tolerance of ± 2° and ± 2mm. The construction need not be below the line for the B2 and the first B1 (but the final B1 won't be awarded).
Correct bisector of 60°	B2	Allow at A or B. Correct construction arcs (initial and secondary) must be seen or an alternative valid method. The angle must be formed for the bisector and the line must reach the intersection of the arcs. Award B1 for one of the following: • correct construction of 60° at A or B. The initial and secondary construction arcs must be seen but line forming the angle may not need to be seen (depending on method) • correct bisector of 'their acute angle' at A or B. The initial and secondary construction arcs and bisector line must be seen and reach the intersection of the arcs.
Arc of radius 5 cm, centre B.	B1	For B1, the arc must be of sufficient length so as not to be considered a 'point' or a 'notch' i.e. for a sector of at least 10° at B.
Correct region identified.	B1	For this B1, the region must be: • in the correct location at B • below the line • include an angle • include an arc. FT if at least B1 previously awarded.