REVISE
.wales

3.04 — Cubic equations by trial & improvement

Mark schemes for the 3.04 question pack

Spec 2.2.9 — Unit 3

SOLUTIONS · 2025 SPECIFICATION

Mark schemes for the 14 questions in the corresponding revise.wales question pack (59 marks total). Sources: legacy WJEC GCSE papers, WJEC SAM, and custom-authored mark schemes. Pack layout © revise.wales.

4.			*Correct evaluation regarded as enough to identify if negative or positive. If evaluations not seen accept 'too high' or 'too low'.*
One correct evaluation $2 \le x \le 3$	✓	B1	
2 correct evaluations $2{\cdot}15 \le x \le 2{\cdot}35$, (one value < 0, one value > 0.)	✓	B1	
2 correct evaluations $2{\cdot}25 \le x \le 2{\cdot}35$, (one value < 0, one value > 0.)	✓	M1	
$x = 2{\cdot}3$	✓	A1	

x	$2x^3 - 3x - 17$		
2	−7		
2·1	−4·778		
2·2	−2·304		
2·3	0·434	2·15	−3·573...
2·4	3·448	2·25	−0·968...
2·5	6·75	2·26	−0·693...
2·6	10·352	2·27	−0·415...
2·7	14·266	2·28	−0·135...
2·8	18·504	2·29	0·147...
2·9	23·078	2·35	1·905...
3	28		

			the two found is > 90. (statement not required)
3. One correct evaluation $3 \le x \le 4$ 2 correct evaluations $3{\cdot}65 \le x \le 3{\cdot}85$, one < 0, one > 0. 2 correct evaluations $3{\cdot}65 \le x \le 3{\cdot}75$, one < 0, one > 0. $x = 3{\cdot}7$	✓ ✓ ✓ ✓	B1 B1 M1 A1	*Correct evaluation regarded as enough to identify if negative or positive. Evaluations can be rounded or truncated. If evaluations not seen condone 'too high' or 'too low'.* *Look out for testing for $x^3 - 2x = 45$.* x $x^3 - 2x - 45$ 3 −24 3·1 −21·409 3·2 −18·632 3·3 −15·663 3·4 −12·496 3·5 −9·125 3·55 −7·361... 3·6 −5·544 3·65 −3·672... 3·7 −1·747 3·74 −0·166... 3·8 2·272 3·75 0·234... 3·9 6·519 3.85 4.366... 4 11 Mark final answer.

1.(c)	B1	
2.		*Correct evaluation regarded as enough to identify if <91 or >91. If evaluations not seen accept 'too high' or 'too low'.* *Look out for testing* $x^3 + 2x - 91 = 0$
One correct evaluation $4 \le x \le 5$	B1	
2 correct evaluations $4{\cdot}25 \le x \le 4{\cdot}45$, one < 91, one > 91.	B1	
2 correct evaluations $4{\cdot}25 \le x \le 4{\cdot}35$, one < 91, one > 91.	M1	
$x = 4{\cdot}3$	A1	

x	$x^3 + 2x$		
4	72		
4·1	77·121		
4·2	82·488		
4·3	88·107		
4·4	93·984		
4·5	100·125	4·25	85·26....
4·6	106·536	4·35	91·01...
4·7	113·223	4·45	97·02...
4·8	120·192		
4·9	127·449		
5	135		

2.(c) 280°	B1	
3. One correct evaluation $4 \le x \le 5$ 2 correct evaluations $4{\cdot}25 \le x \le 4{\cdot}45$, one < 0, one > 0. 2 correct evaluations $4{\cdot}25 \le x \le 4{\cdot}35$, one < 0, one > 0. (x =) 4·3	 B1 B1 M1 A1	*Correct evaluation regarded as enough to identify if negative or positive. If evaluations not seen accept 'too high' or 'too low'.* *Look out for equating $x^3 - 7x = 51$* x $x^3 - 7x - 51$ 4 −15 4·1 −10·779 4·2 − 6·312 4·25 −3·984... 4·3 − 1·593 4·34 0·366... 4·4 3·384 4·35 0·862... 4·5 8·625 4·45 5·971... 4·6 14·136 4·7 19·923 4·8 25·992 4·9 32·349 5 39 *For this question A1 can only be awarded if M1 given.*
Organisation and Communication Accuracy of writing	OC1 W1	For OC1, candidates will be expected to: • present their response in a structured way • explain to the reader what they are doing at each step of their response • lay out their explanation and working in a way that is clear and logical For W1, candidates will be expected to: • show all their working • make few, if any, errors in spelling, punctuation and grammar • use correct mathematical form in their working

5.

One correct evaluation $5 \le x \le 6$	B1
2 correct evaluations $5{\cdot}55 \le x \le 5{\cdot}75$, one < 107, one > 107.	B1
2 correct evaluations $5{\cdot}65 \le x \le 5{\cdot}75$, one < 107, one > 107.	M1
$x = 5{\cdot}7$	A1

Correct evaluation regarded as enough to identify if 'too high' or 'too low'. If evaluations not seen accept 'too high' or 'too low'.

x	$x^3 - 13x$ (or check $x^3 - 13x - 107=0$)		
5	60		
5·1	66·351		
5·2	73·008		
5·3	79·977		
5·4	87·264		
5·5	94·875		
5·6	**102·816**	5·55	98·803...
5·7	**111·093**	**5·65**	**106·912...**
5·8	119·712	5·655	107·326...
5·9	128·679	5·75	115·359...
6	138		

8. One correct evaluation $1 \le x \le 2$ 2 correct evaluations $1{\cdot}55 \le x \le 1{\cdot}75$, one < 0, one > 0. 2 correct evaluations $1{\cdot}55 \le x \le 1{\cdot}65$, one < 0, one > 0. $x = 1{\cdot}6$	 B1 B1 M1 A1	*Correct evaluation regarded as enough to identify if 'too high' or 'too low'. If evaluations not seen accept 'too high' or 'too low'.* x $2x^3 + x - 10$ (or check $2x^3 + x = 10$) 1 −7 1·1 −6·238 1·2 −5·344 1·3 −4·306 1·4 −3·112 1·45 − 2·452... 1·5 −1·75 1·55 − 1·002... **1·6 −0·208 1·65 0·634...** **1·7 1·526** 1·75 2·468... 1·8 3·464 (1·62 0·123..) 1·9 5·618 (1·63 0·291..) 2 8 (1·64 0·461..)
9. 85% ≡ 6154 $\frac{6154}{85} \times 100$ OR $\frac{6154}{0{\cdot}85}$ = 7240	B1 M1 A1	Accept any indication. Implies the B1.
10. x = 54(°) Opposite angles (of a) cyclic quad. (add up to 180°). y = 108(°) Angle at the centre (is twice the angle at the circumference).	B1 E1 B1 E1	Dependent on an attempt at 180 – 126. FT 2 × 'their 54' only if less than 360° Dependent on an attempt at 2 × 'their 54'.
11. Correct enlargement	B2	Otherwise B1 for 2 correct vertices within a triangle. OR for 3 correct vertices in the correct location not joined to form the triangle OR triangle of correct shape, size and orientation in incorrect position OR consistent correct use of an incorrect negative scale factor.
12(a). $(9p+1)(9p-1)$	B2	B1 for $(9p \ldots 1)(9p \ldots 1)$
12(b). $(7t-2)(t+3)$	B2	B1 for $(7t \ldots 2)(t \ldots 3)$
13. Sight of 297.5 AND 6.5 297.5 ÷ 6.5 = 45.77(km/h)	B1 M1 A1	Accept 6 hours 30 minutes, but not 6.3 hours. If other calculations shown, then the relevant calculation must be identified. Award M1 for their values provided 295≤d<300 AND 6<t≤7 (but not 6 hours 30 minutes). CAO. Correct answer must be clearly identified.
14. sin BAD = (2×70)/(8×19) or equivalent (BAD=) 67(.08…°) (Area of sector ABD=) 67(.08…)/360×π×8^2 Accept answers in the range 37.4(cm^2) to 37.5(cm^2) OR 37(cm^2)	M2 A1 M1 A1	Allow any unambiguous indication of angle BAD. M1 for the correct use of the formula when sinBAD is not the subject, for example: 70 = 1/2×8×19×sinBAD. Allow any answer that rounds to 67(°). Accept 292.9(…)/360×π×8^2 OR 293/360×π×8^2 for the area of the major sector ABD. FT their derived or stated value of angle BAD. Accept an answer in the range 163.5(cm^2) to 163.7(cm^2) OR 164(cm^2) for the area of the major sector ABD.

Unit 2: Higher Tier					
1.		*Correct evaluation regarded as enough to identify if <37 or >37. If evaluations not seen accept 'too high' or 'too low'.* *Look out for testing $x^3 - 3x - 37 = 0$*			
		$\underline{x}$	$\underline{x^3 - 3x}$		
One correct evaluation $3 \le x \le 4$	B1	3	18		
2 correct evaluations $3{\cdot}55 \le x \le 3{\cdot}75$, one < 37, one > 37.	B1	3·1	20·491		
		3·2	23·168		
2 correct evaluations $3{\cdot}55 \le x \le 3{\cdot}65$, one < 37, one > 37.	M1	3·3	26·037		
		3·4	29·104		
		3·5	32·375	3·55	34·08....
$x = 3{\cdot}6$	A1	**3·6**	**<u>35·856</u>**	**3·65**	**<u>37·67..</u>**
		3·7	**<u>39·553</u>**	3·75	41·48...
		3·8	43·472		
		3·9	47·619		
		4	52		

WJEC GCSE MATHEMATICS

AUTUMN 2020 MARK SCHEME

GCSE Mathematics Unit 2 Higher Tier	Mark	Comments
1.(a) $\frac{1}{6} \times \frac{1}{4}$ or equivalent	M1	
$= \frac{1}{24}$ ISW	A1	Accept 0·0416... or 0·0417 or 0·042 for M1A1 M1A0 for '1 in 24', '1:24'.
1.(b) $\frac{1}{5} + \frac{1}{10}$ or equivalent.	M1	
$= \frac{3}{10}$ or equivalent. ISW	A1	
2. $(AC^2 =)\ 10{\cdot}8^2 + 14{\cdot}4^2$	M1	Accept equivalent of using cos rule (as cos 90 = 0).
$AC^2 = 324$ or $(AC =) \sqrt{324}$	A1	
$(AC =)$ 18(cm)	A1	F.T. √'their 324' provided M1 gained. Final answer of AC = 324 is M1A0A0. *Alternative method to find AC* *A correct and complete method (using two trigonometric relationships)* *M2* *AC = 18(cm)* *A1* FT 'their stated AC'. (May be shown on the diagram)
(Area ACD =) $\frac{24 \times 18}{2}$	M1	Accept equivalent of using ½ × 24 × 18 × sin 90 (as sin 90 = 1).
$= 216\ (cm^2)$	A1	
Organisation and Communication	OC1	For OC1, candidates will be expected to: • present their response in a structured way • explain to the reader what they are doing at each step of their response • lay out their explanation and working in a way that is clear and logical • write a conclusion that draws together their results and explains what their answer means
Accuracy of writing	W1	For W1, candidates will be expected to: • show all their working • make few, if any, errors in spelling, punctuation and grammar • use correct mathematical form in their working • use appropriate terminology, units, etc.
3.		*Correct evaluation regarded as enough to identify if negative or positive. If evaluations not seen accept 'too high' or 'too low'.* *Look out for equating $x^3 - 5x = 350$*
One correct evaluation $7{\cdot}2 \le x \le 7{\cdot}3$	B1	
2 correct evaluations $7{\cdot}275 \le x \le 7{\cdot}295$, one < 0, one > 0.	B1	
2 correct evaluations $7{\cdot}275 \le x \le 7{\cdot}285$, one < 0, one > 0.	M1	
$x = 7{\cdot}28$	A1	

x	$x^3 - 5x - 350$		
7·2	−12·75(2)		
7·21	−11(·2..)		
7·22	− 9(·7...)		
7·23	− 8(·2...)		
7·24	− 6(·6...)		
7·25	−5(·1...)		
7·26	− 3(·6...)	7·275	−1(·3....)
7·27	− 2(·1...)	7·284	0(·04..)
7·28	**−0·5(7..)**	**7·285**	**0·1(9..)**
7·29	**0·9(7..)**	7·295	1(·7....)
7·3	2·5(17)		

WJEC GCSE MATHEMATICS

AUTUMN 2021 MARK SCHEME

Unit 2: Higher Tier	Mark	Comments
1. $4(3a - 7) + 2(5a + 4)$ or equivalent. $= 12a - 28 + 10a + 8$ or equivalent. $= 22a - 20$ (cm) or $2(11a - 10)$ (cm)	B1 B1 B1	For a correct expression for the perimeter. For removal of brackets FT only from $2(3a - 7) + (5a + 4)$ or equivalent OR $2(3a - 7) + 2(5a + 4)$ or equivalent. For collection of terms FT if of equivalent difficulty. Mark final answer.
Alternative approach *$2[2(3a - 7) + (5a + 4)]$* *$= 12a - 28 + 10a + 8$ or $2(6a - 14 + 5a + 4)$* *$= 22a - 20$ (cm) or $2(11a - 10)$ (cm)*	*B1* *B1* *B1*	*For a correct expression for the perimeter.* *For removal of brackets (within 'square brackets')* *FT only from* *$2[2(3a - 7) + 2(5a + 4)]$ or equivalent.* For collection of terms *FT only from* *$2[2(3a - 7) + 2(5a + 4)]$ or equivalent.* *FT if of equivalent difficulty.* *Mark final answer*
2. (number of part-time in North Wales =) $\frac{90}{360} \times 96$ OR (number of full-time in North Wales =) $\frac{144}{360} \times 150$ (number of part-time in North Wales =) 24 (number of full-time in North Wales =) 60 (Probability from North Wales =) $\frac{84}{246}$ or equivalent ISW	M1 A1 A1 A1	Or equivalent *Answers may be seen on the diagram.* An answer (or sight) of 24 implies M1. An answer (or sight) of 60 implies M1. FT ('their 24' + 'their 60') /246 provided M1 gained and ('their 24' + 'their 60') < 246. Penalise incorrect notation −1. e.g. '84 in 246'.
3. One correct evaluation $2 \leq x \leq 3$ 2 correct evaluations $2{\cdot}25 \leq x \leq 2{\cdot}45$, one < 20, one > 20. 2 correct evaluations $2{\cdot}25 \leq x \leq 2{\cdot}35$, one < 20, one > 20. $x = 2{\cdot}3$	 B1 B1 M1 A1	*Correct evaluation regarded as enough to identify if <20 or >20. If evaluations not seen accept 'too high' or 'too low'.* *Look out for testing $x^3 + 3x - 20 = 0$* x / $x^3 + 3x$ 2 / 14 2·1 / 15·561 2·2 / 17·248 **2·3** / **19·067** **2·4** / **21·024** 2·5 / 23·125 2·6 / 25·376 2·7 / 27·783 2·8 / 30·352 2·9 / 33·089 3 / 36 2·25 / 18·140…. **2·35** / **20·027….** 2·45 / 22·056…. *Note* *Evidence for M1 must be **seen** before A1 can be awarded.*

8. (a) Any intention of length × width × height = 132 e.g. $5x(x^2+3)$ = 132 $5\times x\times (x^2+3)$ = 132 or $5x\times(x^2+3)$ = 132 or equivalent	B1	Must be = 132. May be seen in parts. Do not allow missing brackets e.g. $5\times x\times x^2+3$ = 132.
8. (b)(i) One correct evaluation $2 \le x \le 3$ 2 correct evaluations $2{\cdot}55 \le x \le 2{\cdot}75$, (one value < 132, one value > 132) 2 correct evaluations $2{\cdot}55 \le x \le 2{\cdot}65$, (one value < 132, one value > 132) x = 2·6	 B1 B1 M1 A1	*Correct evaluation regarded as enough to identify if <132 or >132. If evaluations not seen accept 'too high' or 'too low'.* *Look out for testing* $5x^3+15x-132=0$ *or* $x^3+3x=26{\cdot}4$ *or equivalent* x — $5x^3+15x$ 2 — 70 2.1 — 77.805 2.2 — 86.24 2.3 — 95.335 2.4 — 105.12 2.5 — 115.625 **2.6 — 126.88** **2.7 — 138.915** 2.8 — 151.76 2.9 — 165.445 3 — 180 2.55 — 121.1568… **2.65 — 132.798…..** 2.75 — 145.234…...
8. (b)(ii) An answer in the range 9·76 to 10·16 (cm)	 B1	Answer may be shown on the diagram. FT 'their $2{\cdot}6'^2$ + 3. FT 132 ÷ (5 × 'their x').

2. One correct evaluation $1 \le x \le 2$ 2 correct evaluations $1{\cdot}15 \le x \le 1{\cdot}35$, (one value < 0, one value > 0) 2 correct evaluations $1{\cdot}15 \le x \le 1{\cdot}25$, (one value < 0, one value > 0) $x = 1{\cdot}2$	B1 B1 M1 A1	*Correct evaluation regarded as enough to identify if < 0 or > 0.* *Look out for testing* $x^3 + 5x = 8$ *or equivalent* *If evaluations not seen accept 'too high' or 'too low'.* x | $x^3 + 5x - 8$ 1 | -2 1.1 | -1.169 **1.2** | **-0.272** **1.3** | **0.697** 1.4 | 1.744 1.5 | 2.875 1.6 | 4.096 1.7 | 5.413 1.8 | 6.832 1.9 | 8.359 2 | 10 1.15 -0.72913 1.22 -0.08415 1.23 0.010867 1.24 0.106624 **1.25 0.203125** 1.35 1.210375

3. One correct evaluation $2 \le x \le 3$ 2 correct evaluations $2{\cdot}55 \le x \le 2{\cdot}75$, **(one evaluation < 0, one evaluation > 0)** 2 correct evaluations $2{\cdot}55 \le x \le 2{\cdot}65$, **(one evaluation < 0, one evaluation > 0)** $x = 2{\cdot}6$	B1 B1 M1 A1	*Correct evaluation regarded as enough to identify if negative or positive.* *If evaluations not seen accept 'too high' or 'too low'.* *Look out for equating* $x^3 - 8x = -3$ x / $x^3 - 8x + 3$ 2 / −5 2·1 / −4·539 2·2 / − 3·952 2·3 / −3·233 2·4 / −2·376 2·5 / −1·375 **2·6 / −0·224** **2·7 / 1·083** 2·8 / 2·552 2·9 / 4·189 3 / 6 2·55 −0·818…. 2·61 −0·1004… 2·62 0·0247… 2.63 0·1514… 2.64 0·2797… **2·65 0·409…** 2·75 1·796.. Unsupported $x = 2{\cdot}6$ is awarded B0B0M0A0. An answer of $x = 2{\cdot}6$ can only be awarded M1A1, following sight of 2 correct evaluations $2{\cdot}55 \le x \le 2{\cdot}65$ (**one evaluation** < 0, **one evaluation** > 0).

5. One correct evaluation $3 \le x \le 4$ 2 correct evaluations $3{\cdot}75 \le x \le 3{\cdot}95$, **(one value < 80, one value > 80)** 2 correct evaluations $3{\cdot}75 \le x \le 3{\cdot}85$, **(one value < 80, one value > 80)** $x = 3{\cdot}8$	B1 B1 M1 A1	*Correct evaluation regarded as enough to identify if < 80 or > 80.* *If evaluations not seen accept 'too high' or 'too low'.* *Look out for* $x^3 + 6x - 80 = 0$ $\underline{x}$ $\underline{x^3+6x}$ 3 45 3.1 48·391 3.2 51·968 3.3 55·737 3.4 59·704 3.5 63·875 3.6 68·256 3.7 72·853 **3.8 77·672** **3.9 82·719** 4 88 3.75 75·2343.. 3.84 79·6631.. **3.85 80·1666..** **3.95 85·3298..** Unsupported $x = 3{\cdot}8$ is awarded B0B0M0A0. An answer of $x = 3{\cdot}8$ can only be awarded M1A1, following sight of 2 correct evaluations $3{\cdot}75 \le x \le 3{\cdot}85$ **(one evaluation < 80, one evaluation > 80).** If 3·85 is given as 80 (truncated) award M0 A0 unless 'too high' or equivalent is indicated.

2. One correct evaluation $0 \le x \le 1$ 2 correct evaluations $0{\cdot}65 \le x \le 0{\cdot}85$, **(one value < 0, one value > 0)** 2 correct evaluations $0{\cdot}65 \le x \le 0{\cdot}75$, **(one value < 0, one value > 0)** $x = 0{\cdot}7$		B1 B1 M1 A1	*Correct evaluation regarded as enough to identify if < 0 or > 0.* *If evaluations not seen accept 'too high' or 'too low'.* x | $x^3 + 5x - 4$ (check $x^3 + 5x = 4$) 0 | -4 0.1 | -3.499 0.2 | -2.992 0.3 | -2.473 0.4 | -1.936 0.5 | -1.375 0.6 | -0.784 **0.7** | **-0.157** **0.8** | **0.512** 0.9 | 1.229 1 | 2 0.65 -0.475 0.73 0.039 0.74 0.105 **0.75 0.172** 0.85 0.864 Unsupported $x = 0{\cdot}7$ is awarded B0B0M0A0. An answer of $x = 0{\cdot}7$ can only be awarded B1B1M1A1, following sight of 2 correct evaluations $0{\cdot}65 \le x \le 0{\cdot}75$ with one evaluation < 0 and one evaluation > 0.

End of solutions