REVISE
.wales

2.06 — Recurring decimals & rational/irrational numbers

Mark schemes for the 2.06 question pack

Spec 1.5.1, 1.6.1, 1.6.2 — Unit 2

SOLUTIONS · 2025 SPECIFICATION

Mark schemes for the 18 questions in the corresponding revise.wales question pack (53 marks total). Sources: legacy WJEC GCSE papers, WJEC SAM, and custom-authored mark schemes. Pack layout © revise.wales.

10(a)(i) Tangent drawn at t = 50 Idea of increase in speed ÷ increase in time Reasonable approximation for the gradient	S1 M1 A1	 Ignore signs for M1 only Allow 1 slip in reading the scale for M1 only Only award if S1 awarded Accept a fraction not in its lowest terms Mark final answer
10(a)(ii) e.g. 10x = 2·444… and 100x = 24·444… and attempt to subtract 22/90 (ISW)	 M1 A1	 OR x = 0·2444… and 10x = 2·444… M1A0 for 2·2/9 100x – x leads to 242/990 (which simplifies to 22/90). ISW
10(b)(i) Sight of speeds of 10, 15, 25, 30 Split into at least 4 areas and attempt to sum (Area =) ½×20×(10+30 + 2(15 + 25 + 30)) = 1800 (m)	B1 M1 M1 A1	 Or equivalent. (Areas of 250, 400, 550, 600) (If 8 areas used, areas of 110, 135, ≈160, ≈210, 270, 295, 300, 300) Allow 1 slip in reading the scale CAO. A1 for an answer of ≈1780 (m) if 8 areas used. CAO.
10(b)(ii) (Total distance =) 1800 + 30 × (38 to 40 inclusive) = 2940 to 3000 (m) (Average speed =) total distance ÷ 120 = 24·5 to 25 (m/s)	 M1 A1 M1 A1	 FT 'their 1800' FT 'their total distance'

11.(a) 1/7		B1	
11.(b) $x = 0{\cdot}37272\ldots$ AND $100x = 37{\cdot}2727\ldots$ with an attempt to subtract. $\frac{369}{990}$ ISW (= 41/110)		M1 A1	Or 10x AND 1000x or equivalent with an attempt to subtract. An answer of 36·9 / 99 gains M1 only. *Alternative method* *0·3 + 0·0727272..= 3/10 + 72/990 or equivalent M1* *369/990 (= 41/110) ISW A1*
11.(c) $(\sqrt{63})^2 - \sqrt{63}\sqrt{7} - \sqrt{63}\sqrt{7} + (\sqrt{7})^2$ $= 63 - \sqrt{441} - \sqrt{441} + 7$ $= 28$		B1 B1 B1	Accept equivalent methods of processing $\sqrt{63}\sqrt{7}$ e.g. $\sqrt{9}\sqrt{7}\sqrt{7}$ or $3(\sqrt{7})^2$. F.T. only from '$-(\sqrt{7})^2$' in first line. Accept '14' only if as a result of F.T. '$-(\sqrt{7})^2$' in first line. If no marks awarded, SC1 for 3 out of 4 terms correct in initial expansion. *Alternative method* *Sight of $\sqrt{63} = 3\sqrt{7}$* *B1* *$(2\sqrt{7})^2$* *B1*

			from trial and improvement.
19.(a) Appropriate example: E.g. $\pi \times \pi = \pi^2$, $(1+\sqrt{3})^2 = 4+2\sqrt{3}$ $(\sqrt[3]{2})^2 = \sqrt[3]{4}$ OR $2^{\frac{2}{3}}$		B1	The following can be applied if sight of π in the working lines or answer space: If π or 3.141… (with or without the '…') used AND either π^2 or 9.8696… (with or without the '…') seen in the answer space, this will gain the B1. However, watch out for π seen, and e.g. 3.141 and 9.8658 offered in the answer spaces. This gains B0 because 3.141^2 has been evaluated (not π^2).
19.(b) Two different irrational numbers and the correct rational number as the answer. Examples: $\sqrt{2} \times \sqrt{8} = \sqrt{16}$ (or simplified to 4) $\sqrt{12} \times \frac{1}{\sqrt{3}} = \frac{\sqrt{12}}{\sqrt{3}}$ (or simplified to 2) $\pi \times \frac{1}{\pi} = 1$ $2^{\frac{1}{2}} \times 2^{\frac{3}{2}} = 2^2$ (answer can be simplified to 4)		B1	Answers in the boxes take precedence.

15. *(a)* x = 0·6424242..... $100x$ = 64·24242..... with an attempt to subtract 636/990 or 106/165 or equivalent	M1 A1	Or $10x$ and $1000x$, or equivalent. C.A.O. (63·6/99 gets M1 A0). ISW. *Alternative method* *(0·6+0·0424242...=) 6/10 + 42/990 or equivalent M1* *636/990 (= 106/165) ISW A1*
15. *(b)* 6	B2	B1 for $36^{\frac{1}{2}}$ or $\sqrt{36}$ or $(36/1)^{\frac{1}{2}}$ or $(1/6)^{-1}$ or 1/(1/6) Allow SC1 for an answer of – 6.

8(a) e.g. 100x = 41·666… and 1000x = 416·666… and attempt to subtract (x =) = $\frac{375}{900}$ or $\frac{4125}{9900}$ or $\frac{41625}{99900}$ = $\frac{5}{12}$	M1 A1 A1	Or equivalent Correct values need to be used in the attempted subtraction Allow A1 for e.g. 3.75/9 Must be in lowest terms FT 'their 375/900' provided of equivalent difficulty Accept unsupported $\frac{5}{12}$ only
8(b) (Number of months' pay received =) 5	B1	FT 'their derived 5/12' × 12 truncated or rounded, provided their answer < 12

10		
15. (a) $x = 0{\cdot}2454545.....$ and $100x = 24{\cdot}54545....$ with an attempt to subtract	M1	Or $10x$ and $1000x$, or equivalent. Or a complete alternative method.
243/990 or 27/110 or equivalent.	A1	An answer of 24·3/99 gains M1 only. ISW
Alternative method *0·2 + 0·0454545..... = 1/5 + 45/990 or equivalent* *243/990 or 27/110 or equivalent*	*M1* *A1*	*ISW*
15. (b) $8 \times 5 + 8\sqrt{7} - 5 \times 3\sqrt{7} - 3(\sqrt{7})^2$ or equivalent	M1	
$= 19 - 7\sqrt{7}$	A1	Mark final answer. If no marks awarded, SC1 for 3 of the 4 terms correct.

15. (a) x = 0·37777..... 10x = 3·7777..... with an attempt to subtract 34/90 or 17/45 or equivalent e.g. 374/990	M1 A1	Or 10x and 100x, or equivalent. Or an alternative method. An answer of 3·4/9 gains M1 only. Mark final answer. Do not ignore incorrect cancelling.
Alternative method *0·3 + 0·07777..... = 3/10 + 7/90 or equivalent* *34/90 or 17/45 or equivalent*	*M1* *A1*	 *Mark final answer. Do not ignore incorrect cancelling.*
15. (b) (i) $\sqrt{8}\sqrt{8} - \sqrt{8}\sqrt{2} - \sqrt{8}\sqrt{2} + \sqrt{2}\sqrt{2}$ or $\sqrt{64} - \sqrt{8}\sqrt{2} - \sqrt{8}\sqrt{2} + \sqrt{4}$ or equivalent (= 8 − 4 − 4 + 2) = 2	M1 A1	 Mark final answer. If no marks, award SC1 for 3 correctly evaluated terms.
Alternative method: $(2\sqrt{2} - \sqrt{2})^2$ = 2	*M1* *A1*	 *An answer of* $(\sqrt{2})^2$ *gains M1A0 only* *Mark final answer.*
15. (b) (ii) $2\sqrt{10}$	B2	B1 for $\sqrt{40}$ or $\sqrt{2}$ x $2\sqrt{5}$ or 2 x $\sqrt{30}$ / $\sqrt{3}$
15. (c) 1/64	B2	B1 for 64^{-1} or $1/4^3$ or $(1/4)^3$ or $1/\sqrt{4096}$ or $1/4096^{1/2}$ or $(1/4096)^{1/2}$ or $\sqrt{(1/4096)}$ or SC1 for – 1/64 Allow ±1/64 for B2

angle, side, angle or AGA or equivalent.		Dependent on at least one correct angle found.
13. *(a)* $x = 0{\cdot}2488888.....$ $10x = 2{\cdot}488888.....$ with an attempt to subtract 224/900 or 112/450 or 56/225 or equivalent e.g. 2464/9900	M1 A1	Or $1000x$ and $100x$, or equivalent. An answer of $2{\cdot}24/9$ or $22{\cdot}4/90$ gains M1 only. ISW.
Alternative method *$(0{\cdot}24 + 0{\cdot}00888..=)$ 24/100 + 8/900 or equivalent* *224/900 (= 56/225)*	*M1* *A1*	 *ISW*
13. *(b)* 9	B2	B1 for $729^{\frac{1}{3}}$ or $\sqrt[3]{729}$ or $(729/1)^{\frac{1}{3}}$ or 3^2 or $(1/9)^{-1}$ or $1/(1/9)$ Allow B1 for 1/9 or −9.

14.(a) x = 0·4757575.....100x = 47·5757575..... with an attempt to subtract 471/990 or 157/330 ISW	M1 A1	Or correct values 1000x and 10x, or equivalent. M0 for use of x = 0·475475475..... An answer of 47·1/99 gains M1 only.
Alternative method *(0·4 + 0·07575....=) 4/10 + 75/990 or equivalent* *471/990 or equivalent ISW*	*M1* *A1*	
14.(b) $\frac{1}{8}$	B1	
15. 9 + 4√5 (–) 2 7 + 4√5 AND irrational	B2 B2 B1	If not B2, award B1 for 3 or 4 correct terms within 4 + 2√5 + 2√5 + 5 or 4 + 2√5 + 2√5 + √25 (without subsequent correct collection of terms) (4√5 is equivalent to 'two correct terms') B1 for (numerator of) 10√5 or B1 for (denominator of) 5√5 or √125 or B1 for appropriate factorisation of both numerator and denominator e.g. $\frac{\sqrt{5}\times\sqrt{100}}{\sqrt{5}\times\sqrt{25}}$ or $\frac{\sqrt{5}\times\sqrt{5}\times\sqrt{5}\times\sqrt{4}}{\sqrt{5}\times\sqrt{5}\times\sqrt{5}}$ Mark final answer. FT for equivalent difficulty (requiring collection of terms) AND either B2 awarded AND final answer is irrational.
16.(a) (Area=) ½×1×[16+0+2(15+12+7)] or equivalent = 42	M2 A1	Award M1 if only one y-value incorrect. F.T. from M1. If no marks, SC1 for an answer of 420 (from mis-reading horizontal scale).
Alternative method $\frac{(16+15)}{2} + \frac{(15+12)}{2} + \frac{(12+7)}{2} + \frac{(7+0)}{2}$ = 42	*M2* *A1*	*Individual areas are: 15·5, 13·5, 9·5, 3·5.* *M1 if only one y-value incorrect* *or* *M1 for any 2 (out of 4) correctly evaluated areas (of a complete 'strip').* *(Each area of a trapezium may be seen as the sum of the area of a rectangle and a triangle.)* *F.T. from M1 (provided 4 'strips' considered).* If no marks, SC1 for an answer of 420 (from mis-reading horizontal scale).
16.(b) 'Greater than' WITH valid reason e.g. trapezium rule gives an underestimate in this case and increasing the number of strips improves accuracy; less (shaded area) left out; more of the area (under curve) included; tops of strips are closer to the curve.	E1	Allow e.g. increasing the number of strips improves accuracy.

12. $6(2x+1)-4(3x-5)$ as a numerator within a single fraction $(3x-5)(2x+1)$ as a denominator h26 / $(3x-5)(2x+1)$	M1 M1 A1	Allow intention of brackets, e.g. $6\times 2x+1-4\times 3x-5$ CAO. Allow $26/(6x^2-7x-5)$ (If expanded, the denominator must be correct.) If M1 M1 A1, penalise further incorrect work –1. If no marks awarded, then SC1 for sight of 26.
13. (Linear scale factor =) $\sqrt[3]{}(1280/20)$ (= 4) $\sqrt[3]{}(1280/20)\times 2{\cdot}3$ = 9·2 (cm)	B1 M1 A1	Or equivalent. Accept a method based on ratios e.g. 1 : 4 (from 20 : 1280 = 1 : 64 = 1 : 4^3) FT their derived scale factor (from $\sqrt[3]{}$). SC1 for an answer of 18.4 (using s.f. of 8, from $\sqrt{64}$).
Alternative method (using reciprocal scale factor) *(Linear scale factor =) $\sqrt[3]{}(20/1280)$ (= 1 / 4)* *2·3 ÷ $\sqrt[3]{}(20/1280)$ OR 1 / $\sqrt[3]{}(20/1280)\times 2{\cdot}3$* *= 9·2 (cm)*	*B1* *M1* *A1*	*Or equivalent.* *Accept a method based on ratios.* *FT their derived scale factor (from $\sqrt[3]{}$).*
14. (a) $10x = 8{\cdot}121212.....$ and $1000x = 812{\cdot}1212....$ with an attempt to subtract on both sides 804/990 (= 402/495 = 134/165)	M1 A1	Or x and $100x$, or equivalent. Or a complete alternative method. An answer of 80·4/99 gains M1 only. ISW
Alternative method *0·8 + 0·0121212..... = 8/10 + 12/990 or equivalent* *804/990 (= 402/495 = 134/165)*	*M1* *A1*	*ISW*
14. (b) $6\sqrt{2}$	B1	
14. (c) $7\times 3+7\sqrt{5}-3\times 2\sqrt{5}-2(\sqrt{5})^2$ or equivalent $= 11+\sqrt{5}$	M1 A1	 Mark final answer. Accept $11+1\sqrt{5}$. If no marks awarded, SC1 for 3 correctly simplified terms i.e. 21, $7\sqrt{5}$, $-6\sqrt{5}$, -10.
15. • *FG = HG* (since *G* is the midpoint of *FH*) • *EG* is a common side • Angle *EGF* = Angle *EGH* (since *EG* and *FH* are perpendicular) SAS (or two sides and the included angle) so that EFG and EHG are congruent triangles.	B1 B1 B1 B1	Do not accept indications on the diagram. FT from B2 previously awarded. Must be convincing. Do not allow 'two sides and an angle'.
Allow alternative method • *FG = HG (since G is the midpoint of FH)* • *EG is a common side* • *EF = EH using Pythagoras* *SSS (or all corresponding sides equal) so that EFG and EHG are congruent triangles.*	*B1* *B1* *B1* *B1*	*Do not accept indications on the diagram.* *Must be convincing. An unsupported statement that EF = EH, or that triangle is 'isosceles', is insufficient.* *FT from B2 previously awarded. Allow RHS.* *Must be convincing.*

13. $(4x + 3)(x - 1)$ (=0) $(x =) -\frac{3}{4}$ AND $(x =) 1$	B2 B1	B1 for $(4x$ ..... $3)$ $(x$ ..... $1)$ Strict FT from their brackets provided equivalent difficulty. (Both solutions are required for this B1.) B1 if only $(x =) -\frac{3}{4}$ AND $(x =) 1$ seen.
Alternative method (using quadratic formula) $(x =) \frac{1 \pm \sqrt{[(-1)^2 - 4(4)(-3)]}}{2(4)}$ $x = \frac{1 \pm \sqrt{49}}{8}$ $x = -\frac{3}{4}$ *AND* 1 *(or equivalent)*	*M1* *A1* *A1*	*Allow one error, in sign or substitution, but not in the formula for M1 A0 A0.*
14. *(a)* $\frac{1}{8}$	B2	B1 for 8^{-1} or $\frac{1}{2^3}$ or $(\frac{1}{2})^3$ or $\frac{1}{\sqrt{64}}$ or $\sqrt{\frac{1}{64}}$ or $\frac{1}{64^{\frac{1}{2}}}$ or $(\frac{1}{64})^{\frac{1}{2}}$
14. *(b)* $x = 0{\cdot}02222.....$ $10x = 0{\cdot}2222.....$ with an attempt to subtract $(\frac{1}{3} +) \frac{2}{90}$ OR $(\frac{1}{3} +) \frac{1}{45}$ $x = \frac{32}{90} (= \frac{16}{45})$	M1 A1 B1	Or $10x$ and $100x$, or equivalent. Or an alternative method. Sight of $\frac{0{\cdot}2}{9}$ gains M1 only. FT 'their $\frac{2}{90}$' provided equivalent difficulty. Mark final answer. Do not ignore incorrect cancelling.
Alternative method 1 $x = (\frac{1}{3} +) \frac{0{\cdot}2}{9}$ $= \frac{3{\cdot}2}{9}$ $= \frac{32}{90} (= \frac{16}{45})$	*B1* *M1* *A1*	*Mark final answer*
Alternative method 2 *$x = 0{\cdot}35555.....$* *$10x = 3{\cdot}5555.....$ with an attempt to subtract $x = \frac{32}{90} (= \frac{16}{45})$	*B1* *M1* *A1*	*Or $10x$ and $100x$, or equivalent.* *'FT 'their $0.35555\ldots$' provided equivalent difficulty'.* *Sight of $\frac{3{\cdot}2}{9}$ gains B1 M1 only* *Mark final answer*
Alternative method 3 *$x = 0{\cdot}35555..... (= 0{\cdot}3 + 0{\cdot}05555)$* *$= \frac{3}{10} + \frac{0{\cdot}5}{9}$ or equivalent* *$= \frac{32}{90} (= \frac{16}{45})$*	*B1* *M1* *A1*	*Mark final answer*

	= 42·1(86… cm²) OR 42·2(cm²)	A1	
15.	An irrational number which correctly evaluates to between 9 and 10, for example: $\sqrt{90}, \pi^2, \sqrt{5}+7, \pi+6, \sqrt{107}-1, \sqrt[3]{823}, 3\pi$	B1	Number in the box takes precedence, otherwise the answer must be clearly identified. Allow B1 if the answer in the box is not irrational, but has clearly come from evaluating an irrational number e.g. 9·49(…), from evaluating $\sqrt{90}$.

16. (a)(i) 16	B1	
16. (a)(ii) $\frac{1}{100}$	B1	
16. (b) $100x = 7{\cdot}141414.....$ and $10000x = 714{\cdot}1414....$ with an attempt to subtract on both sides $\frac{707}{9900}$	M1 A1	Or x and $100x$, or equivalent. Or a complete alternative method. The multiplied decimals must be correct. An answer of $\frac{7{\cdot}07}{99}$ gains M1 only. ISW
16. (b) *Alternative method* *$0{\cdot}07 + 0{\cdot}00141414..... = \frac{7}{100} + \frac{14}{9900}$ or equivalent* $\frac{707}{9900}$	*M1* *A1*	 *ISW*
16. (c) $\frac{3\sqrt{5}}{2}$	B2	B1 for one of the following: • a numerator of $3\sqrt{5}$ • $\frac{\sqrt{45}}{\sqrt{4}}$ or $\frac{\sqrt{9}\times\sqrt{5}}{\sqrt{4}}$ i.e. for one step of simplification of surds (but not for $\sqrt{\frac{45}{4}}$) • sight of $1\cdot 5\sqrt{5}$ (from $\sqrt{2\cdot 25}\sqrt{5}$).
16. (d) An appropriate irrational number within the required range	B1	e.g. 2π, $\pi+3$, $\sqrt{40}$, $3\sqrt{5}$, $8-\sqrt{2}$. Ignore additional irrational numbers within range. B0 for multiple answers, unless all are irrational numbers within the required range.

Unit 2: Higher Tier			Mark	Comments
1.(a)	0·27	or equivalent.	B2	Mark final answer. Allow ±0·27 OR (+)0.27 'and/or' –0.27. Award B1 for sight of one of the following: • 0·27 (or equivalent) followed by subsequent working • –0·27 • 0·0729.
1.(b)		8	B1	Answer line takes precedence. Allow embedded answer in working space provided not contradicted on answer line.
1.(c)		7	B1	Answer line takes precedence. Allow embedded answer in working space provided not contradicted on answer line.

Unit 1: Higher Tier	Mark	Comments
9(a) Use of Volume = $\frac{\text{Mass}}{\text{Density}}$ (Maximum possible volume =) $\frac{155}{2.5}$ $= 62\ (\text{cm}^3)$	B1 M1 A1	FT 'their 155' provided $150 < \text{mass} \leq 160$ AND 'their 2.5' provided $2 \leq \text{density} < 3$ CAO If no marks awarded, SC1 for use of 155 AND 2.5
9(b)(i) Identification of correct right-angled triangle $(AD^2 =) 40^2 - (12-2)^2$ or $(AD^2 =) 40^2 - 10^2$ $AD^2 = 1500$ OR $(AD =) \sqrt{1500}$ AND $(AD =)\ 10\sqrt{15}$ (cm)	B1 M1 A1	May be implied by sight of 40 AND (12 – 2) or 10 in working Sight of $AD^2 = 1500$ OR $(AD =)\sqrt{1500}$ AND $10\sqrt{15}$ need to be seen
9(b)(ii) (Total arc length =) $\frac{150}{360} \times 2 \times \pi \times 2$ + $\frac{210}{360} \times 2 \times \pi \times 12$ (= 5π/3 or $1^2/_3\pi$) (= 14π or 42π/3) $= 15\frac{2}{3}\pi$ or $\frac{5640\pi}{360}$ or $\frac{47\pi}{3}$ (cm) or equivalent (Total length of chain =) $20\sqrt{15} + \frac{5640\pi}{360}$ (cm) or equivalent	M2 A2 B1	Allow values of π from 3.14 to 3.142 for M marks only Or equivalent M1 for $\frac{150}{360} \times 2 \times \pi \times 2$ OR $\frac{210}{360} \times 2 \times \pi \times 12$ or equivalents CAO. Allow 15.66π, 15.67π or 15.7π A1 for any one of the following: • AB = 600π/360 or equivalent (= 5π/3 or $1^2/_3\pi$), allowing 1.66π, 1.67π or 1.7π • CD = 5040π/360 or equivalent (=14π or 42π/3) • On FT from M1 for a correct evaluation of 'their $\frac{150}{360}\times2\times\pi\times2$ + $\frac{210}{360}\times2\times\pi\times12$' with 1 correct term, accepting similar notation possibilities as A2 ISW Accept use of $15\frac{2}{3}\pi$ Allow use of 15.66π, 15.67π or 15.7π FT 'their 5640π/360' provided at least 2 marks previously awarded If no marks awarded, and from using π × radius in their calculations, i.e. using the method $2\times10\sqrt{15} + \frac{150}{360}\times\pi\times2 + \frac{210}{360}\times\pi\times12$ SC3 for an answer of $20\sqrt{15} + \frac{5640\pi}{720}$ (cm) or equivalent, allowing use of 7.83(…)π OR SC2 for … + $\frac{5640\pi}{720}$ (cm) or equivalent, allowing use of 7.83(…)π OR SC1 for use of $2\times10\sqrt{15} + \frac{150}{360}\times\pi\times2 + \frac{210}{360}\times\pi\times12$

15. (a) (i)	$2\sqrt{5}$	B1	
15. (a) (ii)	$6\sqrt{2}$	B1	
15. (b)	q^4	B1	

5. Marking codes

- 'M' marks are awarded for any correct method applied to appropriate working, even though a numerical error may be involved. Once earned they cannot be lost.
- 'm' marks are dependant method marks. They are only given if the relevant previous 'M' mark has been earned.
- 'A' marks are given for a numerically correct stage, for a correct result or for an answer lying within a specified range. They are only given if the relevant M/m mark has been earned either explicitly or by inference from the correct answer.
- 'B' marks are independent of method and are usually awarded for an accurate result or statement.
- 'S' marks are awarded for strategy
- 'E' marks are awarded for explanation
- 'U' marks are awarded for units
- 'P' marks are awarded for plotting points
- 'C' marks are awarded for drawing curves

UNIT 1: NON-CALCULATOR, HIGHER TIER

GCSE Mathematics Unit 1: Higher Tier	Mark	Comments

Unit 1: Higher Tier

13. (a) $x = 0{\cdot}47878.....$ **and** $100x = 47{\cdot}878...$ with an attempt to subtract.	M1	Or $10x$ **and** $1000x$ with an attempt to subtract, or equivalent.
$474 / 990$ ISW.	A1	An answer of $\frac{47.4}{99}$ gains M1 only.
(b) $16 - 4\sqrt{3} - 4\sqrt{3} + 3$	B1	
$= 19 - 8\sqrt{3}$	B1	F.T. for addition of at least two irrational numbers.
$a = 19$ AND $b = -8$	B1	C.A.O.
(c) $\frac{1}{9}$	B2	B1 for 9^{-1} or $\frac{1}{3^2}$ or $\frac{1}{\sqrt[3]{729}}$
	7	

End of solutions