REVISE
.wales

1.16 — Sampling techniques in context

Mark schemes for the 1.16 question pack

Spec 1.7.4 — Unit 1

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.

6(a) (Total =) 640 75 × (number of staff in a job type) ÷ 640 (List of unrounded answers =) 14·0625, 37·5, 6·5625, 16·875 (Number in sample =) 14, 37, 7, 17	B1 M1 A1 A1	 Sight of this calculation for any one job type FT 'their total' Allow A1 for any 2 correct CAO
6(b) 'Each doctor is given a 3-digit number from 001 to 120' 'Use the table to select numbers in the range (1 to 120), ignoring repeats' (Working in rows would produce) 032, 021, 081, ~~032~~, 055, 105 (Working in columns would produce) 032, 055, 021, ~~032~~, 119, 081	B1 B1 B1	Or any 120 different numbers OR Each doctor is given a number from 1 to 120, and the random numbers are then partitioned in groups of 3 If they are not working in rows or columns, they need to explain how they are working (Note: the numbers have to be used one at a time) *Alternative:* *B1 for 'the 3-digit number is divided by 120 with the remainder used, a remainder of zero means that doctor 120 is chosen, ignore the numbers 000 and 961 – 999 and repeats, OR 960 – 999 ,and repeats'* *B1 for* *(working in rows would produce)* *032, 040, 021, 084, ~~032~~, 027 OR* *(working in columns would produce)* *032, 062, 117, 055, ~~062~~, 040*

	~~Autumn 2016~~		
9.	FALSE FALSE TRUE TRUE TRUE	B2	B1 for any 4 entries correct

7.(a) Method of systematic sampling, e.g. '(select one person from the first 12 people at random then) ask every (240÷20 =) 12th person'	E1	*Note to markers:* *There should really be mention of the first person being selected at random, however in this first assessment, with only 1 mark available, not doing so will be condoned in this mark scheme*

7. (b) Mid points 20.4, 21.3, 22.2, 23.1 20.4×2 + 21.3×3 + 22.2×10 + 23.1×5 (= 40.8 + 63.9 + 222 + 115.5 =)	B1 M1	FT 'their mid points' provided they are all within or at the bounds of the appropriate groups
(Sum of 20 hand spans is) 442(.2 cm)	A1	OR estimate of the mean (442.2÷20 =) 22(.11 cm) May be implied in further working
(Sum of all 30 hand spans is) 10×22.8 + 442(.2) (= 670(.2) cm)	M1	OR 10×22.8 + 20×22(.11) FT 'their derived 442.2' provided the correct method seen, including where **one** of 'their mid points' was outside the group
÷30	m1	Intention to divide the sum of 30 measurements by 30
22(.34 cm)	A1	Depends on M1, M1 and m1 previously awarded (Watch for an answer 22(.. cm) from $\frac{22.1(1) + 22.8}{2}$, award B1M1A1M0m0A0)
7. (c) Improvement suggestion, e.g. 'ask more people', 'take a bigger sample', 'ask every 5th person instead', 'collect more data (from different regions in Wales)', 'use all the raw data', 'do both hands', 'stratified sample on age', 'stratified sample on gender', 'by narrowing the groups in the table'	E1	Allow, e.g. 'ask people of different ages', Do not accept, e.g. 'measure more accurately'

9. 80 × (Number of pupils in Year 11) ÷ 690	M1	Sight of this calculation for any one school Accept 'their 307 + 239 + 144' for 690 for M1 only
(List of unrounded answers =) 35·5(942…), 27·7(101…), 16·6(956…)	A1	Allow A1 for any 2 correct unrounded answers, OR for final answers of 36,28,17 OR 36,27,17 OR 36,28,16 if unrounded answers not seen
(Numbers invited =) 35, 28, 17	A1	CAO

9(a) False True False False	B2	B1 for 3 correct
9(b) • Number the engineers from 01 to 50 • Consider successive 2-digit numbers • Use numbers in the range 1 to 50 • Ignore repeats (The engineers chosen would be) 29, 45, 07, 24, 39, 17, 03, ~~24~~, 49, 12 ISW	E2 B1	All 4 needed for E2 Allow an equivalent numbering system e.g. 00 to 49. E1 for any 2 or 3 correct statements. Needs to be written in this order *Alternative method:* • *Number the engineers from 01 to 50* • *Consider successive 2-digit numbers* • *Divide each number by 50 and use the remainder to choose an engineer* • *Ignore repeats. When the remainder is 0, engineer 50 is selected* *E2 for all 4 statements* *E1 for any 2 or 3 statements* *B1 for* *29, 47, 45, 04, ~~29~~, 07, 24, 33, 39, 49 ISW*

9(c) Sight of 24·5 or 12·25 AND 43·5	B1	Accept use of ·49 repeated and 12·249 repeated throughout, but not ·49 and 12·249
(S.area of half-hemisphere =) $(4 \times \pi \times 12{\cdot}25^2) \div 4$ or equivalent	B1	(= 471 to 471·6… (m^2)) FT 'their 12·25' provided it is $\geq$ 11·5 and $\leq$ 12·5
(Curved surface area of cylinder =) $(\pi \times 24{\cdot}5 \times 43{\cdot}5) \div 2$ or equivalent	B1	(= 1673 to 1674·75 (m^2)) FT 'their 24·5' or 'their 12·25' and 'their 43·5' including use of 24 or 12, 43 and their lower bounds.
(Total surface area =) $(4\times\pi\times12{\cdot}25^2)\div4 + (\pi\times24{\cdot}5\times43{\cdot}5)\div2 + (\pi\times12{\cdot}25^2)\div2$	M2	*(Area of semicircle 235·5 to 235·8…)* Upper bounds need to be correct. M1 for summing 3 terms, with 2 being correct.
= 2379·5 to 2382 (m^2)	A1	CAO
(Number of tins needed =) (2379·5 to 2382) ÷ 39·5	M1	(= 60·2… to 60·3) FT their total area provided at least M1 awarded.
= 61	A1	FT a correctly rounded up answer to their calculation.

10. 30 × (no. studying a language) ÷ 250	M1	Or 0·12 × (no. studying a language) Sight of this calculation for any one language Allow (no. studying a language) ÷ 8·3(3)
(Number in sample studying French =) 9	A1	CAO
Sight of 6·6 and/or 14·4 (or equivalent mixed numbers) leading to an answer of 9, 7, 14	A2	No incorrect work should be seen for A2 A1 for <u>one error only</u> in working leading to an answer of 9, a, 21 – a, (a needs to be an integer) OR A1 for sight of 6·6 or 14·4, OR A1 for an answer of 9, 7, 14 An unsupported 9, 7, 14 is awarded M0A0A0

	= 480 A1	C.A.O. Allow 483 2 if 30 2 used.
6.(a) 0·32	B1	
6.(b) Sample number from Anglesey on 2nd day = 3000 × 0·42 = 1260 (Rel.Fqu. for two days =) $\frac{640 + 1260}{2000 + 3000}$ = 0·38	 M1 A1 M1 A1	 Allow M1A1 for sight of 1260 e.g. 1260/3000 FT 'their 1260'.
6.(c) 'Answer to part (b)' noted AND Valid explanation e.g. 'more people sampled'	E1	Explanation must refer to the sample being the largest. Allow e.g 'from both days', 'number of people added', 'frequencies are added'. Do not accept 'relative frequencies are added'.

		Accept indication by "shading out".
11. $cx - 4x = d + 3$ or $-3 - d = 4x - cx$	B1	FT until 2nd error provided equivalent difficulty. Collecting x terms.
$x(c-4) = d + 3$ or $-3 - d = x(4 - c)$	B1	Factorising.
$x = (d+3)/(c-4)$ or $x = (-3-d)/(4-c)$ or equivalent	B1	Dividing. Mark final answer.

2(a) (Direct^2 =) $200^2 + 350^2$ Direct^2 = 162500 or (Direct =) √162500	M1 A1	
(Direct =) 403(.11... m) or 50√65 (m) or √162500 (m)	A1	FT from M1 for the correctly evaluated square root of 'their 162500' provided 'their answer' > 350 (m) May be implied in further working Mark final answer or the answer they go on to use, but then FT
(Extra distance =) 200 + 350 – 403(.1...) or 200 + 350 – 50√65 or 200 + 350 – √162500	M1	FT 'their derived 403(.11…)' > 350 and from an attempt to use Pythagoras' Theorem
146.8(87....m) or 146.9(m) or 147(m)	A1	
2(b)(i) Selects or unambiguously implies 'No' with a reason, e.g. 'the median is in group >200m to 1000m (and he lives 200m away)', 'median is more than 200m away (but Ronnie is 200m away)'	E1	Needs to compare 200(m) with median >200(m) The 200(m) can be implied from selecting 'No' Ignore additional spurious statements Allow 'No' with a reason, e.g. 'Ronnie's distance is in the first group, the median is in the second group' 'Ronnie only travels 200m which is less than the median (distance)' 'because the median distance travelled is between 200m and 1000m' 'Ronnie doesn't travel the distance of the 17.5(th) person' 'Ronnie doesn't travel the distance of the 17(th) (or 18th) person' 'the median 17.5(th)' 'the median 17(th) (or 18(th))' 'he only walks 200m when the (median) distance is higher' 'he only walks 200m which is less than the median' 'can't estimate exact number from the group 200< d ≤ 1000' 'the median **could** be 880' '9 less than half of 35' '26 students walk further than him' Do not accept 'No' with a reason e.g. 'Ronnie's distance is in the first group' 'the median **is** 250m'
2(b)(ii) Midpoints 150, 600, 2000, 5000	B1	Check the table Sight of 7750 implies correct midpoints
150×9 + 600×10 + 2000×15 + 5000×1 (= 1350 + 6000 + 30000 + 5000 = 42350 m)	M1	FT 'their midpoints' provided at least 3 are within or at the bounds of the appropriate groups
÷ 35	m1	
1210 (m)	A1	Answer space takes precedence
2(c) (140 ÷ 7 =) 20 or 140 ÷ 20 = 7 or 7 × 20 = 140	B1	May be implied by any of the following: • consistent position patterns + 20 indicated for at least 4 consecutive positions e.g. (2,) 20, 40, 60, 80, 100, 120 • sight of 22 for student 2 with no further working or entries
1 2 3 4 5 6 7 **2 22 42 62 82 102 122**	B1	CAO

8(a) $\frac{360-15}{360} \times \pi \times 60$ (+60) = 241 (mm)	M1 A2	A1 for any one of the following: • answer of 240.5(5) to 240.7 • answer of $\frac{115\pi}{2} + 60$ or $57.5\pi + 60$ • sight of (180.5(5) to 180.7) + 'their 60' correctly rounded to the nearest mm • sight of 181

8(b)		<u>An answer of 68 tins does not imply full marks should be awarded, as it can be a result of inaccuracy in workings</u>
(Greatest possible area of a part =) $\pi\times80.5\times30.25 + \frac{4\times\pi\times30.25^2}{2}$ (7646.2 to 7651.2) (5746.59 to 5750.3)	M3	M2 for • $\pi\times80.5\times30.25 + 4\times\pi\times30.25^2$ OR • $\pi\times$'their 80.5'$\times$'their 30.25' + $\frac{4\times\pi\times\text{'their } 30.25^2\text{'}}{2}$ where 80 < 'their 80.5' $\leq$ 81 and 30 < 'their 30.25' $\leq$ 30.5 and where 'their 30.25' could have different values in the two terms, but both have to be in the range shown M1 for • the sum of 2 terms with 1 correct and with bounds in the same ranges as for M2 OR • $\pi\times80\times30 + \frac{4\times\pi\times30^2}{2}$ $(= 4200\pi)$
= 13392.79 to 13401.5 or 4265.25π (mm^2)	A1	CAO. May be implied by sight of 267 857 600 to 268 028 400 (total surface area of 20 000 parts)
(Minimum number of tins needed =) 20 000 × 13399.678.. ÷ 3 950 000	M1	FT 'their 13399.678…' provided it has come from the use of 'their upper bounds' of 80mm and 60mm if bounds used Allow M1 only for 20 000 × 13399.678.. ÷ 'their 3 950 000' where 3 900 000 $\leq$ 'their 3 950 000' < 4 000 000
= 68 (tins)	A1	A0 for 67.8…tins If no marks awarded, and from a misinterpretation of the question, SC3 for an **answer of 65** tins from $20000\times(\pi\times79.5\times29.75 + \frac{4\times\pi\times29.75^2}{2}) \div 4\,050\,000$ OR SC2 for an **answer of 64(.1...)** tins from $20000\times(\pi\times79.5\times.29.75 + \frac{4\times\pi\times29.75^2}{2}) \div 4\,050\,000$ OR SC1 for a correct evaluation (rounded, truncated or unrounded) of the calculation $20000\times(\pi\times79.5\times29.75 + \frac{4\times\pi\times29.75^2}{2}) \div 4\,050\,000$ where 79 $\leq$ 'their 79.5' < 80 and 29.5 $\leq$ 'their 29.75' < 30 and 4 000 000 < 'their 4 050 000' $\leq$ 4 100 000 OR If no marks awarded, SC1 for use of 80.5 and 30.25

8(c) Statements required: • Number the parts from (0000)1 to 20000 • Consider successive 5-digit numbers • Use numbers in the range e.g. Use numbers from (0000)1 to 20000 or Do not use 0000 or numbers > 20000 • Ignore repeats (Working in rows would give parts) (0)1325, 18266, ~~(0)1325~~, (0)5929, 10429, (0)2891 OR (Working in columns would give parts) (0)5929, (0)1325, 10429, ~~(0)1325~~, (0)2891, 18266	E2 B1	All 4 needed for E2 E1 for any 2 or 3 correct statements Allow an equivalent numbering system e.g. (0000)0 to 19999 Their numbering system can be implied by the range of numbers they state they will choose from Allow the 2nd statement to be implied by their numbering of the parts (from 00001) AND their use of 5-digit numbers in their answer OR 5-digit numbers used in their answer and e.g. 01325 seen Do not allow 'Use numbers less than 20000' if they have numbered the parts from 00001 to 20000 ISW. Part numbers can be given in any order
8(c) Alternative method: *Statements required:* • *Number the parts from (0000)1 to 20000* • *Consider successive 5-digit numbers* • *Divide each number by 20000 and use the remainder to choose a part* • *If the 5-digit number is 00000, then part 20000 is chosen, and ignore repeats.* *(Working in rows would give parts)* *(0)6923, (0)1325, 18552, ~~(0)6923~~, (0)8925, 12712* *OR* *(Working in columns would give parts)* *(0)6923, (0)8925, 15775, (0)5929, ~~(0)8925~~, (0)1325*	*E2* *B1*	*All 4 needed for E2* *E1 for any 2 or 3 correct statements* *Allow an equivalent numbering system e.g. (0000)0 to 19999* *Their numbering system can be implied by the range of numbers they state they will choose from* *Allow the 2nd statement to be implied by their numbering of the parts (from 00001) AND their use of 5-digit numbers in their answer OR* *5-digit numbers used in their answer and e.g. 06923 seen* *If (0000)0 to 19999 used, when the remainder is 0, part (0000)0 is selected* *ISW*

7(a) (AER =) $(1 + 0.0026)^{12} - 1$ or equivalent = 3.16(500…) or 3.17 or 3.2 (%)	M1 A1	e.g. $\left(1 + \frac{12 \times 0.0026}{12}\right)^{12} - 1$ or $\left(1 + \frac{0.0312}{12}\right)^{12} - 1$
7(b) $AER = \left(1 + \frac{2.48 \div 100}{4}\right)^{4} - 1 =$ (= 0.025(03…) or 2.5(03…) (%)) (Amount in account after 10 years =) 3000 × (1 + 0.025(03…))^{10} = (£)3841.43(752…) or (£)3841.44 (Percentage increase =) $\frac{3841.43(752…) - 3000}{3000}$ (×100) or $\frac{3841.43(752…)}{3000} - 1$ (×100) = 28(.04) to 28.05 (%)	M1 M1 A1 M1 A1	The −1 may be implied in further working FT 'their derived 0.025(03…)' provided it comes from the AER formula with $1 < n \leq 12$ CAO. Must come from M1M1 Accept (£)3840.25 from the use of the multiplier 1.025 provided M1M1 previously awarded FT 'their 3841.43(752…)' provided at least one M1 previously awarded An amount in the account after 10 years of (£)3840.25 leads to 28(.008) (%) If no marks awarded, SC1 for an answer of 27.7(58…) or 27.8% from use of $\frac{3000 \times (1.0248)^{10} - 3000}{3000} \times 100$ or $((1.0248)^{10} - 1) \times 100$ or equivalent
7(b) Alternative method 1: *(Quarterly rate =) $\frac{2.48}{4}$ (%) or $\frac{2.48 \div 100}{4}$* *(= 0.62(%) or 0.0062)* *(Amount in account after 10 years =)* *3000 × $\left(1 + \frac{2.48 \div 100}{4}\right)^{10 \times 4}$ or 3000 × 1.0062^{40}* *= (£)3841.43(752…) or (£)3841.44* *(Percentage increase =)* *$\frac{3841.43(752…) - 3000}{3000}$ (×100)* *or $\frac{3841.43(752…)}{3000} - 1$ (×100)* *= 28(.04) to 28.05 (%)*	*M1* *M1* *A1* *M1* *A1*	*May be implied in further working* *FT 'their 0.0062' provided it comes from 2.48(÷100) /n provided $1 < n \leq 12$* *Allow 3000 × $\left(1 + \frac{2.48 \div 100}{n}\right)^{10 \times n}$ provided their value of n has been used consistently and $1 < n \leq 12$* *CAO. Must come from M1M1* *FT 'their 3841.43(752…)' provided at least one M1 previously awarded*

7(b) Alternative method 2: $AER = \left(1 + \frac{2.48 \div 100}{4}\right)^4 - 1 =$ (= 0.025(03…) or 2.5(03…) (%))	M1	The −1 may be implied in further working
(Percentage increase =) $(1 + 0.025(03…))^{10} - 1$	M3	FT 'their 0.025(03…)' provided it comes from $\left(1 + \frac{2.48 \div 100}{n}\right)^n - 1$ where n has been used consistently and $1 < n \leq 12$ M2 for $(1 + 0.025(03…))^{10}$
= 28(.04) to 28.05 (%)	A1	CAO. Must come from M1M3
7(b) Alternative method 3: (Quarterly rate =) $\frac{2.48}{4}$ (%) or $\frac{2.48 \div 100}{4}$ (= 0.62(%) or 0.0062)	M1	
(Percentage increase =) $(1 + 0.0062)^{10 \times 4} - 1$	M3	FT 'their 0.0062' provided it comes from 2.48(÷100) /n provided $1 < n \leq 12$ Allow $\left(1 + \frac{2.48 \div 100}{n}\right)^{10 \times n} - 1$ provided their value of n has been used consistently and $1 < n \leq 12$ M2 for $(1 + 0.0062)^{10 \times 4}$
= 28(.04) to 28.05 (%)	A1	CAO

9(a)(i) Sight of $\frac{150}{360}\times 2\times\pi\times 3$ OR $\frac{300}{360}\times 2\times\pi\times 3$ $(= 2.5\pi)$ $(= 5\pi)$ (Length of wire =) $(2\times)\ \frac{150}{360}\times 2\times\pi\times 3 + (2\times)\ 24 + 38$ or equivalent $= 5\pi + 86$ (cm)	B1 M1 A2	Or equivalents CAO Mark final answer A1 for sight of any one of the following: • $\frac{1800}{360}\pi + 86$ or equivalent • $5\pi + \ldots$. • $2.5\pi + \ldots$. or $5\pi/2 + \ldots$. provided an attempt has been made to add the 3 straight pieces
9(a)(ii) e.g. $10x = 1.333\ldots$, $100x = 13.333\ldots$ AND an attempt to subtract both sides $= \frac{12}{90}$ or $\frac{132}{990}$ or $\frac{1332}{9990}$ or equivalent $= \frac{2}{15}$	M1 A1 A1	 Allow A1 for e.g. 1.2/9 FT from M1A0 provided of equivalent difficulty
9(a)(ii) Alternative method: $\frac{1}{10} + \frac{3}{90}$ *or equivalent* $= \frac{12}{90}$ *or equivalent* $= \frac{2}{15}$	*M1* *A1* *A1*	 *FT from M1A0 provided of equivalent difficulty*
9(b) Statements required: • Number the hangers from (0)1 to 80 • Consider successive 2-digit numbers • Do not use numbers outside the range e.g. Do not use 00 and 81 – 99, OR Use the numbers (0)1 to 80 • Ignore repeats (Clothes hangers chosen =) 29, (0)7, (0)1, 30, 55, 79, 26, ~~39~~, 12	E2 B1	All 4 needed for E2 E1 for any 2 or 3 correct statements Allow an equivalent numbering system e.g. (0)0 to 79 Their numbering system can be implied by the range of numbers they state they will choose from Allow the 2nd statement to be implied by their numbering of the hangers (from 01) AND their use of 2-digit numbers in their answer OR 2-digit numbers used in their answer with 07 and 01 seen Do not allow 'Use numbers less than 81' if they have numbered the hangers from 01 to 80, without stating that 00 will not be used ISW Answer space takes precedence
9(c) (Scale factor =) $\sqrt{1.44}$ or 1.2 (Height of larger hanger =) $\sqrt{1.44}\times 9$ or 1.2×9 $= 10.8$ (cm)	B1 M1 A1	 FT 'their $\sqrt{1.44}$' CAO