REVISE
.wales

3.21 — Estimating mean & median from grouped data

Mark schemes for the 3.21 question pack

Spec 4.2.9, 4.2.11, 4.2.12, 4.2.13, 4.2.14 — Unit 3

SOLUTIONS · 2025 SPECIFICATION

Mark schemes for the 9 questions in the corresponding revise.wales question pack (26 marks total). Sources: legacy WJEC GCSE papers, WJEC SAM, and custom-authored mark schemes. Pack layout © revise.wales.

Autumn 2016		
4(a)(i) 52 hours	B1	
4(a)(ii) 10 girls	B1	
4(a)(iii) FALSE TRUE TRUE FALSE	B2	B1 for any 3 correct answers If no marks, award SC1 for an answer TRUE, TRUE, TRUE, TRUE (as it is a repeat misunderstanding/error)
4(b) Statement 1: Complete method to calculate the interquartile range Girls' IQR (59 or 58 - 33 or 32 =) 25 to 27 AND Boys' IQR (46 or 45 – 19 or 18 =) 26 to 28 AND Trefor correct if IQR boys > IQR girls or Trefor incorrect if IQR boys ≤ IQR girls Statement 2: Conclusion, e.g. 'Incorrect, as the median for the boys is 40 hours which is lower than girls median (52 hours)'	M1 A2 E1	Based on sight of method for either boys or girls, or either IQR correct provided not clearly from incorrect working A1 for either IQR correct Ignore incorrect time notation, e.g. '26.30 hours' for 26.5 hours Conclusion must include statement that 'boys' median is 40 hours' FT for a reason based on 'their 52 hours', (a)(i) and 40 hours. Accept responses based on comparisons of the modal groups 50 to 60 hours (with 52) girls and 40 to 50 hours (with 60) boys Accept comparisons of the estimated means, boys 33·8(571…hours) and girls 45·2(857…hours)

5(a) 45 (seconds)	B1	
5(b) 30	B1	
5(c) 0.9(0) × 70 = 63 (passengers) (In 60 seconds) 65 (passengers left) OR 63 passengers within (58 or) 59 seconds OR 63 (passengers) in less than 60 seconds Conclusion that the target was met	M1 A1 B1 E1	 Ignore incorrect units Check the diagram for indication, provided values are written FT 'their 63' provided M1 previously awarded Depends on M1, B1 previously awarded *Alternative:* *By 1 minute, 65 passengers left B1* *(100 ×) 65/70 M1* *0.92(8…) or 0.93 or 92(.8%) or 93(%) A1* *Conclusion that target met E1* *(Depends on M1, B1)* *Alternative:* *For candidates **clearly** considering the number of passengers left on the plane, must be evidence of this before awarding marks* *(0.1× 70=)* *7 (passengers left on the plane) B1* *(After 1 minute) 70 – 65 M1* *5 (passengers) A1* *Conclusion that target met E1* *(Depends on M1, B1)*

	OR 166·7(..) cm or 167cm		
6.(a)	0·58 on 'Male' branch. 0·65 and 0·35 correctly shown on both pairs of branches.	B1 B2	 B1 if correctly shown on one pair only. SC1 if 0·65 and 0·35 consistently reversed on all branches.
6.(b)	0·42 × 0·35 = 0·147 or equivalent ISW	M1 A1	FT 'their 0·35' (on 'uppermost train branch') provided less than 1

2.(a) 	Throws	20	40	60	80	100
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Heads	11	18	24	30	**37**
Rel. Fq.	0·55	0·45	**0·4**	0·375	0·37		B1 B1	
2.(b) (Mid-points are) 4·5, 14·5 and 24·5. (Estimated total =) $3 \times 4{\cdot}5 + 5 \times 14{\cdot}5 + 2 \times 24{\cdot}5$ (= 135) $\div 10$ (Estimated mean =) = 13·5 (Difference = 15·2 – 13·5 =) 1·7	B1 M1 m1 A1 B1	F.T. 'their mid-points' if within group. C.A.O. F.T. for difference between 15·2 and 'their derived estimated mean (≠15·2)'. Allow −1·7.
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 • write a conclusion that draws together their results and explains what their answer means 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.

4.(a) an expression	B1	
4.(b) an equation	B1	
5. (Mid-points) 2·5, (7·5), 12·5 and 17·5. $8 \times 2{\cdot}5 + (0 \times 7{\cdot}5) + 7 \times 12{\cdot}5 + 5 \times 17{\cdot}5$ $(20 + 0 + 87{\cdot}5 + 87{\cdot}5 = 195)$ $\div 20$ $= 9.75$	B1 M1 m1 A1	Allow for sight of mid-points. F.T. 'their mid-points' including bounds, provided they fall within the classes (including lower and upper bounds and used consistently). C.A.O.
6. $(x =) \frac{360}{15}$ or $180 - \frac{(15-2) \times 180}{15}$ or equivalent $= 24(°)$ (BR =) $8 \times \cos 24$ or $8 \times \sin (90 - 24)$ $= 7{\cdot}3(0\ldots)(\text{cm})$ or $7{\cdot}31(\text{cm})$	M1 A1 M2 A1	May be seen in parts. FT 'their stated value for x' ($x < 90°$) M1 for $\frac{BR}{8} = \cos 24$ or $\frac{BR}{8} = \sin (90 - 24)$ Accept equivalent of using sin rule (as sin 90 = 1). *Alternative method to find BR* *A correct and complete method (using two trigonometric relationships and possibly Pythagoras's theorem)* *M2* *BR = 7·3(0…)(cm) or 7·31(cm)* *A1*
7. $2{\cdot}656 \times 10^6$	B2	B1 for a correct value but not in standard form. Mark final answer. B1 for sight of 2 656 000. SC1 for $2{\cdot}66 \times 10^6$ or $2{\cdot}7 \times 10^6$ or $2{\cdot}6 \times 10^6$ or $2{\cdot}65 \times 10^6$
8. Sight of 24·5 AND 15·5 OR Sight of 23·5 AND 14·5 $2(24{\cdot}5 + 15{\cdot}5) - 2(23{\cdot}5 + 14{\cdot}5)$ or equivalent $= 4(\text{cm})$	B1 M1 A1	Sight of (Greatest =) 80 OR (Least =) 76 implies B1 FT only for upper bounds of 24·4 AND 15·4 or 24·49 AND 15·49 (lower bounds must be 23·5 AND 14·5 else M0) CAO If M0, award B1 and an SC1 for sight of (Greatest =) 80 AND (Least =) 76
Alternative method. *Difference between least and greatest length for each side = 1(cm)* *4 × 1* *= 4(cm)*	*B1* *M1* *A1*	 *FT only for differences of 0·9 or 0·99* *CAO*
9. Method to eliminate variable e.g. equal coefficients with appropriate addition or subtraction. First variable found, $x = 4$ or $y = -1$. Substitute to find the 2nd variable. Second variable found	 M1 A1 m1 A1	*No marks for trial and improvement.* Allow 1 error in one term, not the term with equal coefficients. C.A.O. F.T. their '1st variable'. Award no marks for unsupported correct answers.

2(a)(i) Unambiguously indicates or states 'Yes' with a reason, e.g. 'both 25 kg to 35 kg', 'the highest frequencies at the same mass'	E1	*Ignore any additional spurious or contradictory statements provided 'Yes' selected* Allow 'Yes' with a reason, e.g. 'both at 30 kg', 'both at the same mass', 'both have the same mass', 'tallest (highest frequency) is 30 kg for both polygons' Do not accept 'Yes' with a reason, e.g. 'don't know', 'both in the same place', 'the groups have the same width', 'the graph tells us this'
2(a)(ii) Unambiguously indicates or states 'Can't tell' with a reason, e.g. 'there were 30 dogs with a masses between 15 kg and 25 kg', 'no raw data is given', 'the actual mass of each dog is not given', 'the data is grouped'	E1	*Ignore any additional spurious or contradictory statements provided 'Can't tell' selected* Allow 'Can't tell' with a reason, e.g. 'doesn't show this', 'you can't tell the exact number of dogs' 'doesn't give the amount of dogs' Do not accept 'Can't tell' with a reason, e.g. 'don't know', 'it is an estimate', 'it isn't accurate', 'because they can be anywhere from 10 kg to 20 kg'
2(a)(iii) Unambiguously indicates or states 'Correct' with a reason, e.g. 'Pencwm polygon shows a greater drop for greater masses', 'fewer dogs but more large dogs in Glanafon', 'more dogs in Pencwm, but fewer large dogs', 'about the same number of large dogs, with fewer dogs in Glanafon', 'about the same number of large dogs, with more dogs in Pencwm',	E1	*Ignore any additional spurious or contradictory statements provided 'Correct' selected* **Do not** allow a reason based on calculations of proportions **alone**, e.g. Pencwm 27.5%, Glanafon 41.6% Allow 'Correct' with a reason, e.g. 'Pencwm (polygon) shows a steeper drop from 30 kg', 'line for Pencwm is steeper (drop)' 'Glanafon (polygon) has a less steep drop for larger dogs', 'the greater masses are more frequent (in Glanafon)', '2 of the 3 points for Glanafon are above Pencwm', 'Pencwm line drops below Glanafon after 40 (kg)', Do not accept 'Correct' with a reason, e.g. '36 dogs in Pencwm and 37 dogs in Glanafon' alone without considering proportion, 'the greatest is 45 kg', 'higher frequency in Glanafon', 'Pencwm is bigger but doesn't have higher proportion' 'as seen by the skew in (the) Glanafon (polygon)', 'seen by the shape (of the polygon) for Glanafon'

2(b) (Total number of dogs 20 + 30 + 45 + 25 + 7 + 4 =) 131	B1	May be implied by the sight of ((20 + 30 + 45 + 25 + 7 + 4) ÷ 6 =) 21.8(33….)
10×20 + 20×30 + 30×45 + 40×25 + 50×7 + 60×4 (= 200 + 600 + 1350 + 1000 + 350 + 240) (= 3740)	M1	Ignore any additional products seen FT 'their midpoints' provided at least 5 are within or at the bounds of the relevant groups e.g. use of • lower bounds of each group gives 3085 • upper bounds of each group gives 4395
÷ 131	m1	FT an error in summing 20, 30, 45, 25, 7 and 4
(28.5(496.... kg) so) 3.95 (kg) (less)	A2	CAO ISW further rounding or truncation Allow 4 (kg) from correct working Accept (29 (kg) and) 3.5 (kg) from correct working Award A1 for any of the following as the final answer • 28.5(496.... kg) • 29 (kg) (from correct working) OR Award A1 on FT from M1 m1 previously awarded for a correct evaluation of 'their estimate mean' e.g. use of lower bounds gives (3085/131 =) 23.54…
2(b) Alternative MS if Glanafon's last 2 points used for possible award of B1 M1 m1 only *(Sight of 20 + 30 + 45 + 25 + 10 +7 =) 137*	*B1*	*May be implied by the sight of* *((20 + 30 + 45 + 25 + 10 + 7) ÷ 6 =) 22.8(33….)*
10×20 + 20×30 + 30×45 + 40×25 + 50×10 + 60×7 *(= 200 + 600 + 1350 + 1000 + 500 + 420)* *(= 4070)*	*M1*	*Ignore any additional products seen* *FT 'their midpoints' provided at least 5 are within or at the bounds of the relevant groups* *e.g. use of* • *lower bounds of each group gives 3385* • *upper bounds of each group gives 4755*
÷ 137	*m1*	*FT an error in summing 20, 30, 45, 25, 10 and 7*

9. Midpoints 25, 35, 45, (55), 65, 75	B1	May be implied in later working (i.e the correct products).
Missing 10 for $50 \leq t < 60$	B1	
$25\times2 + 35\times8 + 45\times4 + 55\times\mathbf{10} + 65\times3 + 75\times5$ $(= 50 + 280 + 180 + \mathbf{550} + 195 + 375 = 1630)$	M1	FT 'their 10' provided $\neq 0$ or 1. Allow with consistent incorrect midpoints provided at least 5 within the correct interval including 'bounds' Allow use of a instead of 10 (sight of $1080 + 55a$).
$\div 32$	m1	FT 22 + 'their a' ($a \neq 0$). Allow use of a instead of 10.
50·9(375) or 51 or equivalent ISW	A1	CAO. Must be derived from correct working. If no marks or first B1 only, award SC1 for one of the following: • $(1080 \div 22 =)$ 49(·09…) from use of $a = 0$ • $(1080 \div 32 =)$ 33·7(5) or 34 from use of $a = 0$ • $(1135 \div 23 =)$ 49(·3…) from use of $a = 1$ • $(1135 \div 32 =)$ 35(·46875) from use of $a = 1$. Award B1 B0 M1 m1 A0 for $\frac{1080 + 55a}{22 + a}$ or $\frac{1080 + 55a}{32}$ or equivalent expression involving a.

Unit 1: Higher Tier	Mark	Comments
4(a)(i) 200 – 80 or 90 + 30 120 (customers)	M1 A1	
4(a)(ii) 32 seconds	B1	
4(a)(iii) $\frac{200-170}{200}$ or $\frac{30}{200}$ or $\frac{15}{100}$ $\frac{3}{20}$	M1 A1	Award M1 for 0.15 or 15% Only ignore further working if written as 0.15 or 15% If no marks, award SC1 for an answer of $\frac{17}{20}$ (from 40 seconds or less)
4(b)(i) 36	B1	
4(b)(ii) 46 – 20 26	M1 A1	Allow 20 – 46
4(c) 'No' unambiguously stated or implied AND a reason, e.g. 'upper quartile is higher this year' '75% reading higher this year' 'interval was 37 (or 38) to 50 seconds last year, this year it is 46 to 50 seconds'	E1	Do not ignore incorrect values for the upper quartiles given, E0 if 'upper quartile' or '75%' stated with incorrect upper quartile readings Allow 'No' with a reason, e.g. '(last year) 38, (this year) 46' '(last year) 37.(…), (this year) 46' Do not accept, e.g. 'range greater this year' 'lower quartile is lower this year' 'median higher this year' 'customers still waiting at 50 seconds'

2. Question 1 At least 3 groups without gaps or overlaps that cover a minimum inclusive range of 1 (day) to 20 (days)	B1	Listings must all be groups, with the exception of the initial inclusion of '0', provided at least 3 further groups are given Allow, e.g. 'Less than 8 (days), 8 to 15 (days), more than 15 (days)' '0, 1 to 10 days, 11 to 15 days, 16+ days' Do not accept, e.g. '1 < days < 7, 8 < days < 14, 15 < days < 21, …' (misuse of inequalities) '0, 1 to 10 days, 11 to 21 days' (0 is not a group, so only 2 groups)
2. Question 2 At least 3 appropriate criteria in any order, e.g. 'Great, reasonable, not good', 'Scale of 0 to 10, with 10 being very happy', 'Very unhappy, happy, very happy', 'Yes, no, sometimes'	B1	Accept use of smiley, blank and sad faces Allow, e.g. 'Yes, no, not sure', 'Yes, no, no answer' Do not accept, e.g. 'Scale of 0 to 10' without stating which end of the scale is unhappy or happy, 'Yes, no, own answer', as 'own answer' is not a group

10(a)(i) (Total length =) $\sqrt{500} + \sqrt{80}$ $= 10\sqrt{5} + 4\sqrt{5}$ OR $5\sqrt{20} + 2\sqrt{20}$ $= 14\sqrt{5}$ (m)	M1 m1 A1	If no marks awarded, SC1 for sight of $10\sqrt{5}$ or $5\sqrt{20}$ AND $4\sqrt{5}$ or $2\sqrt{20}$

End of solutions