REVISE
.wales

3.20 — Mean, median, mode, range — ungrouped

Mark schemes for the 3.20 question pack

Spec 4.2.8, 4.2.10 — Unit 3

SOLUTIONS · 2025 SPECIFICATION

Mark schemes for the 20 questions in the corresponding revise.wales question pack (72 marks total). Sources: legacy WJEC GCSE papers, WJEC SAM, and custom-authored mark schemes. Pack layout © revise.wales.

8(a) 2	B1	
8(b) 0	B1	
8(c) Selects to use 1st histogram and work with area, sight of any single area calculated is sufficient 1×2 + 0.5×6 + 0.5×8 + 0.5×10 + 0.5×4 + 1×1 (= 2 + 3 + 4 + 5 + 2 + 1) 17 (anglers last year) 51 (anglers this year)	S1 M1 A1 B1	*Note: check histogram for working* Allow one error CAO FT 3×'their 17' provided S1 previously awarded and their final answer is an integer
8(d) Number of fish caught last year 8×0.25 + 32×0.25 + 40×0.25 + 24×0.25 + 32×0.25 + 16×0.25 + 4×0.5 40 (fish caught last year) Median is the 20th or 20.5th fish Last year median fish weighed 0.75 (kg) Difference is 0.15 (kg)	M1 A1 B1 B1 B1	*Note: check histogram for working* Allow one error (= 2 + 8 + 10 + 6 + 8 + 4 + 2) CAO FT 'half their 40' or 'half their 40' + 0.5 FT 'half their 40' or 'half their 40' + 0.5, provided their answer is in the range 0.5 to 1.25 inclusive FT 0.9 – 'their 0.75' correctly evaluated, or reversed if their 0.75 > 0.9 provided M1 previously awarded
8(e)(i) (Percentage last year within 1 hour) 2/17 (×100 %) or equivalent Appropriate statement e.g. 2/17 > 1/10, 2/17 > 2/20, 11(.76… %) or 12% > 10%, or equivalent	M1 A2	FT from (c), 'their 2'/'their 17', including if not working with area OR as two A1s: A1 for 11(.76… %) or 12% A1 for an appropriate conclusion from 'their 11(.76… %) or 12%' e.g. 'this is greater than 10%', 'not quite as good as last year', 'quite similar to last year', 'proportionally about the same' OR A1 only for 2/17 > 10% *Alternative* *10% of 17 = 1.7* *M1* *1.7 < 2* *A2*
8(e)(ii) Reflection, e.g. 'no, as the number taking part is nowhere near the same'. 'no, as the competition has grown', 'no, as the conditions might not have been the same', 'no, as the weather conditions could have been very different'	E1	'No' may be stated or implied Accept 'Yes' provided their reason has reference to comparing like with like e.g. proportions, percentages

6(a) April	B1	
6(b) January	B1	
6(c)(i) January and February	B1	In either order
6(c)(ii) 43	B1	
6(d) FALSE TRUE FALSE FALSE	B2	B1 for any 3 correct responses

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(a)(i) 4×1 + 4×4 + 4×3 + 8×0·5 = 36	M1 A1	Allow M1 for any 3 correct products CAO
9(a)(ii)		FT for all marks from their answer to (a)(i) provided their work in (a)(ii) is of equivalent difficulty. If FT results in the median being at one the group boundaries, then award a possible S1 only if correctly found
Median is in the group 54 to 58	S1	May be implied in their answer
4x = 14 OR 4x = 2	M1	OR $\frac{14}{16} \times 4$ OR $\frac{2}{16} \times 4$
x = 3·5 or equivalent OR x = 0·5 or equivalent	A1	
(Estimated median =) 57·5 (sec) or equivalent	A1	
		Alternative method: *S1 for median group of 54 to 58* *M1 for* $\frac{14{\cdot}5}{16} \times 4$ *OR* $\frac{1{\cdot}5}{16} \times 4$ *(finding the* $18{\cdot}5^{th}$ *time)* *A1 for 3·6(25) OR 0·3(75)* *A1 for 57·6(25) (sec)*
9(b) Freq densities of 1, 2·5, 8, 9, 1·5	B2	B1 for any 2 correct
Suitable uniform vertical scale	B1	Up to 'their maximum frequency density' provided correct divisions attempted i.e. frequency ÷ class width
Correct bars drawn	B1	FT provided at least B1B0 B1 awarded
9(c) Under-30s quicker AND reason e.g. 'Higher proportion for under 58 seconds compared to over 58 seconds', 'Smaller proportion for 58 to 70 seconds compared to 50 to 58' 'Higher bars for the quicker times', 'Median for 30-and-overs was 60 seconds', 'Under-30s have a quicker modal group'	E1	If values or groups are given in their reason, they need to be correct. Allow reasons e.g. 'More under 58 seconds' 'The peak for the under-30s is lower than the 30-and-overs' Do not accept reasons e.g. 'Higher frequency for 54 to 58 seconds' 'Under-30s have a lower average time' 'The frequency densities reached higher for the under 30s' 'Their histogram is more to the left'

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 $63 \div 9$

3(a)(i) Median in the inclusive range 16.8 to 17 (minutes) Interquartile range 19 to 19.3 - 14 to 14.3 Answer in the range 4.7 to 5.3 (minutes)	B1 M1 A1	
3(a)(ii) Reason, e.g. 'the points on the diagram have been joined with straight lines', 'the data has been grouped, so actual times have been lost', 'the raw data is more detailed (than graph)', 'not exact using a cumulative frequency diagram', 'it is just an estimate using the diagram'	E1	Allow, e.g. 'the raw data is more detailed than Meirion's data' (although both Meiron's data!), 'the points could be joined by a curve' Do not accept, e.g. 'seconds can not be presented'
3(b) 34 – 12 22 (of his customers)	M1 A1	
3(c) Sight of either of the following: • (80% of 120 =) 96 (customers) **OR** (20 minutes is) 102 (customers) • (20% not cleaned in 20 minutes is) 24 (customers) **OR** 18 (customers more than 20 minutes) Sight of any of the following: • (80% of 120 =) 96 (customers) **AND** (20 minutes is) 102 (customers) • (20% not cleaned in 20 minutes is) 24 (customers) **AND** 18 (customers more than 20 minutes) • (96 customers is)19.3 to 19.8 (minutes) • (102 customers is 102/120 × 100 =) 85% • (102 customers is 102/120 × 100 =) 85% • (18 customers is 18/120 × 100 =) 15% Conclusion 'yes'	M1 M1 A1	Accept readings on the graph Accept readings on the graph CAO from correct working only and M2 awarded Accept 'no as 85% (**not** 80%) in less than 20 minutes'

5(a)(i) Orange pippin and 57 (mm)	B1	Accept 'orange' or 'pippin' as indication of the correct tree
5(a)(ii) 41 (mm)	B1	
5(a)(iii) Pink Lady and 33 (mm)	B2	B1 for any of the following: • Gala with 30 (mm) • Orange pippin 29 (mm) • Pink Lady with 79 – 46 • No apple indicated but IQR answer 33 (mm)
5(b) Gala selected with a reason e.g. '(highest) upper quartile', '25% over 80 mm' **OR** Pink Lady selected with a reason e.g. '(highest) median', 'half are over 63 mm'	 B1	Ignore units throughout Do not accept reasons based on range or IQR Do not ignore any additional statements of range, IQR, lower quartile Ignore an incorrect median stated for Pink Lady, e.g. 66mm, provided it is >61 and <67(mm)

6(a) 20 to 25 minutes	B1	
6(b) 'No' indicated or unambiguously implied, with a reason, e.g. 'only shows data for groups', 'it was in the group 40 to 45 minutes', 'doesn't show how many runners finished in 45 minutes', 'the last 2 runners took between 40 and 45 minutes'	E1	Do not accept any reason implying 'Yes' Allow 'No' with, e.g. 'the graph shows the cumulative frequency not the actual times', 'doesn't show the actual times' Do not accept, e.g. 'it goes to the nearest 5 minutes', 'it shows frequency not times of results', 'it doesn't show how many runners finished between 40 and 45 minutes'. 'because it can be an average'
6(c) **70%** (within 30 minutes)' (80% within) **35** (minutes)'	B1 B1	
6(d) Difference 26 - 24.5 to 24.8 Answer in the range • 1.2 to 1.5 (minutes), or • 1 minute 12 seconds to 1 minute 30 seconds	M1 A1	Do not accept an answer in the correct range from incorrect working Mark final answer If units are given they must be correct

1.(a)	$\times 0{\cdot}88^3$	B1	
1.(b)	$\frac{45{\cdot}9 - 42{\cdot}5}{42{\cdot}5}$ (= 0·08) OR $\frac{45{\cdot}9}{42{\cdot}5}$ (= 1·08)	M1	May be seen in parts.
	0·08 × 100 OR (1·08 × 100) – 100	m1	
	8(%)	A1	C.A.O. If no marks awarded allow SC1 for −8(%).

5.	Median value > 6	B1	Possible to allow if enough boxes completed to ensure median > 6.
	Total of five numbers < 40	B1	All boxes must be completed.
	Range < 12	B1	All boxes must be completed.
			Penalise −1 once from any marks gained if a negative number or a number ≥ 20 or non-whole numbers used.

9(a) Explanation e.g. 'Because cumulative frequency is not accurate. It's an estimate', or 'Because the data is grouped. The median could be anywhere between 60 and 80', or 'The marks between 60 and 80 may not be evenly distributed', or 'The 24 marks between 60 and 80 may not be split evenly either side of 70', or 'The 13th mark between 60 and 80 may not be 70' 'The 30.5th mark is greater than 70'	E1	Do not accept e.g. 'This is only an estimate', or 'Because the data is grouped'
9(b) 12	B1	

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.(a) $A \cap B$	B1	
3.(b) B'	B1	
4 Four numbers with a range of 10. Four numbers with a total of 36. Four numbers with a median of 8. Possible answers for all three marks are 5,5,11,15 or 5,6,10,15 or 5,7,9,15 or 5,8,8,15	 B1 B1 B1	B0 if all four original numbers used.
5. (number of females in Porth =) $\frac{90}{360} \times 128$ OR (number of males in Porth =) $\frac{120}{360} \times 72$ (number of females in Porth =) 32 (number of males in Porth =) 24 (Probability from Porth =) $\frac{56}{200}$ or equivalent ISW	M1 A1 A1 A1	Or equivalent *Answers may be seen on the diagram.* An answer of 32 implies M1. An answer of 24 implies M1. FT ('their 32' + 'their 24') /200 provided M1 gained. Penalise incorrect notation −1. e.g. '56 in 200'.
6. sin (QPR) = $\frac{9{\cdot}6}{16{\cdot}7}$ (QPR =) $\sin^{-1}$ (9.6/16·7) or $\sin^{-1}$ (0·57..) = 35·1(°) or 35·09(°) or 35·089(…°)	M1 m1 A1	 Implies M1. Allow any answer that rounds to 35(°)
6.Alternative method. ***Correct** use of 'two-step' method.* *(x)* = 35·1(°) or 35·09(°) or 35·089(…°)	 M2 A1	 *A partial trigonometric method is M0.* Allow any answer that rounds to 35(°)
7. 7x + 2y = (£)41.5(0) AND 4x + 3y = (£)29.75 Method to eliminate variable (Attempt at equal coefficients and subtraction) First variable found x =(£) 5 or y = (£)3.25. Substitute to find the 2nd variable. Second variable found.	B1 M1 A1 m1 A1	Allow use of other letters to denote variables. B0 for using 4150 and 2975. FT 'their equations' if of equal difficulty. Allow 1 error in one term, not one with equal coefficients. C.A.O. (for their equations if FT.) F.T. their '1st variable'. FT answers should be given to the nearest penny (rounded or truncated). If M0, award SC2 (with possible B1) for both answers of (£) 5 AND (£)3.25.

4. (One part =) (£)210 ÷ 3 = (£)70 (Total amount =) 14 × (£)70 OR (£)210 + 4 ×(£)70 + 7 × (£)70 = (£)980	M1 A1 m1 A1	FT 'their (£)70' only if M1 gained. Allow m1 for sight of 210 AND 280 AND 490 together as the three shares. *For 210 ÷ 3 × 14 M3* *= 980 A1*
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
5. 4 5 11 12 OR 4 6 10 12 OR 4 7 9 12	B3	May be written in any order. B1 for Range = 8. B1 for Median = 8. B1 for Total = 32. Penalise –1 **once only** for repeated values, negatives or fractional answers e.g. 4, 8, 8, 12 earns B1 B1 B1 –1 (2 marks), 8, 8, 8, 8 earns B0 B1 B1 –1 (1 mark).
6.(a) $(x - 4)(x - 3)$ $(x =) 4$ AND $(x =) 3$	B2 B1	B1 for $(x \ldots 4)(x \ldots 3)$. Ignore '= 0'. Strict FT from their brackets. Allow the following. B2 for x − 4 (=0) AND x − 3 (=0) (B1) (x =) 4 AND (x =) 3 (B1) B1 for x + 4 (=0) AND x + 3 (=0) (B0) (x =) −4 AND (x =) −3 (B1) FT B1 if only (x =) 4 AND (x =) 3 seen. (B1)
6(b) $25x^2 - 20x + 4$	B2	Otherwise B1 for sight of $25x^2 \pm kx + 4$ (allow k = 0) B1 for sight of $25x^2 - 20x - 4$ 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

5(a) (Total number of pebbles =) 40×1 + 40×1.5 + 20×3.7 + 20×1.8 + 80×0.5 (40 + 60 + 74 + 36 + 40) = 250 (pebbles) (Number of pebbles < 70g = 40×1 + ¾ of 40×1.5 =) 85 (Percentage < 70g =) $\frac{85}{250}$ (×100) = 34 (%)	M1 A1 B1 M1 A1	Allow M1 for the sum of 5 products with any 3 correct CAO FT 'their 40×1' and ¾ of 'their 40×1.5' FT 'their 85' provided > 40 and < 100 but not 70 (if not derived) AND FT 'their derived 250' On FT, the whole number part of their answer needs to be calculated correctly
5(b)(i) Uniform scale in blocks of 4	B2	Complete numbering of the scale needed up to 16 B1 for • Incomplete scale with at least 1 correct value and no incorrect values • 3 correct values and 1 incorrect • Frequency of 40 (for the 1st bar) and 80 (for the 2nd bar). May be seen on diagram. May be seen as frequency of 20 for each 5×5 block • 20 × x + 10 × 4x = 120 or equivalent (x being the height of the 1st bar) Accept use of trials for x, with minimum of 2 trials getting closer to 120 OR Evidence that x = 2 • 20 × y/2 + 10 × 2y = 120 or equivalent (y being the first value on the y-axis) Accept use of trials for y, with minimum of 2 trials getting closer to 120 OR Evidence that y = 4
5(b)(ii) 40 g	B1	

2. (a) 3	B2	Award B1 for sight of $\sqrt[3]{27}$. Mark final answer.
2. (b) $(\sqrt[3]{8 \times 25x})^3 = 10^3$ or $200x = 1000$ or equivalent $(x =)\ 5$ ISW	M1 A1	Award M1 for $8 \times 25x = 10^3$ CAO Unsupported answer of 5 is awarded M1A1. Allow M1A1 for a correct embedded answer (e.g. $5 \times 8 \times 25 = 1000$), BUT M1A0 if contradicted by $x \neq 5$).

4(a)(i) Entries 146 and 160 in the table and the cumulative frequency diagram completed correctly (correct plots (11, 146) and (13, 160) and all plots joined)	B2	B1 for any one of the following: • 146 and 160 in the table, correct plots but **not** joined • 146 and 160 in the table, with one correct plot and one incorrect plot in completing the **cumulative** frequency diagram with plots joined • one error in the table, including FT 'their 146' + 14 and these **cumulative** entries used correctly to complete the **cumulative** frequency diagram with plots joined • correct cumulative frequency diagram with plots joined, with incorrect, incomplete or not attempted entries in the table
4(a)(ii) 8.2 to 8.4 (minutes)	B1	Answer space takes precedence Allow 8 minutes 12 seconds to 8 minutes 24 seconds FT reading from the graph for 'their median', from ½ × 'their 160', provided 'their 160' ≥ 110, with a tolerance of ½ small square from 'their **cumulative** frequency graph', provided it is possible to read 'their median' from the vertical axis on the graph paper provided
4(a)(iii) 7.2 minutes	B1	Answer space in the statement takes precedence, if blank award for indication of '7.2' (circled) in the list Allow '7' in the answer space provided 7.2 indicated in the list Do not accept '8' in the answer space if 7.2 indicated in the list
4(a)(iv) $\frac{20}{160}$ (× 100) or $\frac{1}{2}$ × 25 (%) or equivalent 12.5 (%) or 12½ (%)	M1 A1	FT for (100 ×) 20/'their 160', provided 'their 160'> 106 On FT allow rounding or truncation to 1 decimal place
4(b) (Costs are 180 + 220) (£) 400 **AND** (Profit is 700 – 180 – 220) (£) 300 **OR** (Receipts / Costs =) $\frac{700}{400}$ (× 100) (Percentage profit is) $\frac{300}{400}$ (× 100) or $\frac{700}{400}$ (× 100) – 1 (× 100) 75 (%)	B1 M1 A1	May be embedded, e.g. 700 – 400 = 300 (= 1.75 or 175%) FT 'their 400' and 700 – 'their 400' provided their costs or profit are ≠ 180, ≠ 220 and ≠ 700 CAO Allow if all costs and the total are consistently multiplied by 3.
4(c) 8(.)40 ÷ 1(.)20 or 8(.)40 – 8(.)40 ÷ 6 or equivalent (£) 7 or 700 (p)	M1 A1	Accept a **complete** and **convincing** method of trial and improvement If units are given they must be correct Sight of 7 + 1.40 = 8.40 is awarded M1 A0 unless (£)7 is selected

5(a)(i) King Edward and 90(g)	B1	
5(a)(ii) (90 – 52 =) 38(g)	B2	Do not award from sight of any incorrect working B1 for sight of any of the following: • 52 **and** 90 • Sight of 90 and 50 < 'their lowest mass' ≤ 54 **and** 90 – 'their lowest mass' correctly evaluated • Answer of 35(g) **and** unambiguous selection of ○ (King Edward) 98 and 63 or ○ (Desiree) 88 and 53
5(b) Selects: Desiree, **and** Interquartile range **and** less than for the other 2 varieties	E1	

9(a) 5 $\times \frac{240}{100}$ or $\times 2.4$ or equivalent	M1	A table method altering all 3 in the same manner at the same time is M0 M marks may be seen in either order e.g. Time 4, Houses 240, Vans 12
$\times \frac{4}{3}$ or $\times 1.333\ldots$ or equivalent	M1	FT from M0 previously awarded Must be from use of 5 e.g. if this calculation is performed first Time 3, Houses 100, Vans 6.66…
= 16 (delivery vans)	A1	CAO

Unit 1: Higher Tier	Mark	Comments
7(a)(i) Correct method to calculate a frequency density for any 2 groups Frequency densities of 4, 1.6, 1.2, 0.2	M1 A2	 A1 for any 2 correct frequency densities
7(a)(ii) Fully correct histogram drawn	 B2	FT their frequency densities throughout provided they fit on the given scale B1 for at least 3 correct bars drawn
7(b)(i) Working from the left of the graph $\frac{120}{2} - 34$ or equivalent OR (from the right) $4 + 18 + 24 + 40 - \frac{120}{2}$ or equivalent = 26 (pupils needed from the 10-20 group) (Median =) $(10 +) \frac{26}{40} \times 10$ or equivalent = 16.5 (mins)	 M1 A1 m1 A1	 Allow use of $\frac{120+1}{2}$ for $\frac{120}{2}$ for M1A0, but final m1A1 still available CAO FT 'their 26' Or 16 minutes 30 seconds
7(b)(i) Alternative method: *Working from the right of the graph* $\frac{120}{2} - 4 - 18 - 24$ *or equivalent* *OR (from the left)* $34 + 40 - \frac{120}{2}$ *= 14 (people needed from the 10-20 group)* *(Median =)* $(20 -) \frac{14}{40} \times 10$ *or equivalent* *= 16.5 (mins)*	 *M1* *A1* *m1* *A1*	 *Allow use of* $\frac{120+1}{2}$ *for* $\frac{120}{2}$ *for M1A0, but final m1A1 still available* *CAO* *FT 'their 14'* *Or 16 minutes 30 seconds*
7(b)(ii) 20 (minutes)	B1	FT the upper limit of the group their median is in from (b)(i)

3. Five values that satisfy both conditions: • Total = 22·5 • **Unique mode** = 3·5 3·5 3·5 3 **different** values that total 15·5 3·5 3·5 3·5 2 values that total 12 3·5 3·5 3·5 3·5 8·5	B3	May be written in any order. Answer boxes take precedence. Award B2 for one of the following: • 5 values that total 22·5 • sight of 5 × 4·5 and 5 values with a unique mode of 3·5 • sight of 22·5 and 5 values with a unique mode of 3·5. Award B1 for one of the following: • sight of 5 × 4·5 • sight of 22·5 • 5 values with a unique mode of 3·5. If answer boxes are blank, the 5 values need to be clearly identified in the working space.

17. m^{96}	B1	
18. (1– P(all 3 colours are chosen) =) $1-6\times\frac{3}{15}\times\frac{5}{14}\times\frac{7}{13}$ $=\frac{10}{13}\left(=\frac{2100}{2730}\right)$	M3 A1	M2 for $6\times\frac{3}{15}\times\frac{5}{14}\times\frac{7}{13}\ \left(=\frac{3}{13}=\frac{630}{2730}\right)$ M1 for $1-\frac{3}{15}\times\frac{5}{14}\times\frac{7}{13}\ \left(=\frac{25}{26}=\frac{2625}{2730}\right)$ *CAO* *ISW* *Accept a decimal answer of 0·76(9…) or 0·77.* *If no marks award SC1 for one of the following:* • *Working with replacement leading to an answer of 61/75 (2745/3375) OR 0·81(3) [may be unsupported].* • *Recognising all 21 permutations (and no other) OR recognising up to 27 possible permutations, and then identifying the 21 relevant permutations.*
Alternative method 1 *(P(2 Red & 1 Not Red) OR* *P(2 Blue & 1 Not Blue) OR* *P(2 Yellow & 1 Not Yellow) =)* $3\times\frac{3}{15}\times\frac{2}{14}\times\frac{12}{13}+$ $3\times\frac{5}{15}\times\frac{4}{14}\times\frac{10}{13}+$ $3\times\frac{7}{15}\times\frac{6}{14}\times\frac{8}{13}\ \left(=\frac{304}{455}=\frac{1824}{2730}\right)$ *(P(3 Red) OR P(3 Blue) OR P(3 Yellow) =)* $\left(\frac{3}{15}\times\frac{2}{14}\times\frac{1}{13}\right)+\left(\frac{5}{15}\times\frac{4}{14}\times\frac{3}{13}\right)+\left(\frac{7}{15}\times\frac{6}{14}\times\frac{5}{13}\right)$ $\left(=\frac{46}{455}=\frac{276}{2730}\right)$ *(P(at least 2 counters the same colour) =)* $\frac{10}{13}\left(=\frac{2100}{2730}\right)$	 *M2* *M1* *A1*	*May be seen in stages.* *M1 for:* $\left(\frac{3}{15}\times\frac{2}{14}\times\frac{12}{13}\right)+\left(\frac{5}{15}\times\frac{4}{14}\times\frac{10}{13}\right)+\left(\frac{7}{15}\times\frac{6}{14}\times\frac{8}{13}\right)$ $\left(=\frac{12}{455}+\frac{20}{273}+\frac{8}{65}=\frac{304}{1365}\right)$ *OR* $3\times\frac{3}{15}\times\frac{2}{14}\times\frac{12}{13}\ \left(=\frac{36}{455}=\frac{216}{2730}\right)$ *OR* $3\times\frac{5}{15}\times\frac{4}{14}\times\frac{10}{13}\ \left(=\frac{20}{91}=\frac{600}{2730}\right)$ *OR* $3\times\frac{7}{15}\times\frac{6}{14}\times\frac{8}{13}\ \left(=\frac{24}{65}=\frac{1008}{2730}\right)$ *Award M1M1 for an answer of* $\frac{34}{105}$ *from sight of:* *P(R,R,other)+ P(B,B,other)+ P(Y, Y,other) OR* *P(R,R)+ P(B,B)+ P(Y,Y)* *CAO* *ISW* *Accept a decimal answer of 0·76(9…) or 0·77.* *If no marks award SC1 for one of the following:* • *Working with replacement leading to an answer of 61/75 (2745/3375) OR 0·81(3) [may be unsupported].* • *Recognising all 21 permutations (and no other) OR recognising up to 27 possible permutations, and then identifying the 21 relevant permutations.*