OCR
Oxford Cambridge and RSA

GCSE

Mathematics B (Linear)

Component **J567/03:** Mathematics Paper 3 (Higher)

General Certificate of Secondary Education

Mark Scheme for June 2016

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All examiners are instructed that alternative correct answers and unexpected approaches in candidates' scripts must be given marks that fairly reflect the relevant knowledge and skills demonstrated.

Mark schemes should be read in conjunction with the published question papers and the report on the examination.

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1.   Annotations used in the detailed Mark Scheme.

Annotation	Meaning
✓	Correct
✗	Incorrect
BOD	Benefit of doubt
FT	Follow through
ISW	Ignore subsequent working (after correct answer obtained), provided method has been completed
M0	Method mark awarded 0
M1	Method mark awarded 1
M2	Method mark awarded 2
A1	Accuracy mark awarded 1
B1	Independent mark awarded 1
B2	Independent mark awarded 2
MR	Misread
SC	Special case
∧	Omission sign

These should be used whenever appropriate during your marking.

The **M**, **A, B** etc annotations must be used on your standardisation scripts for responses that are not awarded either 0 or full marks.
It is vital that you annotate these scripts to show how the marks have been awarded.
It is not mandatory to use annotations for any other marking, though you may wish to use them in some circumstances.

Subject-Specific Marking Instructions

2.   **M** marks are for <u>using a correct method</u> and are not lost for purely numerical errors.
      A marks are for an <u>accurate</u> answer and depend on preceding **M** (method) marks. Therefore **M0 A1** cannot be awarded.
      B marks are <u>independent</u> of **M** (method) marks and are for a correct final answer, a partially correct answer, or a correct intermediate stage.
      SC marks are for <u>special cases</u> that are worthy of some credit.

3.   Unless the answer and marks columns of the mark scheme specify **M** and **A** marks etc, or the mark scheme is 'banded', then if the correct answer is clearly given and is <u>not from wrong working</u> **full marks** should be awarded.

      Do <u>not</u> award the marks if the answer was obtained from an incorrect method, ie incorrect working is seen <u>and</u> the correct answer clearly follows from it.

4. Where follow through (**FT**) is indicated in the mark scheme, marks can be awarded where the candidate's work follows correctly from a previous answer whether or not it was correct.

   Figures or expressions that are being followed through are sometimes encompassed by single quotation marks after the word *their* for clarity, eg FT 180 × (*their* '37' + 16), or FT 300 − √(*their* '5^2 + 7^2'). Answers to part questions which are being followed through are indicated by eg FT 3 × *their* (a).

   For questions with FT available you must ensure that you refer back to the relevant previous answer. You may find it easier to mark these questions candidate by candidate rather than question by question.

5. Where dependent (**dep**) marks are indicated in the mark scheme, you must check that the candidate has met all the criteria specified for the mark to be awarded.

6. The following abbreviations are commonly found in GCSE Mathematics mark schemes.

   - **cao** means **correct answer only**.
   - **figs 237**, for example, means any answer with only these digits. You should ignore leading or trailing zeros and any decimal point eg 237000, 2.37, 2.370, 0.00237 would be acceptable but 23070 or 2374 would not.
   - **isw** means **ignore subsequent working** (after correct answer obtained).
   - **nfww** means **not from wrong working**.
   - **oe** means **or equivalent**.
   - **rot** means **rounded or truncated**.
   - **seen** means that you should award the mark if that number/expression is seen anywhere in the answer space, including the answer line, even if it is not in the method leading to the final answer.
   - **soi** means **seen or implied**.

7. Make no deductions for wrong work after an acceptable answer unless the mark scheme says otherwise, indicated for example by the instruction 'mark final answer'.

8. As a general principle, if two or more methods are offered, mark only the method that leads to the answer on the answer line. If two (or more) answers are offered, mark the poorer (poorest).

9. When the data of a question is consistently misread in such a way as not to alter the nature or difficulty of the question, please follow the candidate's work and allow follow through for **A** and **B** marks. Deduct 1 mark from any **A** or **B** marks earned and record this by using the MR annotation. **M** marks are not deducted for misreads.

10. Unless the question asks for an answer to a specific degree of accuracy, always mark at the greatest number of significant figures even if this is rounded or truncated on the answer line. For example, an answer in the mark scheme is 15.75, which is seen in the working. The candidate then rounds or truncates this to 15.8, 15 or 16 on the answer line. Allow full marks for the 15.75.

11. If the correct answer is seen in the body and the answer given in the answer space is a clear transcription error allow full marks unless the mark scheme says 'mark final answer' or 'cao'. Place the annotation ✓ next to the correct answer.

    If the answer space is blank but the correct answer is seen in the body allow full marks. Place the annotation ✓ next to the correct answer.

    If the correct answer is seen in the working but a completely different answer is seen in the answer space, then accuracy marks for the answer are lost. Method marks would still be awarded. Use the M0, M1, M2 annotations as appropriate and place the annotation ✗ next to the wrong answer.

12. Ranges of answers given in the mark scheme are always inclusive.

13. For methods not provided for in the mark scheme give as far as possible equivalent marks for equivalent work. If in doubt, consult your Team Leader.

14. Anything in the mark scheme which is in square brackets […] is not required for the mark to be earned, but if present it must be correct.

MARK SCHEME

Question			Answer	Marks	Part marks and guidance	
1	(a)		Correct reflection Vertices (1, –1), (2, –1), (1, –3)	1		Use overlay Condone missing/incorrect label
	(b)		Correct translation Vertices (–3, 4), (–2, 4), (–3, 6)	2	**B1** for correct movement in *x* or *y* direction OR **SC1** for triangle with vertices (4, –1), (4, –3), (5, –3) or vertices (–3, 0), (–3, 2), (–2, 2)	Use overlay Correctly orientated triangle at intersection of both pairs of green lines scores 2 Correctly orientated triangle within one pair of green lines scores B1 SC1 for either red triangle Condone missing/incorrect label
2	(a)	(i)	38 12 50 100 56 49 45 150 94 61 95 250	2	All four values correct **B1** for two or three values correct	
		(ii)	$2:3$ or $1:1.5$ or $\frac{2}{3}:1$	2	**M1** for 100 : 150 or better seen OR **SC1** for 3 : 2 or 1.5 : 1 or $1:\frac{2}{3}$	For 2 marks or SC1 do not ISW For M1 accept any equivalent, including fractions and decimals to 3sf or better
		(iii)	$\frac{9}{50}$ final answer	2	**M1** for $\frac{45}{250}$ oe fraction seen OR **SC1** for *their* fraction seen written in simplest form	Accept eg $\frac{4.5}{25}$ as an equivalent Both simplified and unsimplified fractions seen

Question			Answer	Marks	Part marks and guidance	

	(b)		8 × 90 soi
			leading to 720
			or
			8 × 85 soi
			leading to 680
				2	**B1** for 8 and 90 used as an estimate
					  Or
					  10 × 90 = 900 or 10 × 87 = 870
					  or 8 × 100 = 800 or 7.95 × 100 = 795
					  or 8 × 87 = 696
						Accept rounding of 720 seen to 700 or 680 seen to 700 for 2 marks
						Condone 8 and 90 seen or 8 and 9 seen with answer 720 for 2 marks, and similar values with result for part marks
						
						0 marks for calculation of 7.95 × 87

3	**(a)**		Triangle ABC correct	**2**	**B1** for ∠BAC = 40° ± 2° Or for AC = 7 cm ± 2 mm	Use overlay Touching or between red lines for angle Touching or between green lines for length
	(b)		Ruled perpendicular from C to AB	**1FT**	**FT** their C, must reach AB	Use overlay Allow 88° to 92° to AB, intention of passing through C Condone dashed/dotted line
			Correct arcs for construction	**1**	Arc centre C intersecting AB twice, second pair from these intersecting below AB Or arc centre A radius AC and arc centre B radius BC crossing below AB	Check arcs carefully: angle bisector of C gives inaccurate perpendicular, this scores max 1
	(c)		22 to 23	**2**	**FT** area = 5 × *their* height **B1FT** for length of *their* perpendicular seen	After full credit in (a) answer must be in range 22 to 23 for 2 marks 2FT is 5 × perpendicular height of their triangle, measure diagram and allow tolerance of 2mm Ignore $\frac{1}{2} \times 7 \times 10 \sin 40$

Question	Answer	Marks	Answer
4*	Statement that he should use voucher A (or 20% off deal) and the meal costs £45.50 with fully correct calculations showing correct discounts for both vouchers Calculations are clearly set out and annotated	5	Total food bill = £47.50 [Total drinks bill = £7.50] Total cost of meal = £55.00 Voucher A: 20% of food bill = £9.50 or meal cost = £45.50 Voucher B: 15% of total bill = £8.25 or meal cost = £46.75 Bigger discount with voucher A, total paid = £45.50
	4A Correct conclusion of voucher A and meal cost £45.50 and £9.50 and £8.25 discounts without clear method Or 4B Statement that he should use voucher A without (or incorrect) final meal cost calculated but fully correct calculations showing £9.50 discount with A and £8.25 discount with B Or 4C Statement of voucher selected with total cost for meal with **one or two** arithmetic slips in calculations. Method is correct and clearly set out and annotated and voucher choice FT their figures 4D Meal cost £45.50 with A and £46.75 with B with fully correct calculations	4-3	For lower mark 3A Correct conclusion of voucher A without final meal cost calculated and £9.50 discount with A and £8.25 discount with B without clear method Or 3B Correct discount using voucher A or voucher B seen with clear method FT *their* total Or 3C Correct discounts using voucher A and B seen without clear method FT *their* totals
	2A Correctly finds 20% of *their* total or 15% of *their* total without clear method Or 2B Correctly finds and identifies 10% of *their* total Or 2C [Total food =] £47.50 or [Total food + drink =] £55.00	2-1	For lower mark: 1A Attempts to find total for food or drinks or meal without discount Or 1B Correctly finds and identifies 10% of a cost

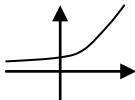| Question			Answer	Marks	Part marks and guidance	
5	(a)		$5p + 9$ final answer	2	**B1** for $5p + k$ or $hp + 9$ final answer, $h \neq 0$ Or **M1** for $3p + 15 + 2p - 6$ seen with at least 3 terms correct	
	(b)		$x < 4$ final answer	2	**M1** for $3x - x < 8$ or better AND **M1** for $x < \dfrac{b}{a}$ after $ax < b$ seen **max 1 mark if answer incorrect** After 0 scored **SC1** for answer 4 or x …. 4 with any incorrect equality or inequality symbol or answer $3 \times 4 < 4 + 8$	Condone use of = or incorrect inequality symbol in place of < for all method marks $a \neq 1$, $b \neq 0$ Trial and improvement methods can only score for correct answer or correct embedded answer
	(c)		$r = 5t + 6$ final answer	2	**M1** for $5t = r - 6$ or $t + \dfrac{6}{5} = \dfrac{r}{5}$ oe After **M0**, **SC1** for answer $5t + 6$ or $r = 5t - 6$ or $r = 5(t + 6)$ or $r = 5t + 30$	Condone $5 \times t$, $t \times 5$ or $t5$ for $5t$
6	(a)		40° final answer	2	**B1** for 140 or 40 seen or **M1** for $360 \div 9$ oe	Eg $180 - 180 \times 7 \div 9$
	(b)		140°	1	Or **FT** $180 -$ *their* 40	FT *their* 40 if < 180
7	(a)		72	2	**M1** for $\dfrac{18}{50} \times 200$ oe OR **SC1** for answer in range 60 to 80 or for answer 128	M1 implied by answer $\dfrac{72}{200}$

Question			Answer	Marks	Part marks and guidance	
	(b)	(i)	Expect different outcomes when experiment repeated	1		Or eg 'counters are selected at random' Or eg 'results are based on chance' See exemplars
		(ii)	[Red =] 116 [Blue =] 84	2	**M1** for $(32 + 26) \times 2$ or $(18 + 24) \times 2$ or for 58 and 42 seen or for two values with total 200	Implied by 116 seen Implied by 84 seen 58 and 42 may be as numerators
8	(a)		5, 5	2	**B1** for one correct Or **M1** for $(-1)^2 - 4\times(-1)$ or $5^2 - 4 \times 5$ seen	
	(b)		Correct smooth curve through all 7 correct points	2	**B1** for at least 6 points plotted correctly FT their table	Use overlay Tolerance for plotting ± 1mm Intention of correct smooth curve through correct points
	(c)		–0.7 to –0.5 and 4.5 to 4.7	2	**B1** for each correct value or each correct value FT *their* parabola	Tolerance half small square
9			$5\frac{5}{6}$ final answer	3	**M1** for $\frac{7}{4}\frac{12}{5}$ or $\frac{9}{4}\frac{10}{3}$ seen or equivalent improper fractions AND **M1** for correct evaluation of their $\frac{7\times10}{4\times3}$ AND **M1** for *their* improper fraction correctly converted to mixed number in lowest terms as final answer **max 2 marks if answer incorrect** $\frac{12}{5}\times\frac{4}{9}$	Answer $\frac{70}{12}$ oe implies M2 For multiplication of improper fractions, not eg $\frac{3}{4}\times\frac{1}{3}$ *Their* improper fraction converted to integer scores M0

Question			Answer	Marks	Part marks and guidance	
10			7.5[0] Or 750p	4	**B1** for $2x$ and $x + 5$ seen AND **M1** for $x + $ *their* $2x + $ *their* $(x + 5) = 35$ seen AND **M1** for $4x = 30$ FT *their* equation simplified to $ax = b$ **AND** **M1** for $x = \dfrac{b}{a}$ after $ax = b$ seen **Max 3 marks if answer incorrect** Alternative method **B1** for any consistent set of values for A, D, E soi AND **M1** for correct trial using Alex <£10, showing values of A, D, E with correct total for trial clearly linked AND **M1** for a second correct trial, using Alex <£10, showing values of A, D, E with correct total for trial clearly linked	Accept any letter used for x Equation must involve summation of terms for 3 children FT *their* linear equation = 35 involving summation of terms for at least 2 children $a \neq 1$, $b \neq 0$ If names not linked with values, B1 may be implied by 3 correct values seen added to give correct total for trial. If names seen, total not required for B1 {table below}

Alex	Dan	Eva	Total
5	10	10	25
6	12	11	29
7	14	12	33
8	16	13	37
9	18	14	41

Question			Answer	Marks	Part marks and guidance	
11	(a)		1×10^6 or $1\,000\,000$ or 1 million	1		Condone equivalent in unusual form if not contradicted eg 0.1×10^7
	(b)		7.3×10^5	2	**B1** for answer figs 73 OR **M1** for $8\,150\,000 - 7\,420\,000$ oe soi	Condone eg 7.3^5 etc for B1 Eg $8\,150\,000 - (4\,210\,000 + 3\,210\,000)$

Question			Answer	Marks	Part marks and guidance	
	(c)		200 or 210 or 250	2	**B1** for answer in range 200 to 260 OR **M1** for 4 000 000 or 4 200 000 oe and 20 000 or 16 000 or 17 000 oe seen	Both rounded values needed for M1
12	(a)	(i)	163	1		
		(ii)	28 to 30	2	**B1** for 50 to 52 seen	
	(b)					See exemplars Must have True/False correct **and** reason Accept 28 to 30 Reason must include 28 to 30 and 80 (or 3/8) or 1/3 are taller than k where $175 < k \le 176$ and tallest girl is 175
			True, 28 taller than 175, greater than one third of 80	1		
			True, median for boys greater than girls	1		Values of median not required in comparison. Do not penalise for incorrect values. Condone mean for median
			False, range or IQR for boys less than girls	1		Correct values of range/IQR are not required if used in comparison. If both ranges/IQRs evaluated correctly no comparison required. Range G = 21, B = 15. IQR G = 8, B = 4

Question			Answer	Marks	Part marks and guidance	
13			120	**4**		Condone answer 121 after 120 clearly identified
					B3 for time = 40 s when N overtakes R or N running for 30s when he overtakes or for R = 120, N = 120 seen paired up OR **B2** for a correct pair of distances for R and N at one time seen paired up Or for N catches up at 1m/s OR **B1** for correct time and distance for R or N eg R 30m after 10 s soi or eg N 40m after 20 s soi or for a series of distances for R or N soi eg 3, 6, 9, …	Implied by $t = 40$ seen following algebraic solution Implied by algebraic method eg $3t = 4(t-10)$ or $\dfrac{d}{3} - \dfrac{d}{4} = 10$ or eg R = 60 when N = 40 R = 30 when N = 0 Implied by correct expression in t or d seen eg $3t$ or $4(t-10)$ or $\dfrac{d}{3}$ or $\dfrac{d}{4}$ Or eg R 30m at 10s or 3×10 = 30 Or eg N 40m at 20s
						<table><tr><td>Time</td><td>10</td><td>20</td><td>30</td><td>40</td><td>50</td></tr><tr><td>R</td><td>30</td><td>60</td><td>90</td><td>120</td><td>150</td></tr><tr><td>N</td><td>0</td><td>40</td><td>80</td><td>120</td><td>160</td></tr></table>
14	**(a)**		−1.5 oe	**2**	**M1** for $y = 0.5 - 1.5x$ soi OR **SC1** for answer 1.5 oe	Any equivalent eg $\dfrac{3}{-2}$ for 2 marks M1 implied by answer of −1.5x oe
	(b)		0.5 oe	**1**	**FT** *their* $y = 0.5 - 1.5x$	FT *their* $y = a + bx$ from (a), if b ≠ 0 Condone (0, 0.5) as answer

Question			Answer	Marks	Part marks and guidance	
	(c)		(3, −4) **nfww**	3	**M1** for equating coefficients of *x* or *y*, correct or FT their rearranged eqn in (a) eg 4*y* + 6*x* = 2 or 14*y* + 21*x* = 7 and 12*y* + 21*x* = 15 **M1FT** for correctly subtracting to eliminate one unknown Eg *x* = 3 or 2*y* = −8	Condone one error in each step for all M marks For substitution method, M1 for substituting rearranged equation into second equation then M1 for rearrangement to *ax* = *b* or *cy* = *d*
15	**(a)**	**(i)**	Correct histogram drawn with linear scale from 0	3	**B2** for at least four bars correct height OR **B1** for at least three correct frequency densities seen or at least three bars correct height FT *their* frequency densities and *their* linear scale AND **B1** for bars correct width and position with linear scale marked on frequency density axis **Max 2 marks if histogram not completely correct**	Use overlay for 2cm to 1 unit scale, other scales are acceptable, for B2 scale may be implied by bars in proportion Tolerance ±1mm for heights and widths Correct f.d. 0.4, 1.5, 2.1, 1, 0.3 *Their* frequency densities must follow attempt at frequency ÷ interval width Need not be frequency densities, scale must start from 0, 0 need not be shown, scale must include minimum two numbers Condone unruled and missing final vertical line
		(ii)	33 or 34	1		Integer answer only

Question			Answer	Marks	Part marks and guidance	
	(b)		$\dfrac{1}{118}$ oe	3	**M2** for $\dfrac{6}{60} \times \dfrac{5}{59}$ oe OR **M1** for $\dfrac{6}{60}$ oe seen or $\dfrac{5}{59}$ seen	3 marks for $\dfrac{30}{3540}$ or equivalent, ISW incorrect cancellation
16	(a)	(i)	**b** − **a** or −**a** + **b** final answer	1		Condone **b** + − **a**
		(ii)	−4**b** oe	1		ISW for incorrect simplification Accept **a** − **b** − (**a** + 3**b**) or equivalent
	(b)	(i)	$\overrightarrow{DC} = 3\mathbf{b} - 3\mathbf{a}$ **and** $\overrightarrow{DC}$ is a multiple of $\overrightarrow{AB}$ or $\overrightarrow{DC} = 3\overrightarrow{AB}$ oe	2	**B1** for 3**a and** 3**b** seen	Condone missing vector arrows For 2 marks, must relate DC and AB Condone AB is a factor of DC For B1 condone −3**a**, −3**b**
		(ii)	Two pairs of equal angles stated with reasons OR Three pairs of proportional sides DC = 3AB, CO = 3OA **and** DO = 3OB OR Two pairs of proportional sides and included pair of angles with reason	2	**M1** for one correct pair of angles with reason or for two correct pairs of angles with no/incorrect reason or for one pair of proportional sides from DC = 3AB, CO = 3OA and DO = 3OB or scale factor 3 soi	Pairs of angles and reasons: ∠AOB = ∠DOC, [vertically] opposite ∠OAB = ∠OCD, alternate [angles] ∠OBA = ∠ODC, alternate [angles] Accept OA = a and OC = 3a etc as pairing sides
17	(a)			1		Clear intention of exponential curve correct shape, condone touching but not crossing, *x*-axis
	(b)		$y = (x - 2)^2$	1		Do not accept $y = f(x - 2)$

Question			Answer	Marks	Part marks and guidance	
18	(a)		$x = -2$ or $x = 4$	3	**M2** for $(x + 2)(x - 4)$ seen or implied in a table OR **M1** for $(x \pm 2)(x \pm 4)$ seen or $(x + a)(x + b)$ where $ab = -8$ or $a + b = -2$ AND **B1** for correct solutions FT *their* quadratic factors	Eg $(x + 8)(x - 1)$ Must be of form $(x + a)(x + b)$ [= 0] with $a \neq 0$, $b \neq 0$
	(b)		$\dfrac{9x + 7}{(x - 2)(x + 3)}$ or $\dfrac{9x + 7}{x^2 + x - 6}$ final answer	3	**M1** for $5(x + 3) + 4(x - 2)$ or $5x + 15 + 4x - 8$ or better seen **M1** for correct common denominator seen as a denominator	Mark final answer but **isw** for incorrect expansion of denominator after correct answer seen Condone missing brackets in denominator for **M1** if intention clear, but for **3 marks** all brackets must be present or correct expansion found Method marks may be awarded when expression is written as two fractions
19	(a)		$7 + 5\sqrt{3}$ final answer	2	**M1** for multiplication of terms in brackets leading to $4 + \sqrt{3} + 4\sqrt{3} + 3$ with at least two terms correct in an expression with three or four terms	For **M1** $\left(\sqrt{3}\right)^2$ or $\sqrt{3}\sqrt{3}$ or $\sqrt{9}$ is acceptable in place of the 3 For **M1** $5\sqrt{3}$ may be counted as two of the required three or four terms eg $5 + 5\sqrt{3}$ would score M1
	(b)		-4	1		
	(c)		6	2	**B1** for $2^{\frac{p}{3}}$ or 2^2 or 2^6 or 4^3 or 64 or $\dfrac{p}{3} = 2$ seen	Expressions must be as shown here **B0** for $\sqrt[3]{2^2}$

Question			Answer	Marks	Part marks and guidance	
20			2π	4	**B1** for $\dfrac{120}{360}$ oe soi	May be implied by eg area of circle = 9π or eg $\dfrac{360}{120}$
					B1 for radius = 3 cm soi	
					M1 for $\dfrac{120}{360} \times 2\pi \times$ *their* radius	Use of correct arc length formula with numerical radius If 2π is obtained from completely wrong method eg 3π – π then 0 marks are scored

APPENDIX

Exemplar responses for Q.7(b)(i)

	Response	Mark
1	It is completely down to chance	**1**
2	Because they selected randomly	**1**
3	It would never have been the exact same results	**1**
4	Random probability	**1**
5	There is a chance that he could have picked more or less of one colour	**1**
6	Because random sampling is not always accurate	**1**
7	Because there are 200 in the bag, the order they're picked out can change [*implies different results expected*]	**1**
8	Because the probability of picking the same number of counters is very small [*implies different results expected*]	**1**
9	Experimental probabilities may change [*implies different results expected*]	**1**
10	There is 200 counters to pick from so the results won't be the same	**1**
11	There are 72 blue counters so there's a chance that these results are correct [*implies different results expected*]	**1**
12	It's only a probability therefore it isn't an accurate answer [*just: accept similar words in place of 'isn't accurate'*]	**1bod**
13	Because there are 62 blue counters, so he might have picked 24 of them [FT *their a, bod referring to chance*]	**1bod**
14	They had different probabilities [*not clear*]	**0**
15	Because he hasn't changed the experiment, variables are the same [*ignore reference to how he did experiment*]	**0**
16	Results won't always be the same as there's a 50/50 chance to get blue or red [*any reference to 50/50 chance is 0*]	**0**
17	As the actual number is unknown Sam or Roma could be right [*any suggestion that one of them is wrong scores 0*]	**0**
18	It may have just been luck [*needs mathematical term, 'luck' is not good enough*]	**0**
19	He may not have repeated it 50 times [*reference to doing experiment wrongly scores 0*]	**0**
20	Because he has picked out more blue counters than Roma	**0**
21	Because Roma could have done it wrong [*reference to Roma being wrong/inaccurate scores 0*]	**0**
22	It's because the number of balls of each colour may be nearly the same	**0**
23	Because you can pick the same one out twice [*just reference to replacement or same one picked again insufficient*]	**0**
24	There may be more blue counters than what was thought	**0**
25	There's a 50/50 chance it will land on red or blue [*reference to equal chance scores 0*]	**0**
26	Picking out different counters each time [*reference to picking different/not picking same counters alone scores 0*]	**0**
27	There are more red counters than blue ones	**0**
28	He may not have replaced the counters	**0**
29	There are only 50 trials and there are 200 counters	**0**
30	He may have just happened to pick those	**0**

Exemplar responses for Q.12(b)

More than one third of the boys are taller than the tallest girl
NB Award 0 if T[rue] or ✓ not stated

	Response	Mark
1	T, 30/80 is larger than 1/3 [*30 and 80 seen*]	1
2	T, 1/3 of boys taller than 175.5, and the tallest girl is 175	1
3	T, because 30 boys are taller than tallest girls and 30 is bigger than 1/3 of 80 [*30 and 80 seen*]	1
4	T, 30 out of the 80 boys were taller than the tallest girl [*30 and 80 seen*]	1
5	T, 3/8 of the boys were taller than the tallest girl [*condone 30/80 simplified to 3/8*]	1
6	T, the tallest girl is 175cm and there are a cumulative frequency of 30 boys who are taller than this [*80 not seen*]	0
7	T, 30 boys out of 50 are over 175cm, the same as the tallest girl [*50 in place of 80*]	0
8	T, because 20 boys are taller than the tallest girl [*no ft from their aii*]	0
9	T, because only just under one third are taller than the tallest girl	0
10	T, more than a third of the boys on the graph are past 175	0
11	T, boys heights are bigger	0
12	T, the last third are longer than the tallest girl	0
13	T, half of the boys are taller than the tallest girl	0
14	F 1/3 of 80 is around 26, 30 boys were taller [*states False, so 0*]	0

On average, the boys are taller than the girls
NB Award 0 if T[rue] or ✓ not stated

	Response	Mark
1	T, boys have a higher median	1
2	T, the girls average is 163cm and is smaller than the boys of 172cm [*comparison, ignore values*]	1
3	T, the boys mean is bigger [*condone mean*]	1
4	T, the boys' line is further to the right [*implies higher median*]	1
5	T, they have greater upper and lower values and the boys median is higher [*first comment is not incorrect, so do not penalise*]	1
6	T, half the girls are taller than 163cm whereas all the boys are taller than 164cm [*correct statement and implies higher median*]	1
7	T the boys heights are further along the diagram showing that they are all averagely taller	**1bod**
8	T, the median is higher [*needs to specify boys' median*]	0
9	T, the median for the girls' heights is 165.5cm while for boys it is 175.5 cm [*no comparison of values*]	0
10	T, the boys average is bigger [*no interpretation, repeating question*]	0

11	T, the first boy was 164 where the first girl was 154 [*must compare average, not tallest/shortest*]	0
12	T, the line is further along [*needs to specify boys' line*]	0
13	T, the boys height starts a lot higher than girls. Girls line stops at 175cm, boys at 179cm [*compares tallest/shortest*]	0
14	T, they have a taller start, finish and steeper gradient [*too vague*]	0
15	T, because most of the boys heights are taller than girls [*too vague*]	0
16	T, the boys' heights range from 164-178 whereas the girls' range from 154 to 175. So there are more taller boys	0
17	T, the boys heights reach 179cm, the girls reached 175cm [*must compare average, not tallest/shortest*]	0
18	T, the boys always have a larger height on the diagram [*not quite enough*]	0
19	T, UQ for boys is bigger than UQ for girls [*not comparing medians*]	0

The boys' heights are more varied than the girls' heights	
NB Award 0 if F[alse] or ✗ not stated Range: girls =21, boys = 15 IQR: girls =8, boys = 4	
Response	**Mark**
1	F, girls' heights are more spread out [*implies bigger range*]	1
2	F, the girls have a bigger range	1
3	F, the IQR for girls is 8cm whereas the IQR for boys is only 4cm [*if IQR correct no explicit comparison required*]	1
4	F, the girls have a range from 154-175 while the boys have a smaller range of 164-179 [*explicit comparison*]	1
5	F, the boys range is 15cm and the girls range is 21cm [*if ranges correct no explicit comparison required*]	1
6	F, the boys heights vary from 164 to 178 where girls vary from 154 to 175, more spread out [*explicit comparison*]	1
7	F, the boys line is much steeper than the girls meaning is shorter so less varied	1
8	F, the girls heights is more varied because the girls line spreads out more than the boys [*implies less steep*]	1
9	F, the boys have a straighter line on the graph meaning close together whereas girls have a bendier line which means that they are more spread out	1bod
10	F, their line has a steeper gradient [*needs to specify boys' line*]	0
11	F, they are closer together [*too vague and doesn't specify boys*]	0
12	F, the girls are continuously changing whereas the boys just rapidly increase at 170 [*unclear*]	0
13	F, the graph shows the girls heights always differ, the boys line shows 170-172 was most common [*not enough*]	0
14	F, the boys line starts at 164cm and ends at 179 where girls starts at 154cm and ends at 175cm [*no comparison*]	0
15	F, because the boys height range from 164-179 and girls range from 154-175 [*must give explicit comparison if range not evaluated*]	0
16	F, this is not shown on the graph	0
17	F, the girls height is more varied than the boys [*repeats question*]	0
18	F, girls range 21 but boys range is only 13 [*must give explicit comparison if ranges not both correct, 'only' is not enough as a comparison*]	0
19	F, boys IQR = 5, girls IQR = 9 [*must give explicit comparison if IQRs not both correct*]	0

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