Level 3 Certificate
MATHEMATICAL STUDIES
1350/1

Paper 1

Mark scheme

June 2021

Version: 1.0 Final

2 1 6 A 1 3 5 0 / 1 / M S

Mark schemes are prepared by the Lead Assessment Writer and considered, together with the relevant questions, by a panel of subject teachers. This mark scheme includes any amendments made at the standardisation events which all associates participate in and is the scheme which was used by them in this examination. The standardisation process ensures that the mark scheme covers the students' responses to questions and that every associate understands and applies it in the same correct way. As preparation for standardisation each associate analyses a number of students' scripts. Alternative answers not already covered by the mark scheme are discussed and legislated for. If, after the standardisation process, associates encounter unusual answers which have not been raised they are required to refer these to the Lead Examiner.

It must be stressed that a mark scheme is a working document, in many cases further developed and expanded on the basis of students' reactions to a particular paper. Assumptions about future mark schemes on the basis of one year's document should be avoided; whilst the guiding principles of assessment remain constant, details will change, depending on the content of a particular examination paper.

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Q	Answer	Mark	Comments
1	continuous	B1	
	Additional Guidance		

Q	Answer	Mark	Comments
2 (a)	James' sample size is too small/ Kia's sample size is better James' method is more biased as all at a bus stop Kia's method is better as she uses more than one day James' method is quicker/cheaper Kia's method uses random sampling whereas James' method uses cluster sampling	B2	oe B1 each correct comparison
	Additional Guidance		
	Two comments about the same aspect of the collection is B1 only eg James' method is quicker and Kia's method is more time-consuming	B1	
	James method is more biased	B0	
	James asks less people	B1	
	James only asks people at a bus stop	B1	
	James asks people at a bus stop	B0	
	James only asks 10 people	B0	
	Accept convenience or opportunity for cluster		
	Allow two comparisons in one answer space		
	Ignore incorrect statements if non-contradictory		

Q	Answer	Mark	Comments
2(b)	20, 8, 2 or 19, 8, 3 or 19, 9, 2	B2	B1 19, 8, 2 or B1 $\frac{84}{130} \times 30$ or 19.4… or $\frac{36}{130} \times 30$ or 8.3… or $\frac{10}{130} \times 30$ or 2.3…
	Additional Guidance		

Q	Answer	Mark	Comments
3(a)	9, 45, 66, 74, 78, 80	B1	implied by correct heights allow one cumulative addition error
	Fully correct cumulative frequency graph joined with lines or smooth curve	B2	$\pm \frac{1}{2}$ square B1 all heights correct and joined with line/curve but plotted at incorrect horizontal position or B1 plotted at upper class values and joined with line or curve with at least 3 heights correct or B1 all points correct but no line/curve or poor line/curve
	Additional Guidance		
	cumulative addition eg 9, 44, 65, 73, 77, 79		B1

Q	Answer	Mark	Comments
3(b)	Correct reading for cf of 16 from their increasing graph	B2ft	allow 11 900 or 11 944 from interpolation B1 0. 2 × 80 or 16 or correct ft reading for their 16 for an increasing graph
	Additional Guidance		
	If an increasing histogram is drawn then only the B1 for 16 is available		
	Use of 16 may be implied from a mark at 16 on the vertical axis ±½ square		

Q	Answer	Mark	Comments
3(c)	**Alternative method 1**		
	(80 – their 50) ÷ 80 (× 100) or [0.37, 0.38] × 100)	M1	their 50 must be reading at 22 000 for an increasing graph $\pm\frac{1}{2}$
	[37, 38]	A1ft	ft their 50 which may be rounded to nearest integer
	Alternative method 2		
	$\left(\frac{8}{10}\times 21+8+4+2\right)\div 80$ (× 100) or 30.8 ÷ 80 (× 100) or 31 ÷ 80 (× 100) or [0.385, 0.39] (× 100)	M1	oe for $\frac{8}{10}\times 21$ allow rounding to 17
	[38.5, 39]	A1	
	Additional Guidance		
	If a cumulative histogram is drawn in part a) then there must be a vertical line up from £22 000 to show where they are taking their reading		

Q	Answer	Mark	Comments	
4	Makes assumption about number of pupils in the school eg 1000	B1	allow 500 to 2500 oe eg 5 or 7 year groups with 300 students in each	
	Makes an assumption about proportion that have school meals eg 80%	B1	allow 20% to 80% oe eg 300 in each year group of which 200 have school meals may include staff	
	Makes an assumption about the number of school days in a year eg 190	B1	allow 150 to 252 days or 5 or 6 days a week for 30–42 weeks per year	
	Works out their percentage × their number of pupils × their days in a school year eg 1000 × 0.8 × 190	M1		
	Accurate answer for their calculations	A1ft	ft their assumptions	
	Additional Guidance			
	For the final 2 marks they may use numbers outside the allowed ranges. Example 100 × 0.2 × 365 = 7300			B0B1B0M1 A1ft

Q	Answer	Mark	Comments
5	Group A median = 4.2	B1	
	Group A IQR = 1.9	B2	B1 (LQ =) 3.0 or (UQ =) 4.9
	Comment on averages in context eg Group A jumped further on average	B1ft	oe ft their median for group A
	Comment on IQR eg Group B were more consistent/less varied	B1ft	oe ft their IQR for group A
	Additional Guidance		
	Answers must be in context eg Group A median is higher Group B IQR is smaller However mention of distance can gain the mark eg Group A median distance was higher/better		 B0 B0 B1

Q	Answer	Mark	Comments
6	(36000 – 26575) × 0.09 or 848.25	M1	oe repayment in year 1
	23 700 – their 848.25 or 22 851.75	M1	amount owing on 31 August 2021 before interest added
	their 22 851.75 × 1.034 or 23 628.71 or 23 628.70	M1	oe amount owing 1 September 2021 their 22 851.75 can be 23 700 but cannot be 848.25
	[(37 000) – (26 575)] × 0.09 or 938.25	M1	new annual repayment
	(their 23 628.71 – their 938.25) × 1.034 or 22 690.46 × 1.034	M1	oe
	23 461.92 or 23 461.93 or 23 461.94	A1	SC3 23 523.65 or 23 523.66
	Additional Guidance		
	Adding the interest before deducting the payments can gain up to M3 eg (36000 – 26575) × 0.09 = 848.25 23 700 × 1.034 = 24 505.80 24 505.80 – 848.25 = 23 657.55 [(37 000) – (26 575)] × 0.09 = 938.25 23 657.55 × 1.034 – 938.25 = 23 523.66		 M1 M1 M0 M1 M0A0
	Adding interest to the payment(s) can gain up to M3 eg (36000 – 26575) × 0.09 = 848.25 848.25 × 1.034 = 877.09 23 700 – 877.09 = 22 822.91 [(37 000) – (26 575)] × 0.09 = 938.25 22 822.91 – (938.25 × 1.034) = 21852.76		 M1 M0 M1 M1 M0A0

Q	Answer	Mark	Comments
7(a)	**Alternative method 1**		
	Works out a possible area for a 4-bedroom house eg 10×20 or 11.5×29 or [200, 335]	M1	
	3-bedroom plot assumption of area that is less than their area for 4-bedroom plot eg $300\,m^2$	B1	
	2-bedroom plot assumption of area that is less than their assumption for the 3-bedroom plot eg $250\,m^2$	B1	
	States an approximation for the length and width of the road	B1	pavement must be included length must be between 800 m and 1200 m and width $5.5 + 2 \times 1.35$ or $5.5 + 2 \times 2$
	Their length of road × their width of road eg $800 \times 9.5 = 7600\,m^2$ or 0.76 hectares	M1	their length and width can be any values
	Works out plot used for 2-bedroom houses eg 0.25×20 or 5 or $0.25 \times (20 - \text{their amount for roads})$ eg $0.25 \times (20 - 0.76) = 4.81$ hectares or $48\,100\,m^2$	M1	accept rounding to 5 hectares 2-bedroom can be 25% of total plot or 25% of plot – roads

Q	Answer	Mark	Comments
7(a) cont'd	Assumption of proportional split between 3 and 4-bedroom houses eg (20 – their area for roads – their area for 2-bed houses) ÷ 2 eg (20 – 0.76 – 4.81) ÷ 2 = 7.215	B1	allow rounding
	Calculate number of houses for one of their three areas 2-bedroom eg 48 100 ÷ 250 = 192 or 3-bedroom eg 72 150 ÷ 300 = 240 or 241 or 4-bedroom eg 72 150 ÷ 333 = 216 or 217	M1	must be integer number of houses allow rounding to nearest ten
	Total of their 2, 3 and 4-bed houses eg 192 + 241 + 217 = 650	A1	must be an integer

Alternative method 2 is on the next page

Q	Answer	Mark	Comments
7(a) cont'd	**Alternative method 2**		
	Works out number of 4-bedroom houses per hectare eg 10 000 ÷ (10 × 20) or 50 or 10 000 ÷ (11.5 × 29) or 30	M1	implied by number of houses in range [30, 50]
	Assumption of number of 3-bedroom houses per hectare that is more than their 4-bedroom value eg their 4-bedroom = 40 their 3-bedroom = 45	B1	must be less than their 2-bedroom value
	Assumption of number of 2-bedroom houses per hectare that is more than their 3-bedroom value eg their 3-bedroom = 45 their 2-bedroom = 50	B1	
	State an approximation for the length and width of the road	B1	pavement must be included length must be between 800 m and 1200 m and width 5.5 + 2 × 1.35 or 5.5 + 2 × 2
	Their length of road × their width of road eg 800 × 9.5 = 7600 m^2 or 0.76 hectares	M1	
	Works out plot used for 2-bedroom houses eg 0.25 × 20 or 5 or 0.25 × (20 – their amount for roads) eg 0.25 × (20 – 0.76) = 4.81 hectares or 48 100 m^2	M1	accept rounding to 5 hectares 2-bedroom can be 25% of total plot or 25% of plot – roads
	Assumption of proportional split between 3 and 4-bedroom houses eg (20 – their area for roads – their area for 2 bed houses) ÷ 2 eg (20 – 0.76 – 4.81) ÷ 2 = 7.215	B1	allowing rounding

Q	Answer	Mark	Comments
7(a) cont'd	Calculate number of houses for one of their three areas 2-bedroom eg 5 (hectares) × 50 houses per hectare or 250 or 3-bedroom eg 7.2 (hectares) × 45 houses per hectare or 324 or 4-bedroom eg 7.2 (hectares) × 50 houses per hectare or 360	M1	must be integer number of houses allow rounding to nearest ten
	Total of their 2, 3 and 4-bed houses eg 250 + 324 + 360 = 934	A1	must be an integer
	Additional Guidance		
	Omitting the road and pavement can gain maximum 7 marks		

Q	Answer	Mark	Comments
7(b)	Acceptable explanation Example If the estimate for the area of roads was higher then there would/might have been fewer houses or If the estimate for the area of roads was lower then there would have been more houses. or If the proportion of 4-bedroom houses built was greater than 3-bedroom then there would have been fewer houses built. or If the proportion of 4-bedroom houses built was less than 3-bedroom then there would have been more houses built	B1	must relate to their assumption about the proportion or to their assumption about the amount of land not used for housing
	Additional Guidance		

Q	Answer	Mark	Comments
8(a)	(116 000 – 100 000) ÷ 2 or 8000	M1	
	4500	A1	
	Additional Guidance		

Q	Answer	Mark	Comments
8(b)	37 500 × 0.2 or 7500	M1	basic rate tax
	(150 000 – 37 500) × 0.4 or 45 000	M1	higher rate tax
	(165 000 – 150 000) × 0.45 or 15 000 × 0.45 or 6750	M1	additional rate tax total tax 59 250 implies M3
	(50 000 – 9500) × 0.12 or 40 500 × 0.12 or 4860	M1	basic NI
	(165 000 – 50 000) × 0.02 or 115 000 × 0.02 or 2300	M1	higher NI total NI 7160 implies M2
	their 7500 + their 45 000 + their 6750 + their 4860 + their 2300 or 59 250 + 7160	M1	totals their tax and NI values – at least one of each

8(b) cont'd	66 410	A1	total tax and NI
	their 66 410 ÷ 165 000 or 0.402… or $\frac{2}{5}$ × 165 000 or 66 000	M1	
	0.402 and Yes or 66 410 and 66 000 and Yes	A1ft	ft their 66 410
	Additional Guidance		

Q	Answer	Mark	Comments
9(a)	**Alternative method 1**		
	evidence of correct fd scale scale marked with 1cm = 10 or height 16 seen or used for 4.5-6 bar or height 34 seen or used for 6-10 bar or 0.8 × 20	M1	may be implied implied by 16 on top parts of 6 -10 bar
	1.5 × 16 or 0.25 × 96 or 1.2 × 20 or 24	M1	oe total for 4.5 to 6 implies first M1
	4 × 34 or 6 × 20 + 4 × 4 or 6 × 20 + 2 × 8 or 6.8 × 20 or 136	M1	oe total for 6 to 10 implies first M1
	160	A1	
	Alternative method 2		
	3.75 × 8 or 30	M1	number of little squares for 4.5-6
	10 × 17 or 170	M1	number of little squares for 6-10
	(their 30 + their 170) × $\frac{20}{25}$ or 200 × 0.8	M1	correct use of scaling
	160	A1	
	Additional Guidance		

Q	Answer	Mark	Comments
9(b)	Frequency density 96 ÷ 4 or 24 or 96 ÷ 0.8 or 120 (small squares) or 96 ÷ 8 or 12 (rows of ten)	M1	
	Correct bar drawn width from 10 to 14, height 2.4 cm	A1	$\pm \frac{1}{2}$ square
	Additional Guidance		

Q	Answer	Mark	Comments
10	**Alternative method 1**		
	0.205 or 1.205 seen or used	M1	
	$1200 = \frac{A}{1 + \text{their } 0.205} + \frac{A}{(1 + \text{their } 0.205)^2}$	M1	oe their 0.205 must have digits 205 and be less than 1 eg 0.0205 used
	1200 = their $0.83A$ + their [0.688, 0.69]A or 1200 = [1.5187, 1.52] A	M1dep	calculates 1÷ their 1.205 and (1 ÷ their 1.205) ^{2} dep on 2nd M1
	1200 ÷ their 1.52 or [789.47, 790.15]	M1dep	dep on 2nd and 3rd M1
	790	A1	
	Alternative method 2		
	0.205 or 1.205 seen or used	M1	
	$1200 = \frac{A}{1 + \text{their } 0.205} + \frac{A}{(1 + \text{their } 0.205)^2}$	M1	oe eg 1.205 used their 0.205 must have digits 205 and be less than 1 eg 0.0205 used
	$1200 = \frac{\text{their } 1.205A + A}{\text{their } 1.205^2}$	M1dep	oe dep on 2nd M1
	$\frac{1200 \times \text{their } 1.205^2}{\text{their } 2.205} = A$ or 790.2…..	M1dep	oe dep on 2nd and 3rd M1
	790	A1	
	Additional Guidance		