Level 3 Certificate
MATHEMATICAL STUDIES
1350/2A

Paper 2A Statistical techniques

Mark scheme

June 2021

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Q	Answer	Mark	Comments
1 (a)	1 : 3	B1	

Q	Answer	Mark	Comments
1 (b)	**Statement 1**		
	5810 + 6900 + 7640 or 20 350	M1	
	their 20 350 × 27 000 or 549 450 000 or 500 000 000 ÷ 27 000 or 18 518(…) or 500 000 000 ÷ their 20 350 or 24 570(…)	M1dep	
	549 450 000 **and** Yes or 18 518(…) **and** 23 500 **and** Yes or 24 570(…) **and** Yes	A1	SC2 543 240 000 **and** Yes SC1 543 240 000
	Statement 2		
	Alternative method 1		
	2615 ÷ 5810 (× 100) or 0.45(0…) (× 100) or 45(.0…)% and 5450 ÷ 7640 (× 100) or 0.71(3…) (× 100) or 71.(3…)%	M1	
	their 0.45 × 1.5 or 0.675 or their 45 × 1.5 or 67.5 or their 0.71 ÷ their 0.45 or 1.57… or their 71 ÷ their 45 or 1.58	M1dep	oe
	Yes **and** 1.57… or 1.58 or Yes **and** 0.71 **and** 0.675 or Yes **and** 71 **and** 67.5	A1	

1 (b) cont'd	**Alternative method 2**		
	5810 ÷ 2615 (× 100) or 2.22(1…) (× 100) or 222(.1…)% and 7640 ÷ 5450 (× 100) or 1.40(1…) (× 100) or 140(.1…)%	M1	
	their 2.22 ÷ 1.5 or 1.48 or their 222 ÷ 150 or 1.48 or their 2.22 ÷ their 1.40 or 1.58… or their 222 ÷ their 140 or 1.58… or 1.59	M1dep	oe
	Yes **and** 1.58 or 1.59 or Yes **and** 1.40 **and** 1.48 or Yes **and** 140 **and** 148	A1	
	Additional Guidance		
	Statement 2 award the first M1 seen even if not subsequently used		

Q	Answer	Mark	Comments
2(a)	Add extra value(s) to the scale (eg every 10% to Chart 1 or add 1.0 to Chart 2) Move the million tonnes label from the title to the vertical axis Label the axes Show actual numbers on the charts Use a grid so values can be read more accurately Explain what 'EU28' on Chart 1 stands for Move the/Add a y-axis on the left-hand side of the graph	E2	E1 for each valid improvement with up to a maximum of E2 ignore any additional but incorrect suggestions SC1 two errors identified but no suggestions for improvement

Q	Answer	Mark	Comments
2(b)	No key for abbreviation WWF/EU Years used for comparison vary each time Some data were not shown/missing (eg other exports to countries) The article is inconsistent with mixed % and numbers/figures The latest estimates available are several years before the publication of the briefing paper and so may be out of date / no longer representative The different streams make it difficult to understand the full picture, especially across the official and WWF figures The term 'waste stream' is undefined Sweden and the Netherlands are not larger than the UK in terms of population Netherlands isn't larger than the UK in terms of area They do not list all the different types of treatment (it just says etc)	E3	oe E1 for each valid reason
	Additional Guidance		
	Suggested improvements can imply the reason Too many percentages and/or figures scores E0		

Q	Answer	Mark	Comments
2 (c)	**Ecofriends**		
	Alternative method 1		
	122 400 – 53 400 or 69 000	M1	
	their 69 000 ÷ 122 400 × 100 (%) or 56.(3…) or 56.4	M1dep	
	56.(3…) or 56.4 (%) **and** No/false/incorrect/invalid	A1	condone –56.(3…) or –56.4 (%)
	Alternative method 2		
	53 400 ÷ 122 400 or 0.43(…) or 0.44	M1	
	(1 – their 0.43(…)) × 100 (%) or 56.(3…) or 56.4	M1dep	
	56.(3…) or 56.4 (%) **and** No/false/incorrect/invalid	A1	condone –56.(3…) or –56.4 (%)
	Alternative method 3		
	122 400 × 0.6 or 73 440	M1	oe
	122 400 – their 73 440 or 48 960	M1dep	
	48 960 **and** No/false/incorrect/invalid	A1	
	Alternative method 4		
	100(%) – 60(%) or 40(%) or 0.4 seen	M1	oe
	122 400 × their 0.4 or 48 960	M1dep	
	48 960 and 53 400 **and** No/false/incorrect/invalid	A1	

Q	Answer	Mark	Comments
2 (c) cont'd	**Greenusers**		
	Alternative method 1		
	1.53 ÷ 1.24 or 1.23(…)	M1	oe eg working in tonnes
	1.53 – their 1.23(…)	M1dep	
	0.3 or 0.296(…) (million tonnes) or 296 129 **and** Yes/true/correct/valid	A1	
	Alternative method 2		
	(1.53 – 0.3) × 1.24 or 1.52(5…)	M2	oe eg working in tonnes
	1.52(5…) **and** Yes/true/correct/valid	A1	
	Alternative method 3		
	1.53 ÷ (1.53 – 0.3) or 1.243(9….)	M2	oe eg working in tonnes
	24.3(9…) or 24.4 **and** Yes/true/correct/valid	A1	

Q	Answer	Mark	Comments
2 (d)	No units on y-axis One of the bars is incorrect (Malaysia) No title for the graph Not showing all other countries to make up to 100% The y-axis says 'Amount' rather than 'Percentage' All bars are wrong because the vertical axis states amount	E2	E1 for each valid error identification of errors may be implied by suggestions for improvement
	Additional Guidance		
	Allow two errors in one answer space Ignore incorrect statement if non-contradictory		

Q	Answer	Mark	Comments
3(a)	(a single value given as) an estimate of the mean or any other statistical value of a population obtained from a sample taken from the population	E2	E1 an estimate of the population mean/any other statistical value or estimate of the mean/any other statistical value taken from a sample

Q	Answer	Mark	Comments
3(b)(i)	154, 159, 179, 168, 167 selected **and** 165.4 (cm) or 163, 161, 172, 168, 174 selected **and** 167.6 (cm)	B2	B1 154, 159, 179, 168, 167 selected or 163, 161, 172, 168, 174 selected or correct mean calculated for their five selected numbers

Q	Answer	Mark	Comments
3(b)(ii)	Increasing the sample size	E1	oe

Q	Answer	Mark	Comments
4(a)	39	B1	

Q	Answer	Mark	Comments
4(b)	95% value → 1.96	B1	1.96 can be implied in C.I calculation
	39 ± their 1.96 × √290 ÷ √14 or 39 ± 1.96 × 4.55(…) or 39 ± 8.92(…)	M2	M2 for correct equation using their 39 and their 1.96 M1 for one error in the equation
	([29.9, 30.2], [47.9, 48.2])	A1ft	ft their 39 and their 1.96 accept only 25, 33 or 49 for 39
	Additional Guidance		
	If candidates use 290 or 14 instead of √290 or √14 can score B1 M1 A0 only However, if both 290 and 14 used instead of √290 and √14 can score B1 only		
	Premature rounding or truncating (eg √14 = 4) leading to an inaccurate answer only gains method marks		

Q	Answer	Mark	Comments
4(c)	Exact weight/mean weight unknown or value rounded to nearest kg or 1.96 has been rounded	B1	oe

Q	Answer	Mark	Comments
4(d)	45 lies within the 95% confidence interval	B1ft	ft their CI
	Yes or correct or right or Insufficient evidence to comment on the claim being correct or incorrect	E1ft	ft their statement about 45
	Additional Guidance		
	If they did not write a confidence interval in part 4b, then part 4d scores 0		

Q	Answer	Mark	Comments
5(a)(i)	For the algebra/calculus scores, as one variable increases, there is a higher/greater chance of the second variable increasing (compared to the algebra/statistics scores) or The points on the algebra/calculus graph would be closer to a straight increasing line than the points on the algebra/stats graph	E2	oe E1 as one variable increases, the other increases too or points lie closer to a straight line or increasing line or pmcc closer to 1

Q	Answer	Mark	Comments
5(a)(ii)	$a \rightarrow c$ pmcc $\rightarrow$ 0.9(0 …)	B1	
	$a \rightarrow s$ pmcc $\rightarrow$ [0.766, 0.77]	B1	
	0.902 > 0.766 or 0.902 is closer to 1	E1ft	SC1 Line of best fit drawn or by rough eye followed by a statement that all points much closer to the line of best fit for $a \rightarrow c$ than $a \rightarrow s$ ft their pmcc

Q	Answer	Mark	Comments
5(b)(i)	c = [3.1, 3.14] + [0.7, 0.74] a	B2	allow use of x and y allow $c = 3 + 0.7a$ do not allow c = [3.1, 3.14] + – [0.7, 0.74] a B1 [3.1, 3.14] or [0.7, 0.74] seen

5(b)(ii)	Correct line drawn from a = 22 to a = 88	B2ft	ft their equation ± ½ square B1 one correct point identified or plotted
	Additional Guidance		
	No regression equation stated in part 5bi, then part 5bii scores B0 unless a fully correct regression line is drawn, then 5bii scores B2		

Q	Answer	Mark	Comments
5(c)(i)	(51 − 16.8) ÷ 0.55	M1	
	62.18(…) or 62.2 or 62	A1	

Q	Answer	Mark	Comments
5(c)(ii)	Substitutes a = 62.18(…) into their equation to find c e.g. 3.1 + 0.73 × their 62.18(…) or reads the value of c at a = their 62.18(…) on their regression line drawn in 5bii	M1	ft their equation from **5b(i)** and their 62.18(…)
	Substitutes s = 51 into their equation to find c (c =) 0.930 + 0.934 × 51	M1	
	Calculates their correct value for c using method 1 **and** 48.5(64) or 48.6 or 49 **and** yes/no	A2ft	A1 calculates their correct value for c using method 1 **and** 48.5(64) or 48.6 or 49 **and** incorrect decision or without decision or one correct value **and** correct decision for their values ft their equation from **5b(i)** or regression line in **5bii** and their 62.18(…)

Q	Answer	Mark	Comments
6(a)(i)	0.5	B1	oe fraction, decimal or percentage

Q	Answer	Mark	Comments
6(a)(ii)	($z =$) (290 – 275) ÷ 12 or 1.25 or [0.894, 0.895]	M1	condone (275 – 290) or –1.25 can be implied by correct answer
	[0.105, 0.106]	A1	oe fraction, decimal or percentage
	Additional Guidance		
	[0.105, 0.106] seen without method or contradiction score full marks		

Q	Answer	Mark	Comments
6(a)(iii)	0.97725 seen or used or 0.02275	M1	
	2 × (1 – 0.97725) or 2 × 0.02275 or 0.0455	M1dep	
	0.9545	A1	SC1 for stating that approx. 95% of values lie within 2 sds of the mean

Q	Answer	Mark	Comments
6(b)	0.52(…) seen	B1	condone –0.52 implied by correct answer
	$(n - 275) \div 12 =$ their 0.52(…) or [281.2, 281.3] seen	M1	oe correct equation using any letter
	281	A1	
	Additional Guidance		
	281 seen without method or contradiction award full marks		

Q	Answer	Mark	Comments
6(c)	$(z =)$ (270 – 275) ÷ 15 or –0.33(…) or [0.629, 0.631]	M1	condone (275 – 270) or 0.33(…)
	80 ÷ P($z >$ their– 0.33) or 80 ÷ their [0.629, 0.631]	M1	can be implied by correct answer
	127	A1	