



SET Z

Level 3 Certificate
MATHEMATICAL STUDIES

Paper 2A

Mark scheme

Glossary

The marking scheme is given to indicate roughly where marks are likely to be awarded. The scheme does not necessarily reflect the precise allocation of marks that would be used by AQA Examining teams.

M	Method marks: awarded for evidence of a correct method which could lead to a correct answer.
A	Accuracy marks: awarded for a correct answer that follows from a correct method. To get these marks a correct method must be explicitly or implicitly shown; a correct answer alone gets no marks.
B	Marks that are awarded independently of any method.
ft	Follow through: marks awarded for an answer that uses correct working following a mistake in an earlier step.

Mark scheme Paper 2A

Question	Answer	Mark
1 (a)	James has omitted the 0 and two 35s from his stem-and-leaf diagram / the stem-and-leaf diagram only shows 27 of the 30 data values collected. This has led to an incorrect median.	B1
	Possible improvements (any 2): Include a key. Give more information in the title to show what the stem-and-leaf diagram is about. Ask students to record times for more than one day.	B2
1 (b)	Median = $\frac{39 + 41}{2} = 40$ minutes	M1 A1
2	The Transport Price Index includes many forms of transport, not just rail. Lucy has assumed that changes in rail costs are in line with this general price index.	B1
	The calculation of 14.3% is correct, but this increase is 14.3% of the base year price (when the CPI was 100), not a 14.3% increase of the 2010 price.	B1
	Lucy also subtracted incorrectly: $480 - 68.64 = 411.36$ (not 412.36)	B1
	2010 price = $\frac{122.1}{136.4} \times 480 = 429.68 \approx \text{£}430$ (Other methods are possible.)	M1 A1
3 (a) (i)	$365 \text{ (or } 366) \times 1.25 \div 1.5 = \text{£}304 \text{ or } \text{£}305 \text{ (nearest pound) or approx } \text{£}300$	M1 A1
3 (a) (ii)	The newspaper report must be about relative poverty, as $\text{£}300$ per annum is far lower than household incomes in the UK.	B1 B1
3 (b)	Median disposable, equivalised household income = 50th percentile = $\text{£}319$	B1
	Relative poverty threshold = 60% of $\text{£}319 = \text{£}191.40$ The 'children in poverty' are those living in households with incomes less than $\text{£}191.40$	M1 A1
	Suppose median household income fell, to say $\text{£}300$, whilst the incomes at the bottom end of the scale remained the same.	B1
	60% of $\text{£}300 = \text{£}180$, so only those living in households with incomes less than $\text{£}180$ would now be said to be living in poverty. This would be fewer households than before, so the official spokesperson is correct.	B1 B1
	(From the table there are now less than 20% below the poverty threshold whereas previously there were more than 20%.)	

4 (a)	$100 \times \frac{18}{37} \approx 49$	M1 A1
4 (b)	$P(B < 34.5) = P\left(z < \frac{-14.1}{5}\right) = P(z < -2.82)$	M1 A1
	$= 1 - \Phi(2.82) = 1 - 0.9976$	M1 A1
	$= 0.0024$	B1
4 (c)	If the wheel were fair, then the chance of fewer than 35 black numbers occurring would be less than 0.24%.	B1
	The chance of obtaining 33 black numbers is therefore so small that there are, at least, grounds for concern about bias.	B1
5 (a)	The population is the set of all the items under consideration (or about which information is sought).	B1
5 (b)	Method in which each orange has an equal chance of being selected.	B1
	Description (eg number the oranges, then use random number tables or a random number generator to select the sample).	B1
5 (c)	Standard error $= \frac{12}{\sqrt{10}} = 3.7947\dots$	M1 A1
	$z = 1.65$ (or 1.64 or 1.645)	B1
	$[201 - 1.65 \times 3.7947\dots, 201 + 1.65 \times 3.7947\dots]$	M1
	$= [195, 207]$ (g) (to 3sf)	A1 A1
6 (a)	$\frac{4}{\sqrt{6}} \approx 1.633 = 1.63$ (3sf)	M1 A1
	This is the standard deviation of the mean times of all possible samples of size 6.	B1
6 (b)	The mean of the sample must be less than 10 minutes. The distribution is $N(11, 1.63^2)$. $P(T < 10) = P\left(z < \frac{-1}{1.633}\right) = P(z < -0.6124)$	M1 A1
	$= 1 - 0.7291$	M1 A1
	≈ 0.271	B1
7 (a) (i)	pmcc = -0.644 (3sf)	B1
7 (a) (ii)	This indicates fairly strong negative correlation.	B1
	This means that the relationship between the quantity sold and the price is quite strong with the quantity sold falling as the price rises.	B1
7 (b)	The correlation is still negative, but less strong for barley. This indicates that the quantity sold and the price are less strongly related for barley. (Demand for barley is less responsive to changes in prices than for wheat.)	B1
7 (c) (i)	$Q = 1620 - 8.13 \times 170 = 238$ tonnes (3sf)	M1 A1
7 (c) (ii)	£170 is outside the range of the given data. Allow 'Extrapolating is unreliable'.	B1

8 (a)	$y = 0.190n + 27.1$ (to 3sf)	B1 B1																													
	$\bar{x} = 48.5$ and $\bar{y} = 36.4$	B1																													
	<p style="text-align: center;">Aston Villa 2000–2015 Scatter graph of average home attendances against points</p> <p>The scatter graph displays the relationship between the number of points earned and the average home attendance at Aston Villa from 2000 to 2015. The x-axis represents the number of points, ranging from 35 to 65. The y-axis represents the average attendance in thousands, ranging from 33 to 41. A line of best fit is drawn through the data points, with the equation $y = 0.1904x + 27.129$ and a coefficient of determination $R^2 = 0.71684$.</p> <table border="1"> <caption>Data points from the scatter graph</caption> <thead> <tr> <th>Number of points</th> <th>Average attendance (thousands)</th> </tr> </thead> <tbody> <tr><td>38</td><td>34.0</td></tr> <tr><td>38</td><td>34.1</td></tr> <tr><td>38</td><td>36.1</td></tr> <tr><td>41</td><td>34.1</td></tr> <tr><td>41</td><td>35.1</td></tr> <tr><td>45</td><td>35.0</td></tr> <tr><td>47</td><td>37.4</td></tr> <tr><td>48</td><td>37.2</td></tr> <tr><td>50</td><td>35.0</td></tr> <tr><td>50</td><td>36.2</td></tr> <tr><td>56</td><td>36.6</td></tr> <tr><td>60</td><td>40.0</td></tr> <tr><td>62</td><td>39.8</td></tr> <tr><td>64</td><td>38.6</td></tr> </tbody> </table>	Number of points	Average attendance (thousands)	38	34.0	38	34.1	38	36.1	41	34.1	41	35.1	45	35.0	47	37.4	48	37.2	50	35.0	50	36.2	56	36.6	60	40.0	62	39.8	64	38.6
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	Line through mean point (within 1 square)	B1 ft																													
	Line through one other calculated point eg (40, 34.7) (within 1 square)	B1 ft																													
8 (b)	Gradient of Aston Villa line (0.19) is greater than that for Tottenham Hotspur (0.017).	B1																													
	This suggests an increase in average attendance of 190 for each extra point in a season at Aston Villa, but only 17 at Tottenham Hotspur.	B1																													