SPECIMEN MATERIAL

Level 3 Certificate MATHEMATICAL STUDIES 1350/2C

Paper 2C – Graphical techniques

Mark scheme

Specimen

Version 1.1

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 Assessment Writer.

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.

Further copies of this mark scheme are available from aqa.org.uk

Principal Examiners have prepared these mark schemes for specimen papers. These mark schemes have not, therefore, been through the normal process of standardising that would take place for live papers.

Further copies of this Mark Scheme are available from aqa.org.uk

Glossary for Mark Schemes

Examinations are marked in such a way as to award positive achievement wherever possible. Thus, for mathematics papers, marks are awarded under various categories.

If a student uses a method which is not explicitly covered by the mark scheme the same principles of marking should be applied. Credit should be given to any valid methods. Examiners should seek advice from their senior examiner if in any doubt.

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M	mark is for method
dM	mark is dependent on one or more M marks and is for method
A	mark is dependent on M or m marks and is for accuracy
B	mark is independent of M or m marks and is for method and accuracy
E	mark is for explanation
ft	follow through from previous incorrect result
CAO	correct answer only
CSO	correct solution only
AWFW	anything which falls within
AWRT	anything which rounds to
ACF	any correct form
AG	answer given
SC	special case
OE	or equivalent
A2,1	2 or 1 (or 0) accuracy marks
PI	possibly implied
SCA	substantially correct approach
c	candidate
sf	significant figure(s)
dp	decimal place(s)

Q	Answer	Mark	Comments
1	the numbers in column D can be automatically calculated by using a sum formula to add those in columns B and C or cell D3 should be 23 or cell D3 has not been added up correctly or cell B3 or Cell C3 may have the wrong value as they don't add up to 33	B1	
	comments on sampling. eg sample size too small or he has not asked the whole class	B3	B1 each correct statement
	no time period is given so an average per day cannot be calculated		
	comments on lack of average, eg.no averages mentioned: texts per person per day or similar is expected or totals cells needed/cell with formula to calculate average		
	collection of texts received is irrelevant		

Q	Answer	Mark	Comments
Alt 1 **2**	3 × 66 000 = 198 000 (not 188 000)	B1	This is the amount the bank will lend him.
	Pete should divide by 0.9 (instead of multiplying by 0.9)	B1	This is to find the maximum house price he can afford. There is no purpose to the multiplication done.
	(£) 220 000	B1	This is the maximum price he can afford for a house.
Alt 2 **2**	188 000 ÷ 3 ≠ 66 000	B1	
	$\frac{188000}{90}\times 100$ or $\frac{198000}{90}\times 100$	B1	
	(£) 220 000	B1	This is the maximum price he can afford for a house.

3(a)	says that the complaint was justified and gives any two of the following reasons • column headings needed • the last column should be stated to be percentages • the last but one column should be stated to be votes received • all candidates should be listed • the total electorate should be stated • the percentage turnout is omitted	E2	or equivalent E1 says that the complaint was justified and gives one correct reason (ignore any incorrect reasons given) or gives two correct reasons but does not say that the complaint was justified

Q	Answer	Mark	Comments
3 (b)	calculates 2010 electorate: 51 228 ÷ 0.714 or [71 740, 71750]	M1	oe
	uses their 2010 figure to make a sensible estimate of the 2014 figure and makes a valid conclusion based on 50% of their electorate	A1	eg assumes the electorate remains stable and compares half of their electorate assumes an increase in electorate and compares half of their increased electorate SC1 says that as we are not told the number of registered voters in 2014 we cannot say if half did not vote
	says that UKIP did make the biggest numerical gain and gives evidence	E1	relevant figures are: Conservative – 10 159 Labour – 4596 Liberal – 9242 UKIP + 8074 condone 'UKIP' were the only ones of the four parties from 2010 to increase their vote there is no need for a comment about the parties who did not take part in 2010, but accept any correct comment eg the other parties cannot have increased their vote beyond the 1891 of the independent candidate
	or says that UKIP did make the biggest percentage gain and gives evidence		relevant figures are: Conservative – 8.9(%) Labour – 4.6(%) Liberal – 17.4(%) UKIP + 22.1(%) condone 'UKIP' were the only ones of the four parties from 2010 to increase their vote there is no need for a comment about the parties who did not take part in 2010, but accept any correct comment eg the other parties cannot have increased their vote beyond the 4.9% of the independent candidate

Q	Answer	Mark	Comments
3(c)	Jenrick (Conservative)		
	Conservatives did gain a majority, however more people voted against them (47.65) than for them (45%)	E2	full well communicated comment putting both sides E1 for partial explanation eg Jenrick was correct as Conservatives gained more votes than any other party or Jenrick is wrong as more people voted against the government (46.7%) than for the government (45%) or the government is a coalition so including the Liberal Democrat percentage gives the government an even bigger majority (47.6%)
	Helmer (UKIP)		
	any comparison of 3.8 and 25.9	M1	no credit for result in general election approx factor of 5 as not a justification
	$\frac{25.9}{3.8} \approx 6$ so he is right or 25.9 ÷ 3.8 is approx 7 so he is wrong or 6 × 3.8 = 22.8 so it's more than a factor of 6	A1	can conclude they agree or disagree with Helmer with correct reasoning
	any comparison of $7\,403$ and $16\,152$	M1	
	$\frac{7403}{16152} \approx \frac{1}{2}$ or 16152 ÷ 2 = 8076 and yes / they more than halved the majority	A1	
	Payne (Labour)		
	various sensible numerical arguments are possible, for example • reference to the $45.0\,\%$ being less than half	E1	

	• only a quarter of the electorate voted **against** the Conservative candidate		
	clearly communicated answers with links to each candidate's statement and numerical justifications	B1	

Q	Answer	Mark	Comments
Alt 1 4	110 + 221 or 331	M1	
	their 331 ÷ 8 × 5 or 206(.875) or 207	M1	
	their 206.875 × 0.9 or 186.2 or their 206.872 × 0.1 or 20.7	M1	
	their 186.2 ÷ 75 or [2.48, 2.5] and their 20.7 ÷ 40 or [0.5, 0.52]	M1	[2 hours 28 mins, 2 hours 30 mins] [30 mins, 32 mins]
	their 2.48 + their 0.5 or 2.98 (hours) or their 2 hours 28 mins + their 30 mins	M1	[2.98, 3] [2 hours 58 mins, 3 hours]
	9.00 am + 6 hours + their 2 hours 58 mins	M1	9.00 am + their [8 hours 58 mins, 9 hours]
	[5.58 pm, 6 pm] and yes	A1	condone any indication that his arrival time may be affected by other factors
Alt 2 4	110 + 221 or 331	M1	
	their 331 × 0.9 or [297, 298] or their 331 × 0.1 or [33, 33.1]	M1	
	their 75 ÷ 5 × 8 or 120 or their 40 ÷ 5 × 8 or 64	M1	
	their 298 ÷ 120 or [2.48, 2.5] and their 33 ÷ 64 or [0.5, 0.52]	M1	[2 hours 28 mins, 2 hours 30 mins] [30 mins, 32 mins]
	their 2.48 + their 0.5 or 2.98 (hours) or their 2 hours 28 mins + their 30 mins	M1	[2.98, 3] [2 hours 58 mins, 3 hours]
	9.00 am + 6 hours + their 2 hours 58 mins	M1	9.00 am + their [8 hours 58 mins, 9 hours]
	[5.58 pm, 6 pm] and Yes	A1	condone any indication that his arrival time may be affected by other factors

Q	Answer	Mark	Comments
5(a)	this statement cannot be made	B1	"She might be" "I can't say"
	as no scale given on the vertical axis of the graph	E1	
Alt 1 **5(b)**	bar A	E1	mark only awarded if correct reasoning given
	the sales are decreasing	E1	
	investment will hopefully reverse this trend	E1	oe if student talks about functions
Alt 2 **5(b)**	bar B	E1	mark only awarded if correct reasoning given
	sales are already improving	E1	
	investment will hopefully help to continue this trend	E1	oe if student talks about functions

Q	Answer	Mark	Comments
Alt 1 **6(a)**	16, 64, 144, 256, 400	B1	values of T^2 allow mark for correct including these values on the graph
	points plotted on graph at least 3 points correctly ± 2 mm	B1ft	ft their values
	line correct from at least T^2 = 0 to 400	B1	1 ruled line up to 1 mm thick
	$1.0 < b < 1.5$	B1	allow substitution to find a if a point **on the line** is used
	evidence of measurements of "Δx and Δy"	M1	if a and b are transposed or not assigned B0M1A0 max
	a = 0.018 to 0.025	A1	
Alt 2 **6(a)**	$1.5 = 16a + b$	B1	B1 one equation based on one data point
	$9.5 = 400a + b$	B1	B1 second equation based on a different data point
	$384a = 8$	B1	B1 correct difference between equations B1 correct value for a
	$a = 8/384 = 0.02$	B1	
	$b = 7/6 = 1.17$	M1A1	M1 using value of *a* to find *b* A1 correct value for *b*
6(b)	their 0.02×24^2 + their 1.17 or their 0.02×576 + their 1.17 or [12.65, 13.2]	M1	
	their $12.69 \times 23\,000$	M1	
	[290 950, 303 600]	A1	
6(c)	percentage share cannot exceed 100	B2	"M would become too large" B1 general comment on extrapolation B1

Q	Answer	Mark	Comments
7(a)	increasing, curved the right way	B1	ignore anything drawn for $t < 0$
	(0, 4000)	B1	y-intercept = 4000
7(b)	$4000 \times e^{(0.034 \times 6)}$ or $4000 \times e^{0.204}$	M1	
	4905	A1	accept any integer in the range 4900 to 4910 for M1A1 but any decimal in same range M1A0
7(c)	$(8000 = 4000 \times e^{0.034t})$	M1	
	$2 = e^{0.034t}$ $0.034t = \ln 2$	M1	for taking logs correctly
	20.4 (hours) [20.38, 20.4]	A1	accept 20, 20.3 or 21 with working trial and improvement give 3 marks for 20.4, or 2 marks for 20 or 21. NMS AWRT 20.4, 20 hours 24 mins, 20 hours, 23 mins score M1M1A1 but anything else scores zero
7(d)	yes	B1	mark only awarded if correct reasoning given
	$2N = Ne^{0.034t}$ $t = \frac{\ln 2}{0.034}$ $t = 20.4$	B2	B1 for considering other numerical values to reach conclusion B2 for using algebra to show that for any value it will always be true ie some credit for trying say 3000 to 6000, but more credit for those who can generalise

Q	Answer	Mark	Comments

Alt 1

8

numerical method:

t	*s*	*v*	*a* ($m\ s^{-2}$)
0	0	0	
0.2	0.20	1.96	9.76
0.4	0.78	3.90	9.72
0.6	1.76	5.84	9.68
0.8	3.12	7.78	9.64
1.0	4.86	9.70	
1.2	7.00		

Mark	Comments
M1	M1 using numerical method to get estimates of the velocity
A1	A1 initial value of zero for *v*
A1	A1 other values as in table
M1	M1 using numerical method to get estimates of the acceleration
A1	A1 values that show acceleration decreasing
B1	B1 correct units of acceleration
A1	A1 comment to explain what is happening eg acceleration decreases slightly as the ball falls

Alt 2

8

graphical method:

use given table to draw distance-time graph	B1	
draw tangents to given *t* values to estimate gradients gradients are the velocities	M1 A2	1.96, 3.90, 5.84, 7.78, 9.70 all ± 1.0
use calculated velocities to draw a velocity-time graph	B1	
state acceleration is approximately constant with reason	B1 B1	 graph is nearly a straight line

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