SPECIMEN MATERIAL

Level 3 Certificate
MATHEMATICAL STUDIES
1350/1

Paper 1

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.

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
1a	sample size too small sample not stratified/ not taken in proportion to group size may be helpful to select according to age may be helpful to select according to length of experience may be helpful to select according to full time/part time	B2	 oe B1 for one reason B2 for two distinct reasons
Alt 1 **1b**	sample size of at least 20 recommended	B1	
	stratified sample	B1	
	their sample size × $\frac{130}{197}$ or their sample size × $\frac{58}{197}$ or their sample size × $\frac{9}{197}$	M1	
	correct values for each department based on their sample size	A1	allow rounding or truncation of any value as long as total is correct
Alt 2 **1b**	sample size of at least 20 recommended	B1	
	systematic sample	B1	
	explains how staff are listed	M1	
	explains that the nth person is chosen	A1	this must result in the correct sample size

Q	Answer	Mark	Comments
Alt 3 1b	sample size of at least 20 recommended	B1	
	random sample	B1	
	explains how the staff will be individualised	M1	eg names written on paper and put in a box staff numbered
	method of selection explained	A1	eg owner picks names from box at random random number generator used
2a	Annual Equivalent Rate	B1	
Alt 1 2b	attempt at $1000 \times 1.04^{any\ value}$	M1	eg $1000 \times 1.04^{10} = 1480(...)$
	attempt at value to give improved answer closer to 2000	M1	eg if 10 used tries number larger than 10 if first answer is more than 2000 then next trial must reduce the number of years
	18 (years)	A1	
Alt 2 2b	4% simple interest $\Rightarrow$ 100% gain after 25 years so less than 25 years or min £40 per year and $1000 \div 40 = 25$	M1	
	trial with $n < 25$ eg $1000 \times 1.04^{20} = 2191.(...)$	M1	
	18 (years)	A1	
Alt 3 2b	4% of 1000 = 40 so after 1 year = 1040	M1	
	4% of 1040 = 41.60 so after 2 years = 1081.60 … after 17 years = [1947, 1948] after 18 years = [2025, 2026]	M1	
	18 (years)	A1	

Q	Answer	Mark	Comments
Alt 4 2b	$1.04^n = 2$	M1	
	n = log2 /log 1.04 = 17.67	M1	
	18 (years)	A1	
Alt 1 3	monthly income = $\frac{£21\,588}{12}$ = (£)1799	M1	dividing by 12
	National Insurance their ((£)1799 – ((£)646) × 0.12 or (£)1153 × 0.12 or (£)138.36	M1	finding amount of NI paid per month
	taxable income = (£)21588 – (£)9440 or (£)12148	M1	
	income tax (0.2 × (£)12148) ÷ 12 or (£)2429.6(0) ÷ 12 or (£)202.47	M1	20% tax rate
	(£)1458.17	A1	
	their (£)1458.17 ÷ 8 rounded correctly to the nearest (£)10 or (£)180	M1	
	their (£)180 × 8 or (£)1440	M1	
	(£)1440 and yes	A1ft	ft their monthly take-home pay

Q	Answer	Mark	Comments
Alt 2 **3**	National Insurance (£)21588 – ((£)646 ×12) or (£)21588 – (£)7752 or (£)13836	M1	finding the amount NI is paid on each year
	their (£)13836 × 0.12 or (£)1660.32	M1	NI paid per year
	taxable income = (£)21588 – (£)9440 or (£)12148	M1	
	income tax their (£)12148 × 0.2 or (£)2429.6(0)	M1	20% tax rate tax paid per year (£)17498.08 implies M4
	(£)1458.17	A1	
	their (£)1458.17 ÷ 8 rounded correctly to the nearest (£)10 or (£)180	M1	
	their (£)180 × 8 or (£)1440	M1	
	(£)1440 and Yes	A1ft	ft their monthly take-home pay
Alt 1 **4 (a)**	(28 +) 32 ÷ 5 × 3 or (28 +) 6.4 × 3 or (28 +) 19.2	M1	draws cumulative frequency diagram or histogram and uses correct method to find UK's position
	47.2 or 47	A1	
	states that the newspaper is (likely to be) incorrect	E1ft	ft their 47.2
	states that the newspaper could be correct with reason	E1ft	eg if 11 or fewer of the 32 countries in the UK's band were above 77 ft their 47.2, but note that this mark cannot be awarded if the decision is unequivocal

Q	Answer	Mark	Comments
Alt 2 **4 (a)**	(12 + 24 + 44 + 53 +) 32 ÷ 5 × 2 or (133 +) 6.4 × 2 or (133 +) 12.8 or 145.8	M1	draws cumulative frequency diagram or histogram and uses correct method to find UK's position
	47.2 or 47	A1	
	states that the newspaper is (likely to be) incorrect	E1ft	ft their 47.2
	states that the newspaper could be correct with reason	E1ft	eg if 11 or fewer of the 32 countries in the UK's band were above 77 ft their 47.2, but note that this mark cannot be awarded if the decision is unequivocal

Q	Answer	Mark	Comments
4 (b)	makes 2 comments about trends eg in all regions the male life expectancy is lower than the female life expectancy the greatest differences between male and female are in Europe and the Americas/the least differences are in Africa	B2	
	compares each gender or regions with the mean eg only 1 region is below the mean for females whereas half the regions are below for males or the majority of regions are above the mean or very close to the mean	B1	can award B2 here if B2 not gained in trends section of mark scheme
	concludes that world region has greater effect on life expectancy and gives valid reason eg Africa is well below the mean for both male and female or there are greater differences between region values than between male/ female values	E1	

Q	Answer	Mark	Comments
4 (c)	oe other units throughout eg miles or steps	B1	
	years/life ≈ 68.5	B1	justified life span
	reasonable starting point eg 10,000 paces per day or km/day ≈ 6 (allow 4-10) or velocity of less than 4 km/hr for a reasonable number of hours per day	B1	justified distance/time unit. Need not be based on days
	'6' × 365 (accept 365.25 or 366)	M1 A1	calculation of scaling factor for units of time from days (as shown) or other units of time to match other calculations
	km/life = km/day × their days /life	M1	scaling up to distance per year from daily, weekly or monthly distances
	km/life ≈ 150 000 (allow 50 000 to 400 000)	A1ft	ft for correct answer to a justified method if paces have been used then final mark can only be awarded if a realistic conversion is made to distance (eg 1 pace = 30 – 80 cm) Award B1 for an answer to a sensible degree of accuracy (1 or 2 sf max)

Q	Answer	Mark	Comments
5 (a)	= (B4 –16 365)*0.09	B2	B1 for B4 – 16 365 B1 for *0.09

5 (b)	Year	Salary (£)	Repayment (£)	Outstanding loan		
	1	17000	57.15	12000 + 240 – 57.15 = 12182.85	M1	any initial value after year 1 × 0.02 (calculate interest)
					A1	correct new loan amount at end of year 2
	2	18500	192.15	12182.85 + 243.66 – 192.15 = 12234.36	M1	correct repayment of 462.15 used for 2017 (Year 4)
					A1ft	all end of year values correct
	3	20000	327.15	12234.36 + 244.69 – 327.15 = 12151.90	B1	after 4 years
	4	21500	462.15	12151.90 + 243.04 – 462.15 = 11932.79		
	5					

Q	Answer	Mark	Comments
Alt 1 **6**	lists cumulative frequencies of (0), 9, 44, 74, 92, 102, 110, 120	B1	
	labels and scales axes for a cumulative frequency diagram	M1	
	plots their points correctly and joins with a smooth curve or straight lines	A1ft	ft their cumulative frequencies
	reads off the median value at 60 runners	M1	Lines may be drawn, but accept correct value
	reads off the lower quartile value at 30 runners and the upper quartile value at 90 runners	M1	Lines may be drawn, but accept correct values
	median [130, 134]	A1ft	ft their cumulative frequency diagram this value may be shown on a box and whisker diagram
	Lower Quartile [112, 116] and Upper Quartile [156, 159]	A1ft	ft their cumulative frequency diagram this value may be shown on a box and whisker diagram
	correct comment made about the fastest and/or slowest times	B1	eg both the fastest and slowest times were slower by over 20 minutes
	correct comment made about the average time, with evidence	B1ft	ft their results eg they were slower on average – the median was about 16 minutes slower
	correct comment about spread	B1ft	ft for their IQR, but not for the range eg the range of times stayed roughly the same the interquartile range was greater by about 16 minutes the interquartile range had increased from 28 to 44

Q	Answer	Mark	Comments
Alt 2 **6**	Identifies lower quartile at 30 and identifies upper quartile at 90	B1	
	$\frac{21}{35}$ × 20 (+ 100) or 12 (+ 100)	M1	
	$\frac{16}{18}$ × 20 (+ 140) or [17, 18] (+ 140)	M1	
	Identifies median at 60	B1	
	$\frac{16}{30}$ × 20 (+ 120) or [10, 11]	M1	
	Median is 130 or 131	A1	
	Lower Quartile 112 and Upper Quartile 157 or 158	A1	
	correct comment made about the fastest and/or slowest times	B1	eg both the fastest and slowest times were slower by over 20 minutes
	correct comment made about the average time, with evidence	B1ft	ft their results eg they were slower on average – the median was about 16 minutes slower
	correct comment about spread	B1ft	ft for their IQR, but not for the range eg the range of times stayed roughly the same the interquartile range was greater by about 16 minutes the interquartile range had increased from 28 to 44

Q	Answer	Mark	Comments
7 (a)	continuous and secondary	B2	B1 one correct and no others ticked or continuous and primary or discrete and secondary
7 (b)	assumptions about waste:		
	size of town/no. of households (*t*) eg 20 000	B1	
	amount of waste per household (per time period) (*w*) eg 0.8	B1	given in cubic units for volume or Litres for capacity
	considered or refined assumption about volume of waste produced or town size eg less than 0.8 due to increased recycling	B1	
	calculation for volume of rubbish to be put into the landfill per year = *t* x *w* x time factor to scale to a year then x 15 for number of years eg 20000 x 0.8 x 15 =240 000 m^3	M1 A1	M1 for calculation that scales to 15 years A1 for correct result
	shape of hole used to model the site: most likely: cube, cuboid or hemisphere but any reasonable shape to be considered eg Cuboid 20 m deep, 120 long by 100 m wide eg Cylinder 20 m deep, radius 62 m	M1 A1	one dimension calculated from volume, with any additional dimensions assumed as necessary overall dimensions clearly stated
	other shapes are acceptable with correct calculations eg waste compacted over time or recycling reduces total waste output per person		

any further or refined assumptions must be considered in the overall calculation but may be seen in earlier working eg	B2	do not give credit for repeat of same assumptions
waste is compacted to increase the site capacity/volume by x amount		
some waste will degrade to increase the capacity/volume		
food waste is collected and disposed of separately		
landfill site modelled as a hole with a mound on top		
are dimensions realistic for the situation?		
increase in proportion of recycling over time