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<br>sample not stratified/ not taken in proportion to group size<br>may be helpful to select according to age<br>may be helpful to select according to length of experience<br>may be helpful to select according to full time/part time | B2 | <br>oe<br><br>B1 for one reason<br>B2 for two distinct reasons |
| **Alt 1**<br>**1b** | sample size of at least 20 recommended | B1 | |
| | stratified sample | B1 | |
| | their sample size × $\frac{130}{197}$<br>or<br>their sample size × $\frac{58}{197}$<br>or<br>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**<br>**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<br>names written on paper and put in a box<br>staff numbered |
| | method of selection explained | A1 | eg<br>owner picks names from box at random<br>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<br>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<br>or min £40 per year and $1000 \div 40 = 25$ | M1 | |
| | trial with $n < 25$<br>eg $1000 \times 1.04^{20} = 2191.(...)$ | M1 | |
| | 18 (years) | A1 | |
| **Alt 3 2b** | 4% of 1000 = 40<br>so after 1 year = 1040 | M1 | |
| | 4% of 1040 = 41.60<br>so after 2 years = 1081.60<br>…<br>after 17 years = [1947, 1948]<br>after 18 years = [2025, 2026] | M1 | |
| | 18 (years) | A1 | |

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

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

| Q | Answer | Mark | Comments |
|---|---|---|---|
| **Alt 2**<br>**4 (a)** | (12 + 24 + 44 + 53 +) 32 ÷ 5 × 2<br>or<br>(133 +) 6.4 × 2<br>or<br>(133 +) 12.8<br>or<br>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<br>if 11 or fewer of the 32 countries in the UK's band were above 77<br>ft their 47.2, but note that this mark cannot be awarded if the decision is unequivocal |

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|---|---|---|---|
| **4 (b)** | makes 2 comments about trends<br>eg in all regions the male life expectancy is lower than the female life expectancy<br>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<br>eg only 1 region is below the mean for females whereas half the regions are below for males<br>or<br>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<br>eg Africa is well below the mean for both male and female<br>or<br>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<br>eg<br>10,000 paces per day<br>or<br>km/day ≈ 6 (allow 4-10)<br>or<br>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<br>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<br>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)<br>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<br>B1 for *0.09 |

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

| Q | Answer | Mark | Comments |
|---|---|---|---|
| **Alt 1**<br>**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<br>this value may be shown on a box and whisker diagram |
| | Lower Quartile [112, 116]<br>and<br>Upper Quartile [156, 159] | A1ft | ft their cumulative frequency diagram<br>this value may be shown on a box and whisker diagram |
| | correct comment made about the fastest and/or slowest times | B1 | eg<br>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<br>eg<br>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<br>eg<br>the range of times stayed roughly the same<br>the interquartile range was greater by about 16 minutes<br>the interquartile range had increased from 28 to 44 |

| Q | Answer | Mark | Comments |
|---|---|---|---|
| **Alt 2**<br>**6** | Identifies lower quartile at 30<br>and<br>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<br>and<br>Upper Quartile 157 or 158 | A1 | |
| | correct comment made about the fastest and/or slowest times | B1 | eg<br>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<br>eg<br>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<br>eg<br>the range of times stayed roughly the same<br>the interquartile range was greater by about 16 minutes<br>the interquartile range had increased from 28 to 44 |

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|---|---|---|---|
| **7 (a)** | continuous and secondary | B2 | B1 one correct and no others ticked<br>or<br>continuous and primary<br>or<br>discrete and secondary |
| **7 (b)** | assumptions about waste: | | |
| | size of town/no. of households (*t*)<br>eg 20 000 | B1 | |
| | amount of waste per household (per time period) (*w*)<br>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<br>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<br>eg 20000 x 0.8 x 15 =240 000 $m^3$ | M1<br>A1 | M1 for calculation that scales to 15 years<br>A1 for correct result |
| | shape of hole used to model the site:<br>most likely: cube, cuboid or hemisphere but any reasonable shape to be considered<br>eg Cuboid 20 m deep, 120 long by 100 m wide<br>eg Cylinder 20 m deep, radius 62 m | M1<br>A1 | one dimension calculated from volume, with any additional dimensions assumed as necessary<br>overall dimensions clearly stated |
| | other shapes are acceptable with correct calculations<br>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 | | |