# GCSE
# MATHEMATICS
# 8300/1F

Foundation Tier Paper 1 Non-Calculator

**Mark scheme**

June 2019

Version: 1.0 Final

*196G83001F/MS*

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.

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**Glossary for Mark Schemes**

GCSE examinations are marked in such a way as to award positive achievement wherever possible. Thus, for GCSE 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** | Method marks are awarded for a correct method which could lead to a correct answer. |
| **A** | Accuracy marks are awarded when following on from a correct method. It is not necessary to always see the method. This can be implied. |
| **B** | Marks awarded independent of method. |
| **ft** | Follow through marks. Marks awarded for correct working following a mistake in an earlier step. |
| **SC** | Special case. Marks awarded for a common misinterpretation which has some mathematical worth. |
| **M dep** | A method mark dependent on a previous method mark being awarded. |
| **B dep** | A mark that can only be awarded if a previous independent mark has been awarded. |
| **oe** | Or equivalent. Accept answers that are equivalent.<br>eg accept 0.5 as well as $\frac{1}{2}$ |
| **[a, b]** | Accept values between a and b inclusive. |
| **[a, b)** | Accept values $a \leq$ value $< b$ |
| **3.14 …** | Accept answers which begin 3.14 eg 3.14, 3.142, 3.1416 |
| **Use of brackets** | It is not necessary to see the bracketed work to award the marks. |

Examiners should consistently apply the following principles

**Diagrams**

Diagrams that have working on them should be treated like normal responses. If a diagram has been written on but the correct response is within the answer space, the work within the answer space should be marked. Working on diagrams that contradicts work within the answer space is not to be considered as choice but as working, and is not, therefore, penalised.

**Responses which appear to come from incorrect methods**

Whenever there is doubt as to whether a student has used an incorrect method to obtain an answer, as a general principle, the benefit of doubt must be given to the student. In cases where there is no doubt that the answer has come from incorrect working then the student should be penalised.

**Questions which ask students to show working**

Instructions on marking will be given but usually marks are not awarded to students who show no working.

**Questions which do not ask students to show working**

As a general principle, a correct response is awarded full marks.

**Misread or miscopy**

Students often copy values from a question incorrectly. If the examiner thinks that the student has made a genuine misread, then only the accuracy marks (A or B marks), up to a maximum of 2 marks are penalised. The method marks can still be awarded.

**Further work**

Once the correct answer has been seen, further working may be ignored unless it goes on to contradict the correct answer.

**Choice**

When a choice of answers and/or methods is given, mark each attempt. If both methods are valid then M marks can be awarded but any incorrect answer or method would result in marks being lost.

**Work not replaced**

Erased or crossed out work that is still legible should be marked.

**Work replaced**

Erased or crossed out work that has been replaced is not awarded marks.

**Premature approximation**

Rounding off too early can lead to inaccuracy in the final answer. This should be penalised by 1 mark unless instructed otherwise.

**Continental notation**

Accept a comma used instead of a decimal point (for example, in measurements or currency), provided that it is clear to the examiner that the student intended it to be a decimal point.

| Question | Answer | Mark | Comments |
|---|---|---|---|
| **1** | reflex | B1 | |
| **2** | $x = 2$ | B1 | |
| **3** | 6 | B1 | |
| **4** | $12 \times \frac{1}{2}$ | B1 | |
| **5(a)** | 382.4<br>or<br>362.42<br>or<br>15.82 | B1 | implied by correct answer of 380.32<br><br>384.48 or 344.52 implies B1<br>(both additions or both subtractions) |
| | 380.32 | B1ft | ft correct evaluation of<br>their 382.4 – 2.08<br>or their 362.42 + 17.9<br>or their 15.82 + 364.5 |
| | **Additional Guidance** | | |
| | Do not apply a misread or allow follow through if this results in a subtraction of either two 2 decimal place values or two 1 decimal place values | | |
| **5(b)** | 18.72 | B1 | oe eg 18.720 |

| Question | Answer | Mark | Comments |
|---|---|---|---|
| 6 | (2, 5) or (8, 5) | B2 | B1<br>correct point indicated on grid<br>or $(x, 5)$ or $(2, y)$ or $(8, y)$,<br>where $x$ can be $x$ or blank or any number other than 13 and $y$ can be $y$ or blank or any number |
| | **Additional Guidance** | | |
| | Mark answer line first, then if no marks scored, check grid for B1 plot | | |
| | No tolerance on values of 2 or 8 for B2 but allow half a square tolerance on plotting for B1 | | |
| 7 | 7 + 5 or 12<br>or 17<br>or 36 | M1 | |
| | 19 or 19.00 | A1 | 19.0 is M1A0 |
| | **Additional Guidance** | | |
| | Ignore names if used | | |
| | Condone £19p or £19.00p | | M1A1 |
| 8(a) | 29 | B1 | |
| | **Additional Guidance** | | |
| | Accept words | | |

| Question | Answer | Mark | Comments |
|---|---|---|---|
| 8(b) | $\frac{4}{50}$ | B1 | oe fraction, decimal or percentage<br>eg $\frac{2}{25}$ 0.08 8% |
| | **Additional Guidance** | | |
| | Ignore attempts to simplify or convert a correct fraction | | B1 |
| | Ignore probability words unless contradictory, eg $\frac{4}{50}$ unlikely | | B1 |
| | 4 out of 50 or 4 in 50 or 4 : 50 is B0<br>however, condone 4 out of 50 or 4 in 50 with a correct fraction, decimal or percentage (together on answer line)<br>but do not accept 4 : 50 with a correct fraction, decimal or percentage (together on answer line) | | B1<br>B0 |
| | $\frac{4}{50}$ seen, but answer 4 | | B0 |

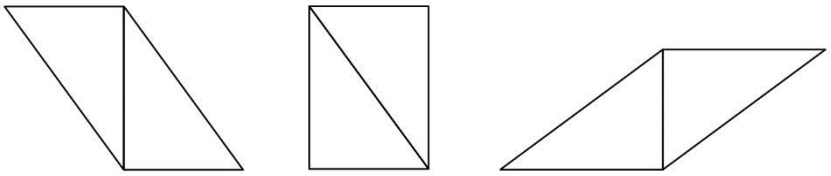
| Question | Answer | Mark | Comments |
|---|---|---|---|
| **8(c)** | 8 + 10 + 14 + 7<br>or 50 – 4 – 7 or 50 – 11 or 39 | M1 | allow one error (but not omission) in the 4 frequencies being added<br>frequencies may be seen as numerators of fractions (as probabilities) – ignore denominators as long as they are all the same and all probabilities are < 1<br>in subtraction method, both frequencies must be correct<br>Condone 51 for 50 for M1 |
| | $\frac{39}{50}$ | A1 | oe fraction, decimal or percentage<br>eg 0.78 78% |
| | **Additional Guidance** | | |
| | Ignore attempts to simplify or convert a correct fraction | | M1A1 |
| | $\frac{8}{100}+\frac{10}{100}+\frac{14}{100}+\frac{6.5}{100}$<br>(frequencies have one error and no omissions, seen as probabilities, with same denominator) | | M1A0 |
| | $1-\frac{11}{50}$ or $1-\frac{7}{50}-\frac{4}{50}$ is correct for M1 (allow $\frac{50}{50}$ in place of 1)<br>also accept the above with any consistent denominator eg $\frac{52}{52}-\frac{11}{52}$ | | at least M1<br>M1A0 |
| | $\frac{39}{50}$ then 39 as final answer | | M1A0 |
| | 39 out of 50 or 39 in 50 or 39 : 50 is M1A0<br>however, condone 39 out of 50 or 39 in 50 with a correct fraction, decimal or percentage (together on answer line)<br>but do not accept 39 : 50 with a correct fraction, decimal or percentage (together on answer line) | | M1A1<br>M1A0 |
| | Ignore probability words unless contradictory, eg $\frac{39}{50}$ unlikely | | M1A0 |
| | Numbers may be shown on the diagram but must then be added (or subtracted from 50 as appropriate) to score M1 | | |
| | $\frac{39}{51}$ (or denominator other than 50) | | M1A0 |

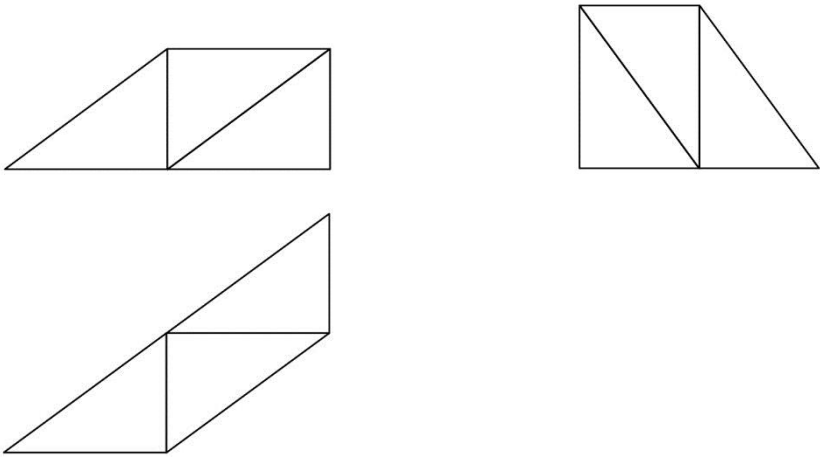
| Question | Answer | Mark | Comments |
|---|---|---|---|
| 9(a) | 1, 2, 3, 6, 9, 18 | B2 | B1<br>the 6 correct values, some or all repeated, with no incorrect values<br>or<br>5 or 6 correct values with up to 2 incorrect values<br>or<br>4 correct values with 0 or 1 incorrect values<br>or<br>3 correct values with 0 incorrect values |
| | **Additional Guidance** | | |
| | Use of products or 'coordinates' is B1 max for at least 2 correct products with 0 or 1 incorrect products<br>eg 1 × 18, 2 × 9, 3 × 6<br>eg 1 × 18, 2 × 9, 3 × 6, 4 × 4 | | <br>B1<br>B1 |
| | Lists with repeated values cannot score B2, but ignore repeated values in any format for B1<br>eg 1, 2, 3, 3<br>eg 1 × 18, 2 × 9, 3 × 6, 18 × 1, 9 × 2, 6 × 3 | | <br>B1<br>B1 |
| | If a prime factor 'tree' or similar is used, factors must be identified | | |

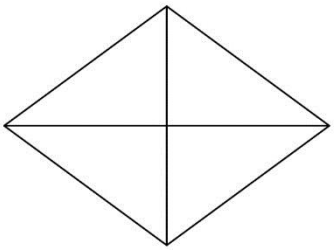
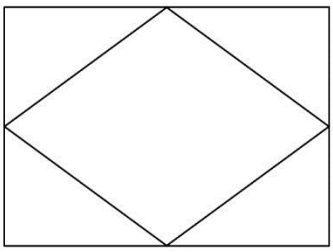
| Question | Answer | Mark | Comments |
|---|---|---|---|
| 9(b) | 60 | B2 | B1 any common multiple of 12 and 15 eg 120, 180<br>B1 at least the first two multiples correct for each of 12 and 15 (ignore errors after first two)<br>B1 $(12=)\ 2(\times)2(\times)3$ and $(15=)\ 5(\times)3$ and $2(\times)2(\times)5(\times)3\ ((\times)\ 3)$ (or the equivalent work seen in a correct Venn diagram) |
| | **Additional Guidance** | | |
| | Answer 60 with error(s) seen may be B0 or B1 but cannot be B2<br>These error(s) may occur after the 60 – but cannot be ignored | | |
| | If they have listed both multiples and factors, they must choose multiples to score | | |
| | For B2, 60 must be chosen and not just at the end of a list of multiples | | |

| Question | Answer | Mark | Comments |
|---|---|---|---|
| 10(a) | **Alternative method 1** | | |
| | 820 ÷ 50 or 82 ÷ 5 | M1 | oe eg 1640 ÷ 100<br>eg counting up in 50s to at least 800 (allow one error)<br>eg counting down in 50s to less than 50 (allow one error) |
| | 16.4 or 16+ or over 16 | A1 | oe eg 16 r 20 or 16 with 20 left<br>allow 16 if 17 is final answer |
| | 17 | A1ft | ft rounding up from a decimal, fraction or remainder with M1 awarded |
| | **Alternative method 2** | | |
| | 850 | M1 | |
| | 850 ÷ 50 | M1dep | oe eg 85 ÷ 5<br>eg counting up in 50s to try to achieve 850 (allow one error)<br>eg counting down in 50s to at least 50 (allow one error) |
| | 17 | A1 | |
| | **Additional Guidance** | | |
| | Incorrect remainders or decimals or fractions cannot score the second mark<br>eg 820 ÷ 50 = 16.2 answer 17 | | M1A0A1ft |
| | Remainder or decimal not shown, leading to answer of 17 will score full marks<br>eg 820 ÷ 50 = 16. answer 17 | | M1A1A1ft |
| | A1ft cannot be scored if their division does not yield a remainder<br>eg 820 ÷ 50 = (exactly) 14 answer 14 | | M1A0A0ft |
| | 800 ÷ 50 or 16 implies M1 from Alt 1 | | |
| | 800 ÷ 50 = 16 so 17 needed (oe) | | M1A1A1 |
| | If 82 ÷ 5 is attempted, allow 16 r 2 or 16 with 2 left over for the first A1 | | |

| Question | Answer | Mark | Comments |
|---|---|---|---|
| 10(b) | 13 × 450 | M1 | Accept repeated addition of thirteen 450s |
| | Correct vertical method of long multiplication with 4500 correct<br>or<br>Correct vertical method of long multiplication with at least one of 650 and 5200 correct<br>or<br>Correct set up of grid method with at least three of the four or six products correct<br>or<br>Correct set up of Gelosia method with at least three of the six products correct<br>or<br>10 × 450 = 4500 and 3 × 450 = 1350 attempted with at least one correct<br>or<br>13 × 400 = 5200 and 13 × 50 = 650 attempted with at least one correct | M1dep | oe<br>Allow a placeholder space to be present instead of a physical zero in vertical method |
| | 5850 | A1 | |
| | **Additional Guidance** | | |
| | For repeated addition method, to score M1dep, answer must end in 50 with a 6 carried into the hundreds column | | |
| | Students may choose to multiply 13 by 45 using any method, for the method marks. We do not need the zero to be recovered for either method mark, so 13 × 45 scores at least M1<br>eg 13 × 45 = 585 scores M2 even if answer line gives 585<br>eg 13 × 45 vertical method with 450 correct or at least one of 65 and 520 correct<br>eg 13 × 45 using grid method with 40 and 5 rather than 400, 50 and 0, with three of the four products correct<br>eg 13 × 45 using Gelosia method with no zero column, with at least three (of the now four) products correct | | M2<br>M2<br>M2<br>M2 |

| Question | Answer | Mark | Comments |
|---|---|---|---|
| 11(a) | Correct shape drawn in any orientation | B1 | |
| | **Additional Guidance** | | |
| | eg  | B1 | |
| | Mark intention with regard to vertices on dots and use of straight lines | | |
| | Condone wrong size triangles drawn, as long as they are right-angled, scalene and congruent | | |
| | Internal lines must be drawn to show position of triangles | | |
| | Allow students to extend grid with dots but shapes not on (extended) grid cannot score | | |

| Question | Answer | Mark | Comments |
|---|---|---|---|
| 11(b) | Correct shape drawn in any orientation | B1 | |
| | **Additional Guidance** | | |
| | eg  | | |
| | Mark intention with regard to vertices on dots and use of straight lines | | |
| | Condone wrong size triangles drawn, as long as they are right-angled, scalene and congruent | | |
| | Internal lines must be drawn to show position of triangles | | |
| | Allow students to extend grid with dots but shapes not on (extended) grid cannot score | | |

| Question | Answer | Mark | Comments |
|---|---|---|---|
| 11(c) | Correct shape drawn in any orientation | B1 | |
| | **Additional Guidance** | | |
| | eg  | | |
| | Condone an arrangement which produces an internal rhombus<br>eg  | | |
| | Mark intention with regard to vertices on dots and use of straight lines | | |
| | Condone wrong size triangles drawn, as long as they are right-angled, scalene and congruent | | |
| | Internal lines must be drawn to show position of triangles | | |
| | Allow students to extend grid with dots but shapes not on (extended) grid cannot score | | |

| Question | Answer | Mark | Comments |
|---|---|---|---|
| 12 | **Alternative method 1** | | |
| | 300 ÷ 10 or 30 | M1 | oe |
| | their 30 × 6.5<br>or<br>their 30 × 6 + their 30 ÷ 2<br>or<br>300 – their 30 × 3.5<br>or<br>300 – (their 30 × 3 + their 30 ÷ 2) | M1dep | oe |
| | 195 | A1 | SC2 105 |
| | **Alternative method 2** | | |
| | 300 ÷ 100 or 3 | M1 | oe |
| | their 3 × 65 or 300 – their 3 × 35 | M1dep | oe |
| | 195 | A1 | SC2 105 |
| | **Alternative method 3** | | |
| | Correct method to work out any multiple of 5% of 300 up to 95% | M1 | eg 50% = 300 ÷ 2 |
| | Fully correct build-up method to work out 65% of 300 | M1dep | eg 300 ÷ 2 + 3 × 300 ÷ 20<br>or 150 + 3 × 15<br>(no errors seen) |
| | 195 | A1 | SC2 105 |
| | **Alternative method 4** | | |
| | 65 ÷ 100 or 0.65 or 65 × 300<br>or 19 500 | M1 | |
| | $300 \times \frac{65}{100}$ or 300 × their 0.65<br>or their 19 500 ÷ 100 | M1dep | oe |
| | 195 | A1 | SC2 105 |
| | **Additional Guidance is on the following page** | | |

| Question | Answer | Mark | Comments |
|---|---|---|---|

| | | |
|---|---|---|
| **12 cont** | **Additional Guidance** | |
| | In Alt 3, either a correct method or a correct value must be seen for the first M1<br>Note that 300 × 50% is not allowed as a correct method | |
| | If Alt 3 is to be used, the percentage that is attempted must be stated<br>eg 20% = 300 ÷ 5 | |
| | Do not ignore further working for the A mark<br>eg 300 – 195 | M1M1A0 |

| | | | |
|---|---|---|---|
| **13** | 125 | B1 | |

| | | | |
|---|---|---|---|
| **14** | 5 × 7 × 10 | M1 | |
| | 350 | A1 | |
| | **Additional Guidance** | | |
| | Ignore further "method" for M1<br>eg 5 × 7 × 10 ÷ 2 = 175<br>however 5 × 7 × 10 × 5 × 7 × 10 or $350^2$ is M0A0 | | M1A0 |
| | ignore units | | |

| | | | |
|---|---|---|---|
| **15** | cylinder | B1 | |

| Question | Answer | Mark | Comments |
|---|---|---|---|
| 16(a) | No and correct reason<br>or<br>No and correct description of correct method<br>or<br>No and 280(°) | B1 | eg No, he has done B from A<br>No, the North line should go from B |
| | **Additional Guidance** | | |
| | Ignore non-contradictory, irrelevant responses alongside a correct response | | |
| | Answer must either include 'No' or 'Kemal is wrong' oe | | |
| | Ignore diagram if B1 scored from answer lines | | |
| | No, it is 280 | B1 | |
| | No, should start / measure from B | B1 | |
| | No, it's from the wrong point | B1 | |
| | Kemal is wrong, he started from A (and went to B) | B1 | |
| | No and a correct method/drawing shown in either box | B1 | |
| | No, the bearing should be reflex | B1 | |
| | No, he did A to B (not A from B) | B1 | |
| | No, should be anticlockwise | B0 | |
| | No, measured the wrong way around | B0 | |
| | No, bearing would be 260 | B0 | |
| | (It should be) 280 (not sufficient to imply 'no') | B0 | |
| | No, he measured from A which is 100 but you're meant to measure from B which is 170 | B0 | |
| | Bearing should start from B (should is not sufficient to imply 'no') | B0 | |
| | Not measured from B | B0 | |
| | Started from A (and went to B) | B0 | |
| | No, it's from the wrong place | B0 | |

| Question | Answer | Mark | Comments |
|---|---|---|---|
| 16(b) | No and correct reason | B1 | eg No, it's North East<br>No, NW is 315(°) |
| | **Additional Guidance** | | |
| | Reasoning may be seen on diagram. The angles do not need to be accurate if intention is clear. | | |
| | No, you've gone anticlockwise | | B1 |
| | No, NW lies between 270 and 360 (but 045 is between 0 and 90) | | B1 |
| | No, D is NE of C | | B1 |
| | Do not accept incorrect statements<br>eg No, North West is 225° | | B0 |
| | No, C is SW of D (true but not referencing what Nina says) | | B0 |
| | 045 is NE | | B0 |
| | D is NE of C | | B0 |
| | No, it will be larger | | B0 |

| Question | Answer | Mark | Comments |
|---|---|---|---|
| **16(c)** | Line drawn due South from *E* (any length)<br>or<br>[4.3, 5.1] | M1 | mark intention on 'south'<br>mark intention on 'line'<br>accept a cross on coast roughly south of E |
| | their value × 100 | M1 | [430, 510] implies M2<br>eg 1.3 × 100 |
| | [450, 490] and correct for their value | A1 | SC1 600<br>[450, 490] scores M1M1A1 unless error seen |
| | **Additional Guidance** | | |
| | Line drawn or no line drawn and 4.6 × 100 = 465<br>(within range but not correct for their value) | | M1M1A0 |
| | No line drawn and 4.2 × 100 = 420 | | M0M1A0 |
| | 600 may score up to M2, only award SC1 if M0 scored | | |
| | If line goes North as well as South of E, working must choose the South direction length (in range) for at least 1st M1 (but 2nd M1 could still be scored) | | |
| | If line does not reach coast or goes beyond coast, full marks can still be awarded for a correct method with correct answer within range | | |
| | Ignore units throughout eg 4.8 × 100 = 480 cm | | M1M1A1 |
| **17(a)** | 28 : 12 or 14 : 6<br>or<br>56 ÷ 8 and 24 ÷ 8<br>(may be done in stages)<br>or<br>3 and 7 seen | M1 | |
| | 7 : 3 | A1 | |
| **17(b)** | 1.25 : 1 | B1 | oe eg $\frac{5}{4}:1$ |

| Question | Answer | Mark | Comments |
|---|---|---|---|
| 17(c) | 180 ÷ (1 + 9) or 18 or 162 | M1 | |
| | 18 and 162 | A1 | |
| | **Additional Guidance** | | |
| | 162 and 18 | | M1A0 |
| | Build-up method will score 2 or 0<br>eg 1 : 9<br>2 : 18 does not score M1 for 18 | | |

| Question | Answer | Mark | Comments |
|---|---|---|---|
| 18 | Valid statement about proportion | B1 | eg there were more 41s or over than 40s or under |
| | Valid statement about average | B1 | eg the average listening time of the 41s or over was higher |
| | Valid statement about spread | B1 | eg the listening times of the 41s or over were more spread out |
| | **Additional Guidance** | | |
| | Do not allow incorrect values supporting statements (eg a miscalculation) but repeating the values in context is acceptable | | |
| | Condone irrelevant statements with correct statements | | |
| | Student statements may not be in the same order as the measures in the table | | |
| | Accept 'older people' for 41s or over and 'younger people' for 40s or under similarly accept over 40s to stand for 41s and over (oe) | | |
| | **Proportion of the audience statements** | | |
| | There were more over 41s | B1 | |
| | They are mostly over 41 | B1 | |
| | There were 58% more over 41s than 40s and under | B1 | |
| | The proportion / % / percentage of over 41s is higher | B1 | |
| | Over 41s are a higher proportion than 40s and under | B1 | |
| | Less 40 and under than over 41 | B1 | |
| | The 40 and unders were 21%, the over 41 were 79% | B1 | |
| | The 40s and under were 21% which is less than half/quarter | B1 | |
| | The 40s and under were 21% | B0 | |
| | The difference is 58% | B0 | |
| | **Additional Guidance continues on the next page** | | |

| Question | Answer | Mark | Comments |
|---|---|---|---|
| 18 cont | **Average listening time statements** | | |
| | The over 41s had a higher mean | B1 | |
| | Over 41s listened for 5.1h more (on average) | B1 | |
| | Over 41s listened longer (on average) than the 40s and under | B1 | |
| | 41+ longer listening (on average) | B1 | |
| | (More/most) 40s and under listened less than the over 41s (on average) | B1 | |
| | Average listening 5.1 hours difference | B0 | |
| | **Spread of listening time statements** | | |
| | The over 41s had a higher range | B1 | |
| | More of a time gap in the over 41s than the 40s and under | B1 | |
| | Over 41s have a higher spread | B1 | |
| | 40s and under times are closer together than over 41s | B1 | |
| | Over 41s have a wider listening time range | B1 | |
| | The 41 and over listening time gap was high, the under 40 listening time gap was low | B1 | |
| | 40 and under is 4.5, 41 or over is 13.9 | B1 | |
| | 40 and under listen to the radio 4.5 hours, 41 or over listen to the radio 13.9 hours | B0 | |
| | The difference in range is 9.4 | B0 | |
| | Listening times were quite close together | B0 | |
| | The 41 and over listening times gap was high | B0 | |

| Question | Answer | Mark | Comments |
|---|---|---|---|
| 19(a) | 5 | B1 | |
| | **Additional Guidance** | | |
| | Condone 10 – 5 = 5 | | B1 |
| | Condone $x = 5$ | | B1 |
| | $\frac{10}{2}$ | | B0 |
| 19(b) | –10 | B1 | |

| Question | Answer | Mark | Comments |
|---|---|---|---|
| **19(c)** | Unsimplified expression in $a$, $b$ and $c$ which would evaluate to 23 | M1 | eg<br>$2(4a – 2b) + a + c$<br>or $8a – 4b + a + c$<br>or $11(a + c) – (4a – 2b)$<br>or $11a + 11c – 4a + 2b$ |
| | Simplified expression in $a$, $b$ and $c$ which would evaluate to 23 | A1 | eg<br>$9a – 4b + c$<br>$7a + 2b + 11c$<br>SC2 Values assigned to $a, b$ and $c$ which satisfy original equations and expression given which has value 23<br>eg $a = 3, b = 1, c = 0$ and $7a + 2b + c$ |
| | **Additional Guidance** | | |
| | There are infinitely many correct solutions. Allow solutions where the coefficients are not integers if initial working is shown.<br>eg<br>$3(4a – 2b) – \frac{7}{3}(a + c) = \frac{29}{3}a – 6b – \frac{7}{3}c$ | | M1A1 |
| | $5a – 2b + c + 10 = 23$ | | M1A1 |
| | Condone '= 23' after the expression | | |
| | Answer using only two variables eg $2.3(4a – 2b)$ | | M0A0 |

| | | | |
|---|---|---|---|
| **20(a)** | $9.7 \times 10^{-4}$ | B1 | |
| | **Additional Guidance** | | |
| | Condone $9.7 \,.\, 10^{-4}$ or $9.7 \cdot 10^{-4}$ | | B1 |
| | Ignore zeroes before the '9'<br>eg $00009.7 \times 10^{-4}$ | | B1 |
| | $9.7 \times 10^{4-}$ | | B0 |

| Question | Answer | Mark | Comments |
|---|---|---|---|
| **20(b)** | 300 000 and 4000<br>or<br>$(10^5 \div 10^3 =) 10^2$<br>or $(10^5 \div 10^3 =) 100$<br>or $7.5 \times 10^{(1)}$ or $75 \times 10^0$<br>or<br>$\frac{3\times10^2}{4}$ or $\frac{300}{4}$ | M1 | |
| | 75 | A1 | |
| | **Additional Guidance** | | |
| | If the answer is given in standard form and as 75 the student must indicate that 75 is their chosen answer or it must be the final answer given<br>eg1 $7.5 \times 10^{(1)} = 75$ on the answer line<br>eg2 $75 = 7.5 \times 10^{(1)}$ on the answer line | | <br><br>M1A1<br>M1A0 |
| | $\frac{300}{4}$ or 75 from incorrect working scores zero<br>eg1 $3 \times 10^5 = 30\,000$ and $4 \times 10^3 = 400$ and $30\,000 \div 400 = \frac{300}{4} = 75$<br>eg2 $\frac{30\,000}{400} = 75$ | | <br><br>M0A0<br>M0A0 |
| | For the method mark, ignore incorrect work from a correct expression<br>eg $0.75 \times 10^2 = 7.5 \times 10^3$ | | <br>M1A0 |
| | If the student attempts two methods (simplifying the powers and attempting to convert to ordinary numbers) mark both methods and award the higher mark | | |

| Question | Answer | Mark | Comments |
|---|---|---|---|
| 21(a) | $\frac{1}{6}$ on '1' and $\frac{1}{3}$ or $\frac{2}{6}$ on '2 or 3'<br>and<br>$\frac{1}{2}$ on each of 'Odd' and 'Even' | B2 | oe fraction, decimal or percentage<br>B1<br>$\frac{1}{6}$ on '1' and $\frac{1}{3}$ or $\frac{2}{6}$ on '2 or 3'<br>or<br>$\frac{1}{2}$ on each of 'Odd' and 'Even'<br>or<br>all correct unsimplified probabilities with one or more simplification errors<br>eg $\frac{3}{6}$ on 'Odd' simplified to $\frac{1}{3}$ |
| | **Additional Guidance** | | |
| | Accept decimals or percentages rounded or truncated correctly to at least 2 significant figures | | |
| | Only withhold a mark for simplification errors if B2 would otherwise be awarded | | |
| | Ignore extra branches added | | |
| | Ignore attempts to work out combined probabilities to the right of the tree diagram | | |
| | If an answer line is blank, the student may have written their answer elsewhere on the branch | | |

| Question | Answer | Mark | Comments |
|---|---|---|---|
| 21(b) | **Alternative method 1: P(1) + P(4, 5 or 6) × P(Odd)** | | |
| | $\frac{1}{2}$ × their $\frac{1}{2}$ or $\frac{1}{4}$ | M1 | oe |
| | their $\frac{1}{4}$ + their $\frac{1}{6}$ | M1dep | oe |
| | (P(win) =) $\frac{10}{24}$ or $\frac{5}{12}$ | A1ft | oe ft their tree diagram |
| | Lose (and P(Lose) = $\frac{14}{24}$ or $\frac{7}{12}$ oe) | A1ft | ft correct decision for their $\frac{5}{12}$ (and their $\frac{7}{12}$) with M2 scored |
| | **Alternative method 2: 1 – P(2 or 3) – P(4, 5 or 6) × P(Even)** | | |
| | $\frac{1}{2}$ × their $\frac{1}{2}$ or $\frac{1}{4}$ | M1 | oe |
| | their $\frac{1}{4}$ + their $\frac{1}{3}$<br>or P(lose) = $\frac{7}{12}$ | M1dep | oe<br>ft their tree diagram |
| | (P(win) =) $\frac{10}{24}$ or $\frac{5}{12}$ | A1ft | oe ft their tree diagram |
| | Lose (and P(Lose) = $\frac{14}{24}$ or $\frac{7}{12}$ oe) | A1ft | ft correct decision for their $\frac{5}{12}$ (and their $\frac{7}{12}$) with M2 scored |
| | **Additional Guidance is on the following page** | | |

| Question | Answer | Mark | Comments |
|---|---|---|---|

| | Additional Guidance | |
|---|---|---|
| **21(b) cont** | Check the tree diagram for working | |
| | Any 'their' or ft probability must be > 0 and < 1 for marks to be awarded | |
| | For the second A1ft, the ft can be from an incorrect tree (which may score 4 marks) or an arithmetic error (which scores 3 marks, M1M1A0A1ft) | |
| | Accept equivalent fractions or decimals within calculations and equivalent fractions, decimals or percentages for final probabilities | |
| | Accept decimals or percentages rounded or truncated correctly to at least 2 significant figures | |
| | Condone $\frac{1}{2} \times$ their $\frac{1}{2}$ as part of a longer, incorrect multiplication<br>eg $\frac{1}{2} \times \frac{1}{2} \times \frac{1}{6}$ | M1M0A0A0 |
| | Condone decimals used within fractions<br>eg P(Win) = $\frac{2.5}{6}$ | at least M1M1A1 |
| | For the method marks, condone incorrect mathematical notation<br>eg $\frac{1}{2} \times \frac{1}{2} = \frac{1}{4} + \frac{1}{6} =$ … | at least M1M1 (may go on to score 3 or 4 marks) |
| | For the second A1ft, if the student gives a value for P(Lose), their P(Win) + their P(Lose) must equal 1<br>However, allow a comparison to $\frac{1}{2}$ unless it is clearly an incorrect value for P(Lose) | |

| Question | Answer | Mark | Comments |
|---|---|---|---|
| 22 | **Alternative method 1** | | |
| | $3 \div \frac{20}{100}$ or $3 \times 5$ or 15 or $3 \times 6$ | M1 | oe |
| | 18 | A1 | |
| | **Alternative method 2** | | |
| | $1.2x = x + 3$ | M1 | oe equation |
| | 18 | A1 | |
| | **Additional Guidance** | | |
| | Trial and improvement scores 0 or 2 unless M1 can be awarded for 15 | | |
| | 15 seen scores M1 | | |

| Question | Answer | Mark | Comments |
|---|---|---|---|
| **23** | $(3^{12} =)\ 531\,441$<br>or<br>$(3^5 =)\ 243$<br>or<br>$(3^{12} \div 3^5 =)\ 3^7$ or $(3^{12} \div 3^5 =)\ 2187$<br>or<br>$(3^2 \times 3 =)\ 3^3$ or $(3^2 \times 3 =)\ 27$<br>or<br>$3^{12} \div 3^5 \div 3^2 \div 3$<br>or<br>$\frac{3^{12}}{3^5} \times \frac{1}{3^2 \times 3}$ | M1 | |
| | $3^7 \div 3^3$ or $3^7 \div 27$<br>or<br>$3^{(12-5-2-1)}$<br>or<br>$\frac{3^{12}}{3^8}$<br>or<br>$3^4$<br>or<br>$2187 \div 27$ | M1dep | oe in the form $3^n \div 3^{(n-4)}$ |
| | 81 | A1 | |
| | **Additional Guidance** | | |
| | $3^4$ and 81 on the answer line in either order | | M1M1A1 |
| | 81 in working and $3^4$ on the answer line | | M1M1A0 |

| Question | Answer | Mark | Comments |
|---|---|---|---|
| 24(a) | $-a$ | B1 | |
| 24(b) | $\frac{1}{c}$ | B1 | |

| Question | Answer | Mark | Comments |
|---|---|---|---|
| 25 | **Alternative method 1: areas** | | |
| | $\pi \times 10^2$ or $100\pi$ | M1 | implied by [314, 314.2] |
| | $\pi \times (8 \div 2)^2$ or $\pi \times 4^2$ or $16\pi$<br>or $\pi \times (8 \div 2)^2 \div 2$ or $\pi \times 4^2 \div 2$<br>or $16\pi \div 2$ or $8\pi$ | M1 | implied by [50.2, 50.3] or [25.12, 25.14]<br>$92\pi$ or $84\pi$ or 92 : 8 or 8 : 92<br>or 84 : 16 or 16 : 84 implies M1M1 |
| | (their $100(\pi)$ – their $8(\pi)$) ÷ their $8(\pi)$<br>or $92(\pi) \div 8(\pi)$<br>or<br>their $100(\pi) \div$ their $8(\pi)$ (– 1)<br>or $12\frac{1}{2}$ (– 1) or 12.5 (– 1) | M1dep | dep on M2<br>absence of $\pi$ must be consistent<br>condone $16(\pi)$ as their $8(\pi)$ in first calculation only, ie condone<br>(their $100(\pi)$ – their $16(\pi)$) ÷ their $16(\pi)$<br>or $84(\pi) \div 16(\pi)$,<br>but not their $100(\pi) \div$ their $16(\pi)$ (– 1) |
| | $11\frac{1}{2}$ or 11.5 | A1 | condone $\frac{23}{2}$ |
| | **Alternative method 2: scale factor** | | |
| | $\frac{10}{8 \div 2}$ or $\frac{10}{4}$ or $\frac{5}{2}$<br>or $\frac{10 \times 2}{8}$ or $\frac{20}{8}$ or 2.5 | M1 | oe scale factor of lengths eg $\frac{2}{5}$ or 0.4<br>accept 2 : 5 or 5 : 2 oe ratio<br>$\pi$ may be present, but must be consistent in numerator and denominator |
| | (their $\frac{5}{2}$)$^2$ or $\frac{25}{4}$ | M1dep | oe scale factor of areas eg $\frac{4}{25}$<br>accept 4 : 25 or 25 : 4 oe ratio |
| | 2 × their $\frac{25}{4}$ (– 1) or $\frac{25}{2}$ (– 1)<br>or $12\frac{1}{2}$ (– 1) or 12.5 (– 1) | M1dep | oe eg 2 ÷ their $\frac{4}{25}$ (– 1) |
| | $11\frac{1}{2}$ or 11.5 | A1 | condone $\frac{23}{2}$ |
| | **Additional Guidance is on the following page** | | |

| Question | Answer | Mark | Comments |
|---|---|---|---|

| | Additional Guidance | |
|---|---|---|
| **25 (cont)** | Accept, for example, $\pi 8$ or $\pi \times 8$ or $8 \times \pi$ for $8\pi$ | |
| | An answer of $11.5\pi$ with no incorrect working | M1M1M1A0 |
| | Consistent use of $\pi d^2$ for the area of a circle gives the area of the circle as $400\pi$, the area of the semicircle as $32\pi$ and the area of the shaded part as $368\pi$. This also gives the answer 11.5, but scores zero | M0M0M0A0 |
| | Irrespective of where their answer comes from and the presence of other measures such as circumference, students can gain the first two marks of alternative method 1 if it is clear that the methods or values given are for area<br>eg 1<br>Big area = $100\pi$, little area = $8\pi$, big circumference = $20\pi$, little circumference = $4\pi$, $20 \div 4 = 5$<br>eg 2<br>$100\pi$, $8\pi$, $20\pi$, $4\pi$ | M1M1M0A0<br><br>M0M0 |
| | Do not award the second mark if the value of $8\pi$ comes from $\pi d$<br>This is implied by, eg, 'Area of circle = $20\pi$, area of semi-circle = $8\pi$' | M?M0<br>M0M0 |
| | $\frac{100(\pi)-16(\pi)}{16(\pi)}$ (which may give an answer of 5.25) | M1M1M1A0 |
| | $\frac{100(\pi)}{16(\pi)}$ (which may give an answer of 6.25) | M1M1M0A0 |

| Question | Answer | Mark | Comments |
|---|---|---|---|
| 26(a) | Plots the points (1, 60), (2, 30), (3, 20) and (4, 15) | M1 | $\pm \frac{1}{2}$ small square |
| | Correct smooth curve through correct four points | A1 | $\pm \frac{1}{2}$ small square |
| | **Additional Guidance** | | |
| | Ignore any calculations and mark the graph only | | |
| | Points cannot be implied by a bar chart or vertical line graph, but condone crosses at the top of a vertical line graph for M1 and the correct curve superimposed for M1A1 | | |
| | For M1, ignore the curve outside the domain $1 \leqslant t \leqslant 4$<br>For A1, whether or not the curve extends outside the domain $1 \leqslant t \leqslant 4$ it must not have a positive gradient at any point | | |
| | If there is no curve, for M1 there must be no other points with $x$-coordinate 1, 2, 3 or 4 | | |
| | The curve should be a single line with no feathering | | |
| | Unless it affects the shape of the curve (in which case A1 cannot be awarded), ignore incorrect evaluations of 60 ÷ a non-integer value<br>eg 60 ÷ 1.5 **=** … | | |

| Question | Answer | Mark | Comments |
|---|---|---|---|
| 26(b) | Vertical line from $3\frac{1}{2}$ minutes to their graph | M1 | $\pm \frac{1}{2}$ small square<br>implied by mark at correct place on the graph or on the vertical axis (but not on the horizontal axis) or by correct reading from their graph |
| | Correct reading from their graph for $t = 3.5$ | A1ft | ft their graph $\pm \frac{1}{2}$ small square |
| | **Additional Guidance** | | |
| | Correct reading for their graph, with or without evidence of using graph | | M1A1 |
| | No graph in (a) | | M0A0 |
| | To score any marks, their graph must be decreasing in the domain $1 \leqslant t \leqslant 4$, but may be a straight line or series of connected straight lines | | |
| | Answer from 60 ÷ 3.5 with no graph, or which does not match graph | | M0A0 |
| | Reading from 3.3 | | M0A0 |

| Question | Answer | Mark | Comments |
|---|---|---|---|
| 27 | **Alternative method 1 – add 6 to both sides first** | | |
| | $x + 6 = 2y$<br>or $-x - 6 = -2y$<br>or<br>$\frac{x+6}{2}$ or $\frac{x}{2} + 3$ or $\frac{1}{2}(x + 6)$ | M1 | oe |
| | $y = \frac{x+6}{2}$ or $y = \frac{x}{2} + 3$<br>or $y = \frac{1}{2}(x + 6)$ | A1 | allow order reversed<br>do not allow further incorrect work eg attempts to divide only the 6 by 2<br>Condone $y = (x+6) \div 2$ for M1A1 |
| | **Alternative method 2 – divide both sides by 2 first** | | |
| | $\frac{x}{2} = y - \frac{6}{2}$ or $\frac{x}{2} = y - 3$<br>or<br>$\frac{x+6}{2}$ or $\frac{x}{2} + 3$ or $\frac{1}{2}(x + 6)$ | M1 | allow $\frac{2y}{2}$ for $y$ |
| | $y = \frac{x+6}{2}$ or $y = \frac{x}{2} + 3$<br>or $y = \frac{1}{2}(x + 6)$ | A1 | allow order reversed<br>do not allow further incorrect work eg attempts to divide only the 6 by 2<br>Condone $y = (x+6) \div 2$ for M1A1 |
| | **Alternative method 3 – flow diagram** | | |
| | $y \rightarrow 2y \rightarrow 2y - 6$<br>$\leftarrow x + 6 \leftarrow x$ | M1 | allow $2 \times y$ or $y \times 2$ for $2y$<br>ignore any operations seen on arrows |
| | $y = \frac{x+6}{2}$ or $y = \frac{x}{2} + 3$<br>or $y = \frac{1}{2}(x + 6)$ | A1 | allow order reversed<br>do not allow further incorrect work eg attempts to divide only the 6 by 2<br>Condone $y = (x+6) \div 2$ for M1A1 |
| | **Additional Guidance** | | |
| | Allow 0.5 for $\frac{1}{2}$ throughout | | |

| Question | Answer | Mark | Comments |
|---|---|---|---|
| **28** | $x^2 + 5x - x - 5$ | M1 | three or four terms with three correct<br>$x^2 + 4x + k$ implies M1 |
| | $x^2 + 4x - 5$ | A1 | |
| | **Additional Guidance** | | |
| | Further work, eg $x^2 + 4x - 5 = 5x - 5$ | | M1A0 |
| | $y = x^2 + 4x - 5$ or $x^2 + 4x - 5 = 0$ | | M1A0 |
| | $x^2 + 4x - 4$ | | M1A0 |
| | $x^2 + 4x$ | | M1A0 |
| | Condone $1x$ for $x$<br>eg $x^2 + 5x - 1x - 5$ | | at least M1 |
| | Terms may be seen in the grid method or in a list where a plus sign can be implied | | |