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# GCSE MATHEMATICS 8300/3F

Foundation Tier Paper 3 Calculator

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Mark scheme

June 2023

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Version: 1.0 Final



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 Examiner.

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.

|                        |                                                                                                                                        |
|------------------------|----------------------------------------------------------------------------------------------------------------------------------------|
| <b>M</b>               | Method marks are awarded for a correct method which could lead to a correct answer.                                                    |
| <b>A</b>               | 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>B</b>               | Marks awarded independent of method.                                                                                                   |
| <b>ft</b>              | Follow through marks. Marks awarded for correct working following a mistake in an earlier step.                                        |
| <b>SC</b>              | Special case. Marks awarded for a common misinterpretation which has some mathematical worth.                                          |
| <b>M dep</b>           | A method mark dependent on a previous method mark being awarded.                                                                       |
| <b>B dep</b>           | A mark that can only be awarded if a previous independent mark has been awarded.                                                       |
| <b>oe</b>              | Or equivalent. Accept answers that are equivalent.<br>eg accept 0.5 as well as $\frac{1}{2}$                                           |
| <b>[a, b]</b>          | Accept values between a and b inclusive.                                                                                               |
| <b>[a, b)</b>          | Accept values $a \leq \text{value} < b$                                                                                                |
| <b>3.14...</b>         | Accept answers which begin 3.14 eg 3.14, 3.142, 3.1416                                                                                 |
| <b>Use of brackets</b> | 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.

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| <b>Q</b>    | <b>Answer</b> | <b>Mark</b> | <b>Comments</b> |
|-------------|---------------|-------------|-----------------|
| <b>1(a)</b> | 3             | B1          |                 |

| <b>Q</b>    | <b>Answer</b> | <b>Mark</b> | <b>Comments</b> |
|-------------|---------------|-------------|-----------------|
| <b>1(b)</b> | 43            | B1          |                 |

| <b>Q</b>    | <b>Answer</b> | <b>Mark</b> | <b>Comments</b> |
|-------------|---------------|-------------|-----------------|
| <b>1(c)</b> | 32            | B1          |                 |

| Q    | Answer | Mark | Comments |
|------|--------|------|----------|
| 2(a) | 4      | B1   |          |

| Q    | Answer                                                                                                                                           | Mark | Comments                                                                                                                                                                                                                                                                                                                             |
|------|--------------------------------------------------------------------------------------------------------------------------------------------------|------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 2(b) | 2 4 4 8 10 11 12 15<br>or<br>2 4 4 8 10<br>or<br>15 12 11 10 8<br>or<br>8 and 10<br>or<br>$18 \div 2$<br>or<br>$\frac{8+1}{2}$ th or 4.5th value | M1   | full list of numbers in either order<br>allow one missing, extra or transcription error in an otherwise full list of numbers<br>list of first or last five numbers in either order<br>allow only a transcription error in a list of the first or last five numbers<br><br>oe<br><br>works out the position of the median in the list |
|      | 9                                                                                                                                                | A1   |                                                                                                                                                                                                                                                                                                                                      |
|      | <b>Additional Guidance</b>                                                                                                                       |      |                                                                                                                                                                                                                                                                                                                                      |
|      | Ordered list in the stem of the question can be assumed to be for part (b) unless contradicted by the working seen in the working space          |      |                                                                                                                                                                                                                                                                                                                                      |
|      | Numbers in a list may be seen crossed out in an attempt to find the median                                                                       |      |                                                                                                                                                                                                                                                                                                                                      |
|      | Answer 9 from any or no list                                                                                                                     |      | M1A1                                                                                                                                                                                                                                                                                                                                 |
|      | Puts list in order then finds the mean                                                                                                           |      | M1A0                                                                                                                                                                                                                                                                                                                                 |
|      | States 4.5th and gives 11.5 (oe)                                                                                                                 |      | M1A0                                                                                                                                                                                                                                                                                                                                 |

| Q    | Answer | Mark | Comments |
|------|--------|------|----------|
| 2(c) | 13     | B1   |          |

| Q    | Answer  | Mark | Comments     |
|------|---------|------|--------------|
| 3(a) | D       | B1   |              |
|      | A and E | B1   | either order |

| Q    | Answer                                                                                                                                                                                    | Mark | Comments                                                                                                                                                                              |
|------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 3(b) | Colour spinner with all sections labelled red, blue or green with at least one of each<br><br>and<br><br>number spinner with all sections labelled 1, 2, 3 or 4 with at least one of each | B2   | B1 one spinner with all sections labelled red, blue or green with at least one of each<br><br>or<br><br>one spinner with all sections labelled 1, 2, 3 or 4 with at least one of each |
|      | <b>Additional Guidance</b>                                                                                                                                                                |      |                                                                                                                                                                                       |
|      | Allow any unambiguous labelling eg R for Red                                                                                                                                              |      |                                                                                                                                                                                       |
|      | Allow any unambiguous splitting into sections eg unrul                                                                                                                                    |      |                                                                                                                                                                                       |
|      | Number spinner under Colour heading and/or Colour spinner under Number heading can score a maximum of B1                                                                                  |      |                                                                                                                                                                                       |
|      | Sections do not have to be equal                                                                                                                                                          |      |                                                                                                                                                                                       |
|      | Ignore any probabilities given on the spinners                                                                                                                                            |      |                                                                                                                                                                                       |

| Q | Answer                                                                                                                                           | Mark  | Comments                                                                         |
|---|--------------------------------------------------------------------------------------------------------------------------------------------------|-------|----------------------------------------------------------------------------------|
| 4 | $9.5 \times 100$ or 950<br>or<br>$20 \div 100$ or 0.2<br>or<br>$2 \times 20 \div 100$ or 0.4                                                     | M1    | oe<br>930 implies 950<br>9.3 implies 0.2                                         |
|   | their $950 - 2 \times 20$<br>or<br>their $950 - 40$ or 910<br>or<br>$9.5 - 2 \times \text{their } 0.2$<br>or<br>$9.5 - \text{their } 0.4$ or 9.1 | M1dep | oe eg $950 - 20 - 20$<br><br>oe eg $9.5 - \text{their } 0.2 - \text{their } 0.2$ |
|   | 910 cm<br>or<br>9.1 m                                                                                                                            | A1    | oe                                                                               |
|   | <b>Additional Guidance</b>                                                                                                                       |       |                                                                                  |
|   | Up to M2 may be awarded for correct work, with no answer or incorrect answer, even if this is seen amongst multiple attempts                     |       |                                                                                  |
|   | 9 m 10 cm on answer line                                                                                                                         |       | M1M1A1                                                                           |
|   | Units may be seen in working but must be seen with the correct value<br>eg 910 on answer line with 910 cm seen in working                        |       | M1M1A1                                                                           |
|   | $9.5 - 2 \times 20 = 910$ centimetres or 9.1 metres                                                                                              |       | M1M1A1                                                                           |
|   | $9.5 - 2 \times 20 = 910$ or 9.1                                                                                                                 |       | M1M1A0                                                                           |
|   | Do not ignore further incorrect conversion after correct answer seen<br>eg $910 \text{ cm} = 91 \text{ m}$                                       |       | M1M1A0                                                                           |

| Q    | Answer                                             | Mark | Comments                        |
|------|----------------------------------------------------|------|---------------------------------|
| 5(a) | 15                                                 | B1   | implied by 70 or 345            |
|      | (3rd term =) 70                                    | B1ft | ft (their $15 - 1$ ) $\times 5$ |
|      | <b>Additional Guidance</b>                         |      |                                 |
|      | 15 70 on answer line                               |      | B1B1                            |
|      | 15 and/or 70 seen but not final term eg Answer 345 |      | B1B0                            |
|      | Answer only 345                                    |      | B1B0                            |

| Q    | Answer                                                    | Mark | Comments           |
|------|-----------------------------------------------------------|------|--------------------|
| 5(b) | $50 \times 2$ or 100                                      | M1   |                    |
|      | 80                                                        | A1   | SC1 120 or 5 or 60 |
|      | <b>Additional Guidance</b>                                |      |                    |
|      | 80, 50, ... on answer line                                |      | M1A1               |
|      | 80, 50, ... in working with answer line blank             |      | M1A1               |
|      | 80, 50, ... in working with 35 on answer line             |      | M1A0               |
|      | $80 + 20 \div 2 = 50$ without answer 80 (embedded answer) |      | M1A0               |

| Q    | Answer | Mark | Comments |
|------|--------|------|----------|
| 6(a) | 7      | B1   |          |

| Q    | Answer | Mark | Comments |
|------|--------|------|----------|
| 6(b) | 15     | B1   |          |

| Q    | Answer                                      | Mark | Comments                                                                      |
|------|---------------------------------------------|------|-------------------------------------------------------------------------------|
| 6(c) | 20 + 3 or 23<br>or<br>10.58                 | M1   | may be implied by a journey (lines or curves) ending at 10.58 on the graph    |
|      | Straight line from (10.35, 7) to (10.58, 0) | A1   | $\pm \frac{1}{2}$ small square<br>ignore any other working lines on the graph |
|      | <b>Additional Guidance</b>                  |      |                                                                               |
|      | Fully correct graph                         |      | M1A1                                                                          |
|      | Accept unruled line if intention clear      |      |                                                                               |

| Q | Answer                                                                                                                                                                        | Mark  | Comments                                                                                   |
|---|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|--------------------------------------------------------------------------------------------|
| 7 | $25 \times 10.2(0)$ or 255                                                                                                                                                    | M1    | oe                                                                                         |
|   | $10 - 7 + 3 - 1$ or $3 + 2$ or 5<br>or<br>$(10 - 7) \times 11.8(0)$ or $3 \times 11.8(0)$<br>or 35.4(0)<br>or<br>$(3 - 1) \times 11.8(0)$ or $2 \times 11.8(0)$<br>or 23.6(0) | M1    | oe                                                                                         |
|   | their $5 \times 11.8(0)$<br>or their 35.4(0) + their 23.6(0)<br>or 59                                                                                                         | M1dep | oe<br>dep on 2nd M<br>their 35.4(0) and their 23.6(0) must both<br>be from correct methods |
|   | 314(.00)                                                                                                                                                                      | A1    | SC2 325.8(0) or 337.6(0)                                                                   |
|   | <b>Additional Guidance</b>                                                                                                                                                    |       |                                                                                            |
|   | 314.0                                                                                                                                                                         |       | M3A0                                                                                       |

| Q | Answer                                                                                                    | Mark  | Comments                                                           |
|---|-----------------------------------------------------------------------------------------------------------|-------|--------------------------------------------------------------------|
| 8 | <b>Alternative method 1</b>                                                                               |       |                                                                    |
|   | $60 + 70 + 85$ or 215                                                                                     | M1    |                                                                    |
|   | $1000 \div 5$ or 200<br>or<br>$1000 \div 4$ or 250                                                        | M1    | oe eg $\frac{1}{5} \times 1000$                                    |
|   | 200 and 215 and 250                                                                                       | A1    |                                                                    |
|   | <b>Alternative method 2</b>                                                                               |       |                                                                    |
|   | $60 + 70 + 85$ or 215<br>or<br>$1 \div 5$ or 0.2<br>or<br>$1 \div 4$ or 0.25                              | M1    | oe do not accept $\frac{1}{5}$ or $\frac{1}{4}$                    |
|   | their $215 \div 1000$ or 0.215<br>or<br>their $215 \times 4$ or 860<br>or<br>their $215 \times 5$ or 1075 | M1dep | oe eg $\frac{215}{1000}$<br>0.86 implies 860<br>1.075 implies 1075 |
|   | 0.215 and 0.2 and 0.25<br>or 860 and 1075 and 1000<br>or 0.86 and 1.075 and 1                             | A1    | oe decimals, percentages or fractions with a common denominator    |

**Mark scheme and Additional Guidance continue on the next page**

|                   |                                                                                                                                                |       |                                                                                     |
|-------------------|------------------------------------------------------------------------------------------------------------------------------------------------|-------|-------------------------------------------------------------------------------------|
| <b>8<br/>cont</b> | <b>Alternative method 3</b>                                                                                                                    |       |                                                                                     |
|                   | $60 \div 1000$ or 0.06<br>or<br>$70 \div 1000$ or 0.07<br>or<br>$85 \div 1000$ or 0.085<br>or<br>$1 \div 5$ or 0.2<br>or<br>$1 \div 4$ or 0.25 | M1    | oe do not accept $\frac{1}{5}$ or $\frac{1}{4}$                                     |
|                   | their 0.06 + their 0.07 + their 0.085<br>or 0.215                                                                                              | M1dep | oe<br>their 0.06 and their 0.07 and their 0.085<br>must all be from correct methods |
|                   | 0.215 and 0.2 and 0.25                                                                                                                         | A1    | oe decimals, percentages or fractions<br>with a common denominator                  |
|                   | <b>Additional Guidance</b>                                                                                                                     |       |                                                                                     |
|                   | Up to M2 may be awarded for correct work, with no answer or incorrect answer, even if this is seen amongst multiple attempts                   |       |                                                                                     |

| Q | Answer                                                                                                     | Mark | Comments    |
|---|------------------------------------------------------------------------------------------------------------|------|-------------|
| 9 | Sometimes true<br>Sometimes true<br>Never true                                                             | B3   | B1 for each |
|   | <b>Additional Guidance</b>                                                                                 |      |             |
|   | Allow any unambiguous indication<br>eg if a cross is the only indication in a row, take that as the answer |      |             |
|   | A row with a tick and some crosses, mark the tick                                                          |      |             |
|   | A row with more than one tick is B0 for that row                                                           |      |             |

| Q     | Answer                     | Mark | Comments |
|-------|----------------------------|------|----------|
| 10(a) | $p^3$                      | B1   |          |
|       | <b>Additional Guidance</b> |      |          |
|       | Accept $1p^3$              |      |          |

| Q     | Answer                                                                   | Mark | Comments                         |
|-------|--------------------------------------------------------------------------|------|----------------------------------|
| 10(b) | $2a + 11c$                                                               | B2   | either order<br>B1 $2a$ or $11c$ |
|       | <b>Additional Guidance</b>                                               |      |                                  |
|       | Further incorrect work after a B2 response is B1<br>eg $2a + 11c = 13ac$ |      | B1                               |
|       | Further incorrect work after a B1 response is B1<br>eg $3a + 11c = 14ac$ |      | B1                               |
|       | $a2 + 11c$ or $2a + c11$                                                 |      | B1                               |
|       | $a2$ or $c11$                                                            |      | B1                               |

| Q  | Answer                                                                                                                                                                                                                                                                                                                                                     | Mark | Comments                                                                                                             |
|----|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|----------------------------------------------------------------------------------------------------------------------|
| 11 | $360 \div 9 (= 40)$ and $40 \times 7 = 280$<br>or<br>$360 \div 9 (= 40)$ and $40 \times 2 (= 80)$<br>and $80 + 280 = 360$<br>or<br>$40 \times 2 (= 80)$ and $40 \times 7 (= 280)$<br>and $80 + 280 = 360$<br>or<br>$280 \div 7 (= 40)$ and $40 \times 9 = 360$<br>or<br>$2:7 = 80:280$ and $80 + 280 = 360$<br>or<br>$360 - 280 (= 80)$ and $80:280 = 2:7$ | B2   | oe<br>B1 $360 \div 9$ or $280 \div 7$ or 40 oe<br>or<br>$\frac{2}{9}$ or $\frac{7}{9}$<br>or<br>$360 - 280$ or 80 oe |
|    | <b>Additional Guidance</b>                                                                                                                                                                                                                                                                                                                                 |      |                                                                                                                      |
|    | 80 and 280 shown on the diagram is not oe for $80 + 280 = 360$                                                                                                                                                                                                                                                                                             |      |                                                                                                                      |
|    | $360 \div 9 \times 7 = 280$                                                                                                                                                                                                                                                                                                                                |      | B2                                                                                                                   |
|    | $360 \div 9$ and $40 \times 2$ and $2:7 = 80:280$                                                                                                                                                                                                                                                                                                          |      | B2                                                                                                                   |
|    | $360 \div 9 = 40$ and $2:7 = 80:280$ ( $40 \times 2$ or $40 \times 7$ missing)                                                                                                                                                                                                                                                                             |      | B1                                                                                                                   |
|    | $40 \times 7 = 280$ without $360 \div 9$<br>eg $40 \times 7 = 280$ and $80 + 280 = 360$ ( $360 \div 9 = 40$ or $40 \times 2$ missing)                                                                                                                                                                                                                      |      | B1                                                                                                                   |
|    | $80:280$ and $80 + 280 = 360$ ( $2:7 = 80:280$ missing)                                                                                                                                                                                                                                                                                                    |      | B1                                                                                                                   |
|    | $360 \div 9 = 40$ and $80 + 280 = 360$ ( $40 \times 2$ or $40 \times 7$ missing)                                                                                                                                                                                                                                                                           |      | B1                                                                                                                   |
|    | $280 \div 7 = 40$ and $360 - 280 = 80$ ( $40 \times 2$ or $40 \times 9$ missing)                                                                                                                                                                                                                                                                           |      | B1                                                                                                                   |
|    | $280 \div 7$ and $40 \times 2$ and $80:280 = 2:7$ ( $80 + 280 = 360$ missing)                                                                                                                                                                                                                                                                              |      | B1                                                                                                                   |
|    | $80 + 280 = 360$                                                                                                                                                                                                                                                                                                                                           |      | B1                                                                                                                   |

| Q     | Answer                                                                                                                        | Mark | Comments                                                                                 |
|-------|-------------------------------------------------------------------------------------------------------------------------------|------|------------------------------------------------------------------------------------------|
| 12(a) | Pair of numbers satisfying all criteria                                                                                       | B2   | B1 pair of numbers satisfying two criteria<br>eg $c = 20$ $d = 14$<br>or $c = 7$ $d = 0$ |
|       | <b>Additional Guidance</b>                                                                                                    |      |                                                                                          |
|       | $c$ and $d$ can be decimals<br>eg $c = 8.6$ $d = 2.6$                                                                         |      | B2                                                                                       |
|       | Correct integer values for B2<br>$c = 9$ $d = 3$<br>$c = 8$ $d = 2$<br>$c = 7$ $d = 1$<br>$c = 6$ $d = 0$<br>$c = 5$ $d = -1$ |      |                                                                                          |
|       | Examples of correct integer values for B1<br>$c = 10$ $d = 4$<br>$c = 4$ $d = -2$                                             |      |                                                                                          |

| Q     | Answer                                  | Mark | Comments                                                                                                                                                                                                                    |
|-------|-----------------------------------------|------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 12(b) | Pair of numbers satisfying all criteria | B2   | eg $w = 1.9$ $x = 0.7$<br>B1 pair of numbers satisfying two criteria<br>eg $w = 1.6$ $x = 1$<br>or $w = 2.4$ $x = 0.2$<br>or $w = 1.4$ $x = 0.9$<br><br>SC1 pair of numbers with a sum of 2.6 satisfying neither inequality |
|       | <b>Additional Guidance</b>              |      |                                                                                                                                                                                                                             |
|       | $w = 0.7$ $x = 1.9$                     |      | SC1                                                                                                                                                                                                                         |

| Q  | Answer                                                                                                               | Mark | Comments                                                                                                                                                                                                                                                                                          |
|----|----------------------------------------------------------------------------------------------------------------------|------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 13 | No ticked<br>and<br>appropriate working to show $AB$<br>and $CD$ are not parallel                                    | B2   | B1 any correct angle on the diagram<br>eg 105 opposite the 105 given<br>eg 85 written next to the 95 given<br>or<br>any correct angle which assumes lines<br>are parallel<br>eg 95 written opposite the 105 given<br>or<br>any correct angle evaluation seen in<br>working<br>eg $180 - 105 = 75$ |
|    | <b>Additional Guidance</b>                                                                                           |      |                                                                                                                                                                                                                                                                                                   |
|    | Angles must be shown on diagram or clearly identified to score B2                                                    |      |                                                                                                                                                                                                                                                                                                   |
|    | Ignore any incorrect or irrelevant terminology alongside correct working                                             |      |                                                                                                                                                                                                                                                                                                   |
|    | “No” may be implied                                                                                                  |      |                                                                                                                                                                                                                                                                                                   |
|    | Condone an incorrect angle if not subsequently used                                                                  |      |                                                                                                                                                                                                                                                                                                   |
|    | Crossed out angles on diagram may be used to support working                                                         |      |                                                                                                                                                                                                                                                                                                   |
|    | No and 95 should be 105                                                                                              |      | B2                                                                                                                                                                                                                                                                                                |
|    | No and 95 written opposite the given 95<br>and 95 is not equal to 105                                                |      | B2                                                                                                                                                                                                                                                                                                |
|    | No and 105 opposite the given 105 and 85 next to the 95<br>and $105 + 85 = 190$ (or should be 180)                   |      | B2                                                                                                                                                                                                                                                                                                |
|    | No and 85 written next to the given 95<br>and 75 written next to the given 105 and $85 \neq 75$                      |      | B2                                                                                                                                                                                                                                                                                                |
|    | No and 75 written alongside 105 and 75 written underneath 95<br>and $95 + 75 = 170$ (or should be 180)               |      | B2                                                                                                                                                                                                                                                                                                |
|    | No and 95 written opposite 105 and the other two angles 75<br>and $95 + 75 + 75 + 105 = 350$ (or should be 360)      |      | B2                                                                                                                                                                                                                                                                                                |
|    | $95 + 105 = 200$ is not a correct angle evaluation<br>No and $95 + 105 = 200$ and if it is 180 they will be parallel |      | B0                                                                                                                                                                                                                                                                                                |

| Q  | Answer                                                              | Mark | Comments                  |
|----|---------------------------------------------------------------------|------|---------------------------|
| 14 | All 3 correct matches                                               | B3   | B1 for each correct match |
|    | <b>Additional Guidance</b>                                          |      |                           |
|    | Mark intention                                                      |      |                           |
|    | Matching to more than one box on the right is choice for that match |      |                           |
|    |                                                                     |      | B3                        |

| Q  | Answer                                                                                                                       | Mark  | Comments                             |
|----|------------------------------------------------------------------------------------------------------------------------------|-------|--------------------------------------|
| 15 | $496 \div 8$ or 62                                                                                                           | M1    | oe eg $8 \times 62$                  |
|    | $5 \times$ their 62 or 310                                                                                                   | M1dep | oe<br>$496 \times \frac{5}{8}$ is M2 |
|    | 638 – their 310 or 328<br>or<br>$(638 - \text{their } 310) \div 2$                                                           | M1dep | oe<br>dep on M2                      |
|    | 164                                                                                                                          | A1    |                                      |
|    | <b>Additional Guidance</b>                                                                                                   |       |                                      |
|    | Up to M3 may be awarded for correct work, with no answer or incorrect answer, even if this is seen amongst multiple attempts |       |                                      |

| Q  | Answer                                                                                                                       | Mark  | Comments        |
|----|------------------------------------------------------------------------------------------------------------------------------|-------|-----------------|
| 16 | $12 \times 16 \div 2$ or 96                                                                                                  | M1    | oe              |
|    | their $96 \div 7.5$                                                                                                          | M1dep |                 |
|    | 12.8                                                                                                                         | A1    | SC1 25.6 or 6.4 |
|    | <b>Additional Guidance</b>                                                                                                   |       |                 |
|    | Up to M2 may be awarded for correct work, with no answer or incorrect answer, even if this is seen amongst multiple attempts |       |                 |
|    | $12.8 \times 7.5 = 96$ , 96 on answer line                                                                                   |       | M1M1A0          |

| Q  | Answer                                                                                                                                                                                                                                                                                                                           | Mark | Comments               |
|----|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|------------------------|
| 17 | 2 correct matches                                                                                                                                                                                                                                                                                                                | B2   | B1 for 1 correct match |
|    | <b>Additional Guidance</b>                                                                                                                                                                                                                                                                                                       |      |                        |
|    | Mark intention                                                                                                                                                                                                                                                                                                                   |      |                        |
|    | Matching to more than one box on the right is choice for that match                                                                                                                                                                                                                                                              |      |                        |
|    | <div> <div> <b>Name</b> </div> <div> <div>Quadratic sequence</div> <div>Linear sequence</div> <div>Fibonacci-type sequence</div> </div> </div> <div> <div> <b>Sequence</b> </div> <div> <div>4, 5, 9, 14, 23...</div> <div>-3, 1, 5, 9, 13...</div> <div>-4, -1, 1, 5, 12...</div> <div>8, 11, 16, 23, 32...</div> </div> </div> |      | B2                     |

| Q  | Answer                                                                                        | Mark | Comments                                          |
|----|-----------------------------------------------------------------------------------------------|------|---------------------------------------------------|
| 18 | 1 – 0.04 or 0.96<br>or $0.04 \times 1\,000\,000$ or 40 000<br>or 960 000                      | M1   | oe eg $1 - \frac{4}{100}$<br>1 040 000 implies M1 |
|    | Full method for exactly 5 compounded percentage calculations with their multiplier            | M1   | oe eg $1\,000\,000 \times \text{their } 0.96^5$   |
|    | [800 000, 820 000] with M2 awarded                                                            | A1   |                                                   |
|    | <b>Additional Guidance</b>                                                                    |      |                                                   |
|    | 815 372.(...) or 815 373 with M2 awarded                                                      |      | M1M1A1                                            |
|    | Answer 800 000 from $40\,000 \times 5$                                                        |      | M1M0A0                                            |
|    | Answer 800 000 without either 40 000 shown or M2 awarded                                      |      | M0M0A0                                            |
|    | Intermediate values for separate calculations are<br>960 000, 921 600, 884 736, 849 346.(...) |      |                                                   |

| Q  | Answer                                                                                                                                                                | Mark | Comments                              |
|----|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|---------------------------------------|
| 19 | No ticked<br>and<br>correct reason<br>or<br>correct evaluation of the surface areas for any numerical or algebraic values<br>or<br>correct ratio of the surface areas | B2   | eg 2 faces are hidden<br>B1 No ticked |
|    | <b>Additional Guidance</b>                                                                                                                                            |      |                                       |
|    | Ignore irrelevant reasons or evaluations alongside a correct reason or evaluation, unless contradictory                                                               |      |                                       |
|    | “No” may be implied by a correct reason                                                                                                                               |      |                                       |
|    | Accept reasoning that uses A as a cube                                                                                                                                |      |                                       |
|    | No ticked and                                                                                                                                                         |      |                                       |
|    | A has 6, B has 10 (condone sides for faces)                                                                                                                           |      | B2                                    |
|    | A has 3, B has 5                                                                                                                                                      |      | B2                                    |
|    | A has 6 sides, on B each cube only has 5                                                                                                                              |      | B2                                    |
|    | Ratio is 3:5 (accept equivalent ratios)                                                                                                                               |      | B2                                    |
|    | The bottom and the top are missing (or covered)                                                                                                                       |      | B2                                    |
|    | When they are put together you lose two faces                                                                                                                         |      | B2                                    |
|    | You wouldn't count two sides (condone sides for faces)                                                                                                                |      | B2                                    |
|    | Some of the faces are covered                                                                                                                                         |      | B2                                    |
|    | You cannot see one side because they are stacked together                                                                                                             |      | B2                                    |
|    | One face covered                                                                                                                                                      |      | B2                                    |
|    | Part of the area of A is covered where it joins B                                                                                                                     |      | B2                                    |
|    | Both touching sides                                                                                                                                                   |      | B2                                    |
|    | Yes ticked or Cannot tell ticked                                                                                                                                      |      | B0                                    |

| Q     | Answer                                                                                                                                                                                                                                                                                                                    | Mark | Comments                          |      |      |      |     |     |     |     |     |      |     |     |
|-------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|-----------------------------------|------|------|------|-----|-----|-----|-----|-----|------|-----|-----|
| 20(a) | 0 and 3 in the correct positions                                                                                                                                                                                                                                                                                          | B2   | B1 0 or 3 in the correct position |      |      |      |     |     |     |     |     |      |     |     |
|       | Additional Guidance                                                                                                                                                                                                                                                                                                       |      |                                   |      |      |      |     |     |     |     |     |      |     |     |
|       | <table><tr><td><math>x</math></td><td><math>-3</math></td><td><math>-2</math></td><td><math>-1</math></td><td><math>0</math></td><td><math>1</math></td></tr><tr><td><math>y</math></td><td><math>3</math></td><td><math>0</math></td><td><math>-1</math></td><td><math>0</math></td><td><math>3</math></td></tr></table> |      | $x$                               | $-3$ | $-2$ | $-1$ | $0$ | $1$ | $y$ | $3$ | $0$ | $-1$ | $0$ | $3$ |
| $x$   | $-3$                                                                                                                                                                                                                                                                                                                      | $-2$ | $-1$                              | $0$  | $1$  |      |     |     |     |     |     |      |     |     |
| $y$   | $3$                                                                                                                                                                                                                                                                                                                       | $0$  | $-1$                              | $0$  | $3$  |      |     |     |     |     |     |      |     |     |

| Q     | Answer                                                  | Mark | Comments                                                                                                                  |
|-------|---------------------------------------------------------|------|---------------------------------------------------------------------------------------------------------------------------|
| 20(b) | Plots at least three points correctly                   | M1   | correct or ft their table in (a)<br>$\pm \frac{1}{2}$ small square<br>points may be implied by graph passing through them |
|       | Correct graph drawn through the five correct points     | A1   | $\pm \frac{1}{2}$ small square<br>smooth quadratic curve                                                                  |
|       | <b>Additional Guidance</b>                              |      |                                                                                                                           |
|       | Correct graph drawn without plotting the correct points | M1A1 |                                                                                                                           |
|       | Ignore any extra points plotted                         |      |                                                                                                                           |
|       | Ignore any part of graph drawn for $x < -3$ or $x > 1$  |      |                                                                                                                           |
|       | Ruled straight lines                                    | A0   |                                                                                                                           |

| Q  | Answer                                                                                      | Mark  | Comments                                                                                    |
|----|---------------------------------------------------------------------------------------------|-------|---------------------------------------------------------------------------------------------|
| 21 | <b>Alternative method 1</b>                                                                 |       |                                                                                             |
|    | 2450 ÷ (2 + 5)<br>or 2450 ÷ 7<br>or 350                                                     | M1    | oe                                                                                          |
|    | their 350 × 5 or 1750<br>or<br>their 350 × 2 or 700<br>or<br>their 350 ÷ 4 or 87.5(0)       | M1dep | oe<br>$2450 \times \frac{5}{7}$ is M2<br>$2450 \times \frac{2}{7}$ is M2<br>2450 ÷ 28 is M2 |
|    | their 1750 ÷ 4<br>or<br>(2450 – their 700) ÷ 4<br>or<br>their 87.5(0) × 5<br>or<br>437.5(0) | M1dep | oe<br>dep on M2<br>$350 \times \frac{5}{4}$ is M3                                           |
|    | 437.5(0) and Yes                                                                            | A1    | accept 437.5(0) > 430                                                                       |
|    | <b>Alternative method 2</b>                                                                 |       |                                                                                             |
|    | 2450 ÷ 4 or 612.5(0)                                                                        | M1    | oe                                                                                          |
|    | their 612.5(0) ÷ (2 + 5)<br>or their 612.5(0) ÷ 7<br>or 87.5(0)                             | M1dep | oe<br>2450 ÷ 28 is M2                                                                       |
|    | their 87.5(0) × 5<br>or<br>their 612.5(0) – their 87.5(0) × 2<br>or<br>437.5(0)             | M1dep | oe<br>dep on M2<br>$612.5(0) \times \frac{5}{7}$ is M3                                      |
|    | 437.5(0) and Yes                                                                            | A1    | accept 437.5(0) > 430                                                                       |

Mark scheme and Additional Guidance continue on the next page

|            |                                                                                                                              |       |                                                                                          |
|------------|------------------------------------------------------------------------------------------------------------------------------|-------|------------------------------------------------------------------------------------------|
| 21<br>cont | <b>Alternative method 3</b>                                                                                                  |       |                                                                                          |
|            | $430 \times 4$ or 1720                                                                                                       | M1    |                                                                                          |
|            | $2450 \div (2 + 5)$<br>or $2450 \div 7$<br>or 350                                                                            | M1    | oe                                                                                       |
|            | their $350 \times 5$ or 1750<br>or<br>their $350 \times 2$ or 700                                                            | M1dep | oe<br>dep on 2nd M<br>$2450 \times \frac{5}{7}$ is M2<br>$2450 \times \frac{2}{7}$ is M2 |
|            | 1720 and 1750 and Yes                                                                                                        | A1    | $2450 - 1720 = 730$ and 700 and Yes                                                      |
|            | <b>Alternative method 4</b>                                                                                                  |       |                                                                                          |
|            | $430 \times 4$ or 1720                                                                                                       | M1    |                                                                                          |
|            | their $1720 \div 5$ or 344<br>or their $1720 \times 2$ or 3440                                                               | M1dep | oe                                                                                       |
|            | their $344 \times 2$<br>or their $3440 \div 5$<br>or 688                                                                     | M1dep | oe<br>dep on M2<br>$1720 \times \frac{2}{5}$ is M3                                       |
|            | 2408 and Yes                                                                                                                 | A1    |                                                                                          |
|            | <b>Additional Guidance</b>                                                                                                   |       |                                                                                          |
|            | Up to M3 may be awarded for correct work, with no answer or incorrect answer, even if this is seen amongst multiple attempts |       |                                                                                          |
|            | $2450 \div 7 \times 1.25$ or $350 \times 1.25$                                                                               |       | M1M1M1                                                                                   |
|            | Yes may be implied<br>eg They receive 7.50 more than 430                                                                     |       | M3A1                                                                                     |
|            | Condone £437.50p and Yes                                                                                                     |       | M3A1                                                                                     |

| Q  | Answer                                                                                                                                                                                                                                                                                                                                             | Mark  | Comments                                                           |
|----|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|--------------------------------------------------------------------|
| 22 | 80 – 25 or 55<br>or<br>360 – 80 – 25 or 255                                                                                                                                                                                                                                                                                                        | M1    | oe<br>implied by 1 degree = 2.4 people<br>or 5 degrees = 12 people |
|    | $\frac{132}{\text{their } 55} \times 360$ or 864<br>or $\frac{132}{\text{their } 55} \times 80$ or 192<br>or $\frac{132}{\text{their } 55} \times 25$ or 60<br>or $\frac{132}{\text{their } 55} \times \text{their } 255$<br>or $\frac{132}{\text{their } 55} \times (80 + 25)$ or 252<br>or $\text{their } 255 \div \frac{\text{their } 55}{132}$ | M1dep | oe<br>2.4 × their 255 is M2<br>12 × 51 is M2<br>2.4 × 105 is M2    |
|    | 612                                                                                                                                                                                                                                                                                                                                                | A1    |                                                                    |
|    | <b>Additional Guidance</b>                                                                                                                                                                                                                                                                                                                         |       |                                                                    |
|    | Up to M2 may be awarded for correct work, with no answer or incorrect answer, even if this is seen amongst multiple attempts                                                                                                                                                                                                                       |       |                                                                    |

| Q  | Answer                                                                                                                                                      | Mark  | Comments |
|----|-------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|----------|
| 23 | <b>Alternative method 1 – using tangent of an angle</b>                                                                                                     |       |          |
|    | tan chosen or used                                                                                                                                          | M1    |          |
|    | $\tan 58 = \frac{x}{46}$ or $46 \times \tan 58$<br>or $\tan 32 = \frac{46}{x}$ or $\frac{46}{\tan 32}$                                                      | M1dep | oe       |
|    | [73.6, 74]                                                                                                                                                  | A1    |          |
|    | <b>Alternative method 2 – finding hypotenuse first</b>                                                                                                      |       |          |
|    | $\frac{46}{\cos 58}$ or $\frac{46}{\sin 32}$<br>or 86.8(...) or 87                                                                                          | M1    | oe       |
|    | $\sqrt{(\text{their } 86.8(\dots))^2 - 46^2}$<br>or $\sqrt{5418.(\dots)}$<br>or their $86.8(\dots) \times \sin 58$<br>or their $86.8(\dots) \times \cos 32$ | M1dep | oe       |
|    | [73.6, 74]                                                                                                                                                  | A1    |          |
|    | <b>Additional Guidance</b>                                                                                                                                  |       |          |
|    | Do not accept scale drawing                                                                                                                                 |       |          |
|    | Answer 73 after answer in range seen                                                                                                                        |       | M1M1A1   |
|    | $\frac{\sin 32}{46} = \frac{\sin 58}{x}$                                                                                                                    |       | M1       |

| Q     | Answer                                                                                         | Mark | Comments                                                                            |
|-------|------------------------------------------------------------------------------------------------|------|-------------------------------------------------------------------------------------|
| 24(a) | 8 or 10                                                                                        | M1   | 8 may be implied by $2^2$ or 4                                                      |
|       | 8 and 10<br>and<br>$\frac{1}{40}$ or 0.025                                                     | A1   | 8 may be implied by $2^2$ or 4<br><br>accept 0.03 with $\frac{1}{40}$ or 0.025 seen |
|       | <b>Additional Guidance</b>                                                                     |      |                                                                                     |
|       | Do not allow exact calculations for M1A1<br>eg $4.113 = 4$ and $10.21 = 10$ and $\frac{1}{40}$ |      | M1A0                                                                                |
|       | $\frac{1}{40}$ or 0.025 with 8 or 10 seen (8 may be implied by $2^2$ or 4)                     |      | M1A0                                                                                |
|       | $\frac{1}{40}$ or 0.025 without 8 or 10 seen (8 may be implied by $2^2$ or 4)                  |      | M0A0                                                                                |

| Q     | Answer                                                                                                                                 | Mark | Comments                               |
|-------|----------------------------------------------------------------------------------------------------------------------------------------|------|----------------------------------------|
| 24(b) | Valid explanation                                                                                                                      | B1   | eg both numbers have been rounded down |
|       | <b>Additional Guidance</b>                                                                                                             |      |                                        |
|       | Ignore irrelevant reasons alongside a correct reason, unless contradictory                                                             |      |                                        |
|       | Ignore a calculation using exact values alongside a correct reason<br>eg 0.025 is greater than 0.0238... and both numbers rounded down |      | B1                                     |
|       | 0.025 is greater than 0.0238...                                                                                                        |      | B0                                     |
|       | The denominator is smaller                                                                                                             |      | B1                                     |
|       | The denominator using the exact values is bigger                                                                                       |      | B1                                     |
|       | (Decimals) rounded down                                                                                                                |      | B1                                     |
|       | Because 8.34 is more than 8 and 10.21 is more than 10                                                                                  |      | B1                                     |
|       | One is divided by less (with answer more)                                                                                              |      | B1                                     |
|       | Estimating rounds the numbers down which makes the denominator less                                                                    |      | B1                                     |
|       | Estimating rounds the numbers down which makes it less                                                                                 |      | B0                                     |
|       | Because it rounds up                                                                                                                   |      | B0                                     |
|       | Because she rounded each number to one significant figure                                                                              |      | B0                                     |
|       | The numbers get rounded up so more than the exact value                                                                                |      | B0                                     |
|       | Rounded up when estimating                                                                                                             |      | B0                                     |
|       | Removing the decimals makes the number bigger                                                                                          |      | B0                                     |

| Q     | Answer                                                                                             | Mark | Comments                                                              |
|-------|----------------------------------------------------------------------------------------------------|------|-----------------------------------------------------------------------|
| 25(a) | $(x + 3)(x + 5)$                                                                                   | B2   | either order<br>B1 $(x + a)(x + b)$<br>where $ab = 15$ or $a + b = 8$ |
|       | <b>Additional Guidance</b>                                                                         |      |                                                                       |
|       | Accept $1x$ for $x$ throughout                                                                     |      |                                                                       |
|       | $(3 + x) \times (x + 5)$                                                                           |      | B2                                                                    |
|       | Condone missing final bracket eg $(5 + x)(3 + x$                                                   |      | B2                                                                    |
|       | Ignore any attempt to solve $(x + 3)(x + 5) = 0$<br>eg $(x + 3)(x + 5)$ followed by $x = 3, x = 5$ |      | B2                                                                    |

| Q     | Answer                                                                             | Mark | Comments     |
|-------|------------------------------------------------------------------------------------|------|--------------|
| 25(b) | $(y =) -2 \quad (y =) 4$                                                           | B1   | either order |
|       | <b>Additional Guidance</b>                                                         |      |              |
|       | Accept any letter eg $x = -2 \quad x = 4$                                          |      | B1           |
|       | $-2$ and $4$ on the answer line                                                    |      | B1           |
|       | $-2$ and $4$ written separately in the stem unless contradicted by answer line     |      | B1           |
|       | $-2$ and $4$ written with $(-2 + 2)(4 - 4)$ unless contradicted by answer line     |      | B1           |
|       | $(-2 + 2)(4 - 4)$ on answer line                                                   |      | B0           |
|       | $(-2 + 2)(4 - 4)$ even if $-2$ and $4$ circled or indicated as the embedded values |      | B0           |