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# GCSE MATHEMATICS 8300/3H

Higher Tier Paper 3 Calculator

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**Mark scheme**

November 2019

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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**

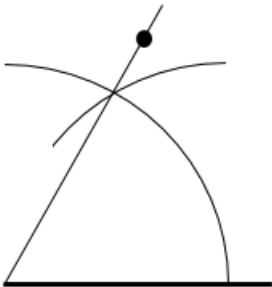
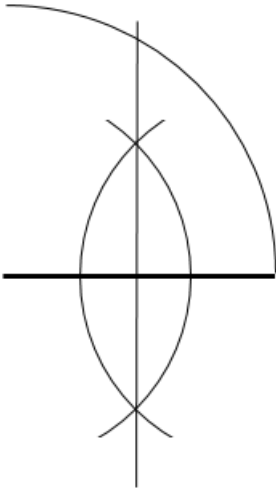
Accept a comma used instead of a decimal point (for example, in measurements or currency), provided that it is clear to the examiner that the student intended it to be a decimal point.

| Question | Answer                 | Mark | Comments |
|----------|------------------------|------|----------|
| 1        | 0.26                   | B1   |          |
| 2        | $\frac{3}{2}$          | B1   |          |
| 3        | $-2x$                  | B1   |          |
| 4        | $6.365 \leq x < 6.375$ | B1   |          |

| Question | Answer                                                                                                                 | Mark   | Comments                                                                                                                                                     |
|----------|------------------------------------------------------------------------------------------------------------------------|--------|--------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 5        | <b>Alternative method 1</b>                                                                                            |        |                                                                                                                                                              |
|          | $7x - 3x = 36 - 16$                                                                                                    | M1     | oe elimination of one variable<br>implied by $4x = n$ ,<br>where $n < 36$ and $n \neq 16$                                                                    |
|          | $4x = 20$ or $x = 5$                                                                                                   | A1     | oe                                                                                                                                                           |
|          | $y = 0.5$                                                                                                              | A1     | oe                                                                                                                                                           |
|          | <b>Alternative method 2</b>                                                                                            |        |                                                                                                                                                              |
|          | $7 \times 2y - 3 \times 2y = 7 \times 16 - 3 \times 36$<br>or<br>$14y - 6y = 112 - 108$                                | M1     | oe elimination of one variable<br>implied by $21x + 14y = 112$ and<br>$21x + 6y = 108$ followed by $8y = n$ ,<br>where $n < 112$ and $n \neq 36, 16$ or $20$ |
|          | $8y = 4$ or $y = 0.5$                                                                                                  | A1     | oe                                                                                                                                                           |
|          | $x = 5$                                                                                                                | A1     |                                                                                                                                                              |
|          | <b>Alternative method 3</b>                                                                                            |        |                                                                                                                                                              |
|          | $36 - 7x = 16 - 3x$<br>or $\frac{36 - 2y}{7} = \frac{16 - 2y}{3}$                                                      | M1     | oe elimination of one variable                                                                                                                               |
|          | $4x = 20$ or $x = 5$<br>or $8y = 4$ or $y = 0.5$                                                                       | A1     | oe collects terms<br>oe                                                                                                                                      |
|          | $x = 5$ and $y = 0.5$                                                                                                  | A1     | oe                                                                                                                                                           |
|          | <b>Additional Guidance</b>                                                                                             |        |                                                                                                                                                              |
|          | $x = 5$ and $y = 0.5$                                                                                                  | M1A1A1 |                                                                                                                                                              |
|          | One correct value with one incorrect value (or no second value) and no working eg $x = 5$ and $y = 2$ or eg $x = 5$    | M1A1A0 |                                                                                                                                                              |
|          | Embedded, correct values in both equations<br>eg $7 \times 5 + 2 \times 0.5 = 36$ and $3 \times 5 + 2 \times 0.5 = 16$ | M1A1A0 |                                                                                                                                                              |
|          | Embedded, correct values in one equation only<br>eg $7 \times 5 + 2 \times 0.5 = 36$                                   | M1A0A0 |                                                                                                                                                              |

| Question | Answer                                                                                                                                                | Mark  | Comments        |
|----------|-------------------------------------------------------------------------------------------------------------------------------------------------------|-------|-----------------|
| 6(a)     | $3 \times 18$ or 54<br>or<br>$2 \times 18 + 14$ or 50<br>or<br>$18 + 3 \times 14$ or 60<br>or<br>$4 \times 14$ or 56<br>or<br>$1 - 0.25$ or 0.75 seen | M1    | oe              |
|          | $3 \times 18 \times (1 - 0.25)$<br>or $3 \times 18 \times 0.75$ or 40.5<br>or<br>$18 \times (1 - 0.25)$<br>or $18 \times 0.75$ or 13.5(0)             | M1dep | oe              |
|          | 40.50                                                                                                                                                 | A1    | condone £40.50p |
|          | <b>Additional Guidance</b>                                                                                                                            |       |                 |
|          | 40.5 on answer line                                                                                                                                   |       | M1M1A0          |

| Question | Answer                                                  | Mark | Comments                                                                                     |
|----------|---------------------------------------------------------|------|----------------------------------------------------------------------------------------------|
| 6(b)     | Should have multiplied 15 by 6<br>or<br>90              | B1   | oe eg $15 \times 6$<br>accept $\frac{240 \times 600}{40 \times 40}$ or $\frac{144000}{1600}$ |
|          | <b>Additional Guidance</b>                              |      |                                                                                              |
|          | Ignore irrelevant statements alongside a correct answer |      |                                                                                              |
|          | 15 × 6 seen but evaluated incorrectly                   |      | B1                                                                                           |
|          | Should have multiplied not added                        |      | B1                                                                                           |
|          | Should have multiplied at the end                       |      | B1                                                                                           |
|          | Adding was wrong                                        |      | B1                                                                                           |
|          | He has added                                            |      | B1                                                                                           |
|          | Times the number for length and width                   |      | B1                                                                                           |
|          | Times the length and width                              |      | B0                                                                                           |
|          | Calculation at the end is wrong                         |      | B0                                                                                           |
|          | Should have multiplied                                  |      | B0                                                                                           |
|          | Needs to work out the area                              |      | B0                                                                                           |
|          | 21 is wrong                                             |      | B0                                                                                           |
|          | Answer is wrong                                         |      | B0                                                                                           |

| Question | Answer                                                                                                                              | Mark | Comments                                                                             |
|----------|-------------------------------------------------------------------------------------------------------------------------------------|------|--------------------------------------------------------------------------------------|
| 7        | Side of length [7.8, 8.2] cm drawn                                                                                                  | B1   |                                                                                      |
|          | Correct construction with intersecting arcs, same radius as their base $\pm 2$ mm to identify the third vertex                      | M1   |    |
|          | or                                                                                                                                  |      |    |
|          | correct construction with intersecting arcs, equal radii $\pm 2$ mm, line drawn at $60^\circ$ and third vertex correctly positioned |      |   |
|          | or                                                                                                                                  |      |  |
|          | Triangle with equal sides [7.8, 8.2], with correct construction seen                                                                | A1ft | ft B0M1 triangle with equal sides $\pm 2$ mm, with correct construction seen         |
|          | <b>Additional Guidance</b>                                                                                                          |      |                                                                                      |
|          | No construction arcs drawn can score a maximum of B1                                                                                |      |                                                                                      |

| Question | Answer                                                                                                                                                | Mark | Comments                                                   |
|----------|-------------------------------------------------------------------------------------------------------------------------------------------------------|------|------------------------------------------------------------|
| 8(a)     | $\frac{2}{5} \times 35$ or $\frac{3}{8} \times 48$                                                                                                    | M1   | oe                                                         |
|          | 14 or 18                                                                                                                                              | A1   |                                                            |
|          | 32                                                                                                                                                    | A1   |                                                            |
|          | <b>Additional Guidance</b>                                                                                                                            |      |                                                            |
|          | Do not ignore further working after 32 seen                                                                                                           |      |                                                            |
|          | $\frac{32}{83}$ on answer line                                                                                                                        |      | M1A1A0                                                     |
| 8(b)     | <b>Alternative method 1</b>                                                                                                                           |      |                                                            |
|          | 35 + 48 – their 32<br>or<br>35 – their 14 + 48 – their 18 or 51                                                                                       | M1   | oe their 32 from (a)<br><br>their 14 and their 18 from (a) |
|          | $\frac{51}{83}$ or 0.61(4...) or 61(.4...)%                                                                                                           | A1ft | ft their 32 from (a)                                       |
|          | <b>Alternative method 2</b>                                                                                                                           |      |                                                            |
|          | $\left(1 - \frac{2}{5}\right) \times 35 + \left(1 - \frac{3}{8}\right) \times 48$<br>or $\frac{3}{5} \times 35 + \frac{5}{8} \times 48$<br>or 21 + 30 | M1   | oe                                                         |
|          | $\frac{51}{83}$ or 0.61(4...) or 61(.4...)%                                                                                                           | A1   |                                                            |
|          | <b>Additional Guidance</b>                                                                                                                            |      |                                                            |
|          | Ignore incorrect conversion if correct fraction seen                                                                                                  |      |                                                            |
|          | If their answer in part (a) is a fraction, only allow follow through if their numerator is used in part (b)                                           |      |                                                            |
|          | Alt 1 ft decimal or percentage answers accept rounding to at least 2 sf                                                                               |      |                                                            |

| Question | Answer                                                                                              | Mark  | Comments                                                                 |
|----------|-----------------------------------------------------------------------------------------------------|-------|--------------------------------------------------------------------------|
| 9        | <b>Alternative method 1</b>                                                                         |       |                                                                          |
|          | $\frac{450}{65-35}$ or $\frac{450}{30}$ or 15                                                       | M1    | oe                                                                       |
|          | (360 – 65 – 35) × their 15<br>or 260 × their 15                                                     | M1dep | oe<br>M2 $\frac{260}{30} \times 450$ or 8.66(...) × 450<br>or 8.67 × 450 |
|          | 3900                                                                                                | A1    |                                                                          |
|          | <b>Alternative method 2</b>                                                                         |       |                                                                          |
|          | $\frac{360}{65-35} \times 450$ or $\frac{360}{30} \times 450$<br>or 12 × 450 or 5400                | M1    | oe                                                                       |
|          | $\frac{360-65-35}{360} \times \text{their } 5400$<br>or $\frac{260}{360} \times \text{their } 5400$ | M1dep | oe eg 0.72(...) × their 5400                                             |
|          | 3900                                                                                                | A1    |                                                                          |
|          | <b>Additional Guidance</b>                                                                          |       |                                                                          |
|          | 260 ÷ 30 = 8.6 and 8.6 × 450 fully correct working seen                                             |       | M1M1A0                                                                   |
| 10       | ÷ 8                                                                                                 | B1    |                                                                          |

| Question | Answer                                                                                                                                         | Mark | Comments                                                                          |
|----------|------------------------------------------------------------------------------------------------------------------------------------------------|------|-----------------------------------------------------------------------------------|
| 11       | 8                                                                                                                                              | B1   |                                                                                   |
|          | $\frac{1}{0.4}$ or $\frac{10}{4}$ or 2.5<br>or $\frac{1}{\frac{2}{5}}$ or $\frac{5}{2}$ or $2\frac{1}{2}$                                      | M1   | $8 \times 0.4$ or $3.2$ implies B1M1<br>$16 : 5$ or equivalent ratio implies B1M1 |
|          | $3.2 : 1$<br>or $\frac{16}{5} : 1$ or $3\frac{1}{5} : 1$                                                                                       | A1ft | ft B0M1                                                                           |
|          | <b>Additional Guidance</b>                                                                                                                     |      |                                                                                   |
|          | $8^3 = 512$ or $8 \times 8 \times 8 = 512$ alone is not sufficient for B1                                                                      |      |                                                                                   |
|          | ft answers must have $n$ exact or correctly rounded to at least 2 sf<br>eg $\sqrt{512} = 22.62$ (incorrect and truncated)<br>2.5<br>$9.05 : 1$ |      | B0<br>M1<br>A1ft                                                                  |
|          | ft answer exact surd value<br>eg $\sqrt{512} = 16\sqrt{2}$<br>2.5<br>$9.05 : 1$ or $\frac{32}{5}\sqrt{2} : 1$                                  |      | B0<br>M1<br>A1ft                                                                  |

| Question | Answer                                                                                 | Mark  | Comments           |
|----------|----------------------------------------------------------------------------------------|-------|--------------------|
| 12       | <b>Alternative method 1</b>                                                            |       |                    |
|          | $280 \div 35$ or 8                                                                     | M1    | oe eg $80 \div 10$ |
|          | $(350 - 280) \div (40 - 35)$<br>or<br>$70 \div 5$<br>or<br>14                          | M1    | oe                 |
|          | 6                                                                                      | A1    |                    |
|          | <b>Alternative method 2</b>                                                            |       |                    |
|          | 320<br>or<br>$350 - 320$ or 30<br>or<br>$350 - 280$ and $320 - 280$<br>or<br>70 and 40 | M1    | oe                 |
|          | $(350 - 320) \div 5$<br>or<br>$(70 - 40) \div 5$<br>or<br>$30 \div 5$                  | M1dep | oe                 |
|          | 6                                                                                      | A1    |                    |
|          | <b>Additional Guidance</b>                                                             |       |                    |
|          | Do not allow a misread from the graph                                                  |       |                    |
|          | Alt 2 40 must come from $320 - 280$ and not 40 hours worked                            |       |                    |

| Question | Answer                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | Mark | Comments                                                                                                                                                                                                                                                                                                                                                                                                                                            |  |
|----------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|
| 13(a)    | 120 and 132 and 96 and 156<br>and states that 4 out of 5 would be<br>above 100<br><br>or<br><br>8.3... and states that 4 out of 5<br>would be above 100<br><br>or<br><br>$10.4 \times 12 = 124.8$ and states this is<br>above 100 or the hypothesis is<br>correct<br><br>or<br><br>median or mode = 10 and $10 \times 12 =$<br>120 and states that median or mode<br>is above 100<br><br>or<br><br>$52 \times 12 (= 624)$ and $5 \times 100 (= 500)$<br>and states $624 > 500$ | B2   | B1<br><br>$10 \times 12$ or 120<br><br>and $11 \times 12$ or 132<br><br>and $8 \times 12$ or 96<br><br>and $13 \times 12$ or 156<br><br>or<br><br>$100 \div 12$ or 8.3...<br><br>or<br><br>states that 4 out of 5 would be above 100<br>with no or incorrect evaluations<br><br>or<br><br>$10.4 \times 12 = 124.8$<br><br>or<br><br>median or mode = 10 and $10 \times 12 = 120$<br><br>or<br><br>$52 \times 12 (= 624)$ and $5 \times 100 (= 500)$ |  |
|          | Additional Guidance                                                                                                                                                                                                                                                                                                                                                                                                                                                            |      |                                                                                                                                                                                                                                                                                                                                                                                                                                                     |  |
|          | '4 out of 5' is implied by 'most people'                                                                                                                                                                                                                                                                                                                                                                                                                                       |      |                                                                                                                                                                                                                                                                                                                                                                                                                                                     |  |
|          | $(10 + 11 + 8 + 10 + 13) \div 5 = 10.4$                                                                                                                                                                                                                                                                                                                                                                                                                                        |      | B0                                                                                                                                                                                                                                                                                                                                                                                                                                                  |  |
|          | $52 \times 12$ or 624 alone                                                                                                                                                                                                                                                                                                                                                                                                                                                    |      | B0                                                                                                                                                                                                                                                                                                                                                                                                                                                  |  |
| 13(b)    | Any two correct reasons from<br><br>The sample is biased<br><br>The sample is too small<br><br>They may not read at the same rate<br>in other months                                                                                                                                                                                                                                                                                                                           | B2   | oe<br><br>eg people in book clubs read more books<br><br>eg she should ask a lot more people<br><br>eg that month may not be representative<br><br>B1<br><br>any one correct reason                                                                                                                                                                                                                                                                 |  |
|          | Additional Guidance                                                                                                                                                                                                                                                                                                                                                                                                                                                            |      |                                                                                                                                                                                                                                                                                                                                                                                                                                                     |  |
|          | Needs to use data from more months                                                                                                                                                                                                                                                                                                                                                                                                                                             |      | B1                                                                                                                                                                                                                                                                                                                                                                                                                                                  |  |
|          | The results of just 5 people used                                                                                                                                                                                                                                                                                                                                                                                                                                              |      | B1                                                                                                                                                                                                                                                                                                                                                                                                                                                  |  |

| Question | Answer                                                                       | Mark  | Comments                                                                                                                     |
|----------|------------------------------------------------------------------------------|-------|------------------------------------------------------------------------------------------------------------------------------|
| 14       | $y = x^3 + 2$ or $a = 2$                                                     | M1    | implied by at least two correct points identified or plotted from<br>$(-3, -25), (-2, -6), (-1, 1), (0, 2), (1, 3), (2, 10)$ |
|          | At least five correct points identified or plotted for their value of $a$    | M1    | correct points are<br>$(-3, -25), (-2, -6), (-1, 1), (0, 2), (1, 3), (2, 10)$ may be seen in a table or in working           |
|          | Seven correct points plotted and joined with a smooth curve                  | A1    | $\pm \frac{1}{2}$ square<br>SC1 fully correct curve for $y = x^3$ for $-3 \leq x \leq 2$                                     |
|          | <b>Additional Guidance</b>                                                   |       |                                                                                                                              |
|          |                                                                              |       |                                                                                                                              |
| 15       | $37\,500 \times 0.2$ or $7\,500$                                             | M1    |                                                                                                                              |
|          | $(9260 - \text{their } 7500) \div 0.4$<br>or $1760 \div 0.4$ or $4400$       | M1dep |                                                                                                                              |
|          | their $4400 + 37\,500 + 12\,500$                                             | M1dep | dep on M2                                                                                                                    |
|          | $54\,400$                                                                    | A1    |                                                                                                                              |
|          | <b>Additional Guidance</b>                                                   |       |                                                                                                                              |
|          | Trial and improvement for any part only scores if the correct value is found |       |                                                                                                                              |
| 16(a)    | $2 \times 14 \times 9 \times 8$                                              | M1    | oe                                                                                                                           |
|          | 2016                                                                         | A1    |                                                                                                                              |
|          | <b>Additional Guidance</b>                                                   |       |                                                                                                                              |
|          | $2016 \div 4 = 504$ penalise further working after 2016 seen                 |       | M1A0                                                                                                                         |
|          | $2 \times 14 \times 9 \times 8 \times 4$ with 2016 not seen                  |       | M0A0                                                                                                                         |
|          | $2 \times 14 \times 9 \times 8 \div 4$ with 2016 not seen                    |       | M0A0                                                                                                                         |

| Question | Answer                                                                                                                                                                                                                                   | Mark | Comments |
|----------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|----------|
| 16(b)    | $(1 \times) 14 \times 9 \times 6$                                                                                                                                                                                                        | M1   | oe       |
|          | 756                                                                                                                                                                                                                                      | A1   |          |
|          | <b>Additional Guidance</b>                                                                                                                                                                                                               |      |          |
|          | $756 \div 4 = 189$ penalise further working after 756 seen                                                                                                                                                                               |      | M1A0     |
|          | $756 \times 4 = 3024$                                                                                                                                                                                                                    |      | M1A0     |
|          | $14 \times 9 \times 6 \div 4$ with 756 not seen                                                                                                                                                                                          |      | M0A0     |
| 17       | $(f(10) =) 3 \times 10^2 - 4 \times 10 + 8$<br>or $(f(10) =) 300 - 40 + 8$<br>or $(f(10) =) 268$<br>or<br>$(f(5) =) 3 \times 5^2 - 4 \times 5 + 8$<br>or $(f(5) =) 75 - 20 + 8$<br>or $(f(5) =) 63$<br>or $(2f(5) =) 2 \times 63$ or 126 | M1   |          |
|          | 268 and 126 and No                                                                                                                                                                                                                       | A1   |          |
|          | <b>Additional Guidance</b>                                                                                                                                                                                                               |      |          |
|          |                                                                                                                                                                                                                                          |      |          |
| 18       | $-\frac{1}{7}$ and $\frac{3}{2}$                                                                                                                                                                                                         | B1   |          |

| Question | Answer                                                     | Mark | Comments                    |
|----------|------------------------------------------------------------|------|-----------------------------|
| 19(a)    | $\tan DBH = \frac{8}{13}$                                  | M1   | oe $\tan^{-1} \frac{8}{13}$ |
|          | 31.6...                                                    | A1   |                             |
|          | <b>Additional Guidance</b>                                 |      |                             |
|          | 31.6... in working, 32 on answer line – correct rounding   |      | M1A1                        |
|          | 31.6... in working, 31 on answer line – incorrect rounding |      | M1A0                        |
|          | $\tan \frac{8}{13}$ or $\tan = \frac{8}{13}$               |      | M0A0                        |
| 19(b)    | 58.39... or 58.4                                           | B1ft | ft 90 – their 31.6...       |
|          | <b>Additional Guidance</b>                                 |      |                             |
|          | Correct or follow through                                  |      |                             |
| 20       | $\sqrt{2}$                                                 | B1   |                             |

| Question | Answer                                                                              | Mark  | Comments |
|----------|-------------------------------------------------------------------------------------|-------|----------|
| 21       | <b>Alternative method 1</b>                                                         |       |          |
|          | $1125 \div 5 \times 2$ or 450                                                       | M1    | oe       |
|          | their $450 \div 6 \times (7 \div 4)$<br>or $75 \times 1.75$ or 131.25               | M1dep |          |
|          | $1125 \div$ their 131.25                                                            | M1dep |          |
|          | 8.57... or 8.6 or $8\frac{4}{7}$ or 8                                               | A1    |          |
|          | <b>Alternative method 2</b>                                                         |       |          |
|          | $5 \div 2$ or 2.5<br>and<br>$7 \div 4$ or 1.75                                      | M1    | oe       |
|          | their $2.5 \div$ their 1.75 or 1.42857...<br>or $\frac{10}{7}$                      | M1dep | oe       |
|          | $6 \times$ their 1.42857...                                                         | M1dep |          |
|          | 8.57... or 8.6 or $8\frac{4}{7}$ or 8                                               | A1    |          |
|          | <b>Alternative method 3</b>                                                         |       |          |
|          | (Small bottle fills) $6 \times \frac{4}{7}$ or $\frac{24}{7}$                       | M1    |          |
|          | (Large bottle fills) their $\frac{24}{7} \times \frac{5}{2}$<br>or $\frac{120}{14}$ | M1dep |          |
|          | their $120 \div$ their 14                                                           | M1dep |          |
|          | 8.57... or 8.6 or $8\frac{4}{7}$ or 8                                               | A1    |          |

Mark scheme for Question 21 continues on next page

| Question | Answer                                                                                    | Mark  | Comments                                                                                                           |
|----------|-------------------------------------------------------------------------------------------|-------|--------------------------------------------------------------------------------------------------------------------|
| 21 cont  | <b>Alternative method 4</b>                                                               |       |                                                                                                                    |
|          | Any two of<br>$b_1 = 6g_1$ and $b_2 = 2.5b_1$<br>and $g_2 = 1.75g_1$                      | M1    | oe any letters for small bottle ( $b_1$ ), small glass ( $g_1$ ), large bottle ( $b_2$ ) and large glass ( $g_2$ ) |
|          | $b_2 = 2.5 \times 6g_1$ or $b_2 = 15g_1$                                                  | M1dep | oe                                                                                                                 |
|          | $b_2 = \text{their } 15\left(\frac{g_2}{1.75}\right)$                                     | M1dep |                                                                                                                    |
|          | $8.57\dots$ or $8.6$ or $8\frac{4}{7}$ or $8$                                             | A1    |                                                                                                                    |
|          | <b>Additional Guidance</b>                                                                |       |                                                                                                                    |
|          | If the student attempts more than one method, mark each method and award the highest mark |       |                                                                                                                    |
|          | Correct answer seen in working, 9 on answer line                                          |       | M1M1M1A0                                                                                                           |

| Question | Answer                                                                                                                                       | Mark | Comments |
|----------|----------------------------------------------------------------------------------------------------------------------------------------------|------|----------|
| 22       | <b>Alternative method 1</b>                                                                                                                  |      |          |
|          | $(x - 5)^2$ or $(5 - x)^2$<br>or<br>$x^2 - 10x + 25 (= 0)$<br>or<br>$b = -10$<br>or<br>$c = 25$                                              | M1   |          |
|          | $b = -10$ and $c = 25$                                                                                                                       | A1   |          |
|          | <b>Alternative method 2 – using <math>b^2 - 4ac</math></b>                                                                                   |      |          |
|          | $b^2 - 4(\times 1) \times c = 0$<br>or<br>$b^2 - 4(\times 1) \times (-25 - 5b) = 0$<br>or<br>$b^2 + 100 + 20b = 0$<br>or<br>$(b + 10)^2 = 0$ | M1   |          |
|          | $b = -10$ and $c = 25$                                                                                                                       | A1   |          |
|          | <b>Additional Guidance</b>                                                                                                                   |      |          |
|          | Do not allow $c = 25$ from $(x + 5)^2$ or $(5 + x)^2$                                                                                        |      |          |

| Question | Answer                                                          | Mark | Comments |
|----------|-----------------------------------------------------------------|------|----------|
| 23       | $\frac{3}{8}$                                                   | B1   |          |
| 24       | Enlargement                                                     | B1   |          |
|          | Scale factor ( $\times$ ) $-\frac{1}{2}$                        | B1   | oe       |
|          | Centre (1, -1)                                                  | B1   |          |
|          | <b>Additional Guidance</b>                                      |      |          |
|          | Enlarge ( $\times$ ) $-\frac{1}{2}$ (1, -1)                     |      | B1B1B1   |
|          | 'Reduces' or 'gets smaller' or 'shrinks'                        |      | 1st B0   |
|          | Do not accept $\div \left(-\frac{1}{2}\right)$ for scale factor |      | 2nd B0   |
|          | Centre 1, -1                                                    |      | 3rd B0   |
|          | Combined transformation given                                   |      | B0B0B0   |

| Question | Answer                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | Mark  | Comments                                                                                         |
|----------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|--------------------------------------------------------------------------------------------------|
| 25       | <b>Alternative method 1</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                              |       |                                                                                                  |
|          | <p>Correct method to work out any viable distance, eg</p> $\frac{1}{2} \times \frac{5}{60} \times 102 \text{ or } 4.25$ <p>or</p> $102 \times \frac{40}{60} \text{ or } 68$ <p>or</p> $\frac{1}{2}(102 + 96) \times \frac{15}{60} \text{ or } 96 \times \frac{15}{60}$ <p>and <math>\frac{1}{2} \times 6 \times \frac{15}{60} \text{ or } 24 \text{ and } 0.75</math></p> <p>or 24.75</p> <p>or</p> $\frac{1}{2}\left(\frac{40}{60} + \frac{45}{60}\right) \times 102 \text{ or } 72.25$ | M1    | <p>first section</p> <p>second section</p> <p>third section</p> <p>first and second sections</p> |
|          | <p>Correct method to work out all parts of distance, eg</p> $\frac{1}{2} \times \frac{5}{60} \times 102 \text{ or } 4.25$ <p>and</p> $102 \times \frac{40}{60} \text{ or } 68$ <p>and</p> $\frac{1}{2}(102 + 96) \times \frac{15}{60} \text{ or } 24.75$                                                                                                                                                                                                                                 | M1dep | 97 scores M1M1                                                                                   |
|          | <p>130 – their whole distance</p> <p>or 130 – 97</p>                                                                                                                                                                                                                                                                                                                                                                                                                                     | M1dep | <p>eg</p> <p>130 – their 4.25 – their 68 – their 24.75</p> <p>dep on M2</p>                      |
|          | 33                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | A1    |                                                                                                  |

**Mark scheme for Question 25 continues on the next page**

| Question | Answer                                                                                                                                                                                                                                                                                                                     | Mark  | Comments                                                                                          |
|----------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|---------------------------------------------------------------------------------------------------|
| 25 cont  | <b>Alternative method 2</b>                                                                                                                                                                                                                                                                                                |       |                                                                                                   |
|          | Correct method to work out $60 \times$ any viable distance, eg<br>$\frac{1}{2} \times 5 \times 102$ or 255<br>or<br>$102 \times 40$ or 4080<br>or<br>$\frac{1}{2}(102 + 96) \times 15$ or $96 \times 15$ and<br>$\frac{1}{2} \times 6 \times 15$ or 1440 and 45 or 1485<br>or<br>$\frac{1}{2}(40 + 45) \times 102$ or 4335 | M1    | first section<br><br>second section<br><br>third section<br><br>first and second sections         |
|          | Correct method to work out $60 \times$ all parts of distance, eg<br>$\frac{1}{2} \times 5 \times 102$ or 255<br>and<br>$102 \times 40$ or 4080<br>and<br>$\frac{1}{2}(102 + 96) \times 15$ or 1485                                                                                                                         | M1dep | 5820 implies M1M1                                                                                 |
|          | 130 – their whole distance<br>or $130 - \frac{5820}{60}$<br>or $130 - 97$                                                                                                                                                                                                                                                  | M1dep | eg<br>$130 - \frac{\text{their } 255 + \text{their } 4080 + \text{their } 1485}{60}$<br>dep on M2 |
|          | 33                                                                                                                                                                                                                                                                                                                         | A1    |                                                                                                   |
|          | <b>Additional Guidance</b>                                                                                                                                                                                                                                                                                                 |       |                                                                                                   |
|          | Accept fractions used as decimals correct to 2 dp or better                                                                                                                                                                                                                                                                |       |                                                                                                   |

| Question | Answer                                                                                                                                    | Mark  | Comments                                                      |
|----------|-------------------------------------------------------------------------------------------------------------------------------------------|-------|---------------------------------------------------------------|
| 26(a)    | $\frac{1}{2} \times 9.7 \times 3.8 \times \sin 73^\circ$ or 17.6...                                                                       | M1    | oe                                                            |
|          | their 17.6... $\times 6 \div 8.5$ or<br>105.7... $\div 8.5$ or 12.4...                                                                    | M1dep | oe                                                            |
|          | 13                                                                                                                                        | A1    |                                                               |
|          | <b>Additional Guidance</b>                                                                                                                |       |                                                               |
|          | $\frac{1}{2} \times 9.7 \times 3.8 = 18.43$ $18.43 \times 6 \div 8.5 = 13.0...$                                                           |       | M0M0A0                                                        |
| 26(b)    | $9.7^2 + 3.8^2 - 2 \times 9.7 \times 3.8 \times \cos 73^\circ$<br>or $94.09 + 14.44 - 73.72 \cos 73^\circ$<br>or 86.976... or 86.98 or 87 | M1    | oe                                                            |
|          | $\sqrt{\text{their } 86.976...}$                                                                                                          | M1dep |                                                               |
|          | 9.3(2...) or 9.33                                                                                                                         | A1    |                                                               |
|          | $\frac{\sin x}{\text{their } 9.32...} = \frac{\sin 42}{8}$<br>or<br>$\sin^{-1}[0.7778, 0.7804]$                                           | M1    | oe<br>their 9.32... must be their length of the vertical line |
|          | [51, 51.3]                                                                                                                                | A1ft  | ft their 9.3(2...) or 9.33                                    |
|          | <b>Additional Guidance</b>                                                                                                                |       |                                                               |
|          | Their 9.32... must come from M1M1 or be clearly identified in working or on the diagram as the length of the vertical line                |       |                                                               |

| Question | Answer                                                                                                                | Mark | Comments |
|----------|-----------------------------------------------------------------------------------------------------------------------|------|----------|
| 27       | $(PQ =) a + b + c$                                                                                                    | M1   | oe       |
|          | $(XY =) \frac{2}{3}a + b + \frac{2}{3}c$<br>or<br>$(XY =) -\frac{1}{3}a + a + b + c - \frac{1}{3}c$                   | M1   |          |
|          | $(PQ =) a + b + c$<br>and<br>$(XY =) \frac{2}{3}a + b + \frac{2}{3}c$<br>and<br>No, as $XY$ is not a multiple of $PQ$ | A1   | oe       |
|          | <b>Additional Guidance</b>                                                                                            |      |          |
|          |                                                                                                                       |      |          |

| Question | Answer                                                                            | Mark | Comments |
|----------|-----------------------------------------------------------------------------------|------|----------|
| 28       | $\frac{y+3}{2} = x$<br>or<br>$x = 2y - 3$ and $x + 3 = 2y$<br>or<br>$2x - 3 = 55$ | M1   |          |
|          | $\frac{x+3}{2}$<br>or $\frac{55+3}{2}$                                            | A1   |          |
|          | $2x^2 - 3$<br>or<br>$2 \times 4^2 - 3$ or $2 \times 16 - 3$                       | M1   |          |
|          | $\frac{55+3}{2} = 29$<br>and<br>$2 \times 4^2 - 3 = 29$ or $2 \times 16 - 3 = 29$ | A1   |          |
|          | <b>Additional Guidance</b>                                                        |      |          |
|          | 29 with no working or only from incorrect working                                 |      | M0A0M0A0 |