# GCSE
# MATHEMATICS
# 8300/1H

Higher Tier Paper 1 Non-Calculator

**Mark scheme**

November 2018

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 Assessment Writer.

It must be stressed that a mark scheme is a working document, in many cases further developed and expanded on the basis of students' reactions to a particular paper. Assumptions about future mark schemes on the basis of one year's document should be avoided; whilst the guiding principles of assessment remain constant, details will change, depending on the content of a particular examination paper.

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**Glossary for Mark Schemes**

GCSE examinations are marked in such a way as to award positive achievement wherever possible. Thus, for GCSE Mathematics papers, marks are awarded under various categories.

If a student uses a method which is not explicitly covered by the mark scheme the same principles of marking should be applied. Credit should be given to any valid methods. Examiners should seek advice from their senior examiner if in any doubt.

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

Examiners should consistently apply the following principles

**Diagrams**

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

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

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

**Questions which ask students to show working**

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

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

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

**Misread or miscopy**

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

**Further work**

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

**Choice**

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

**Work not replaced**

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

**Work replaced**

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

**Premature approximation**

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

**Continental notation**

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

| Question | Answer | Mark | Comments |
|---|---|---|---|
| **1** | $5^8$ | B1 | |
| **2** | $200\pi$ | B1 | |
| **3** | $22a$ | B1 | |
| **4** | $\frac{\sqrt{3}}{2}$ | B1 | |

| Question | Answer | Mark | Comments |
|---|---|---|---|
| 5 | **Alternative method 1** | | |
| | $\frac{17}{2}$ or $\frac{8}{3}$ | M1 | oe fractions |
| | their $\frac{17}{2}$ × their $\frac{3}{8}$ | M1 | conversion of both mixed numbers to improper fractions and multiplication of the conversion of $8\frac{1}{2}$ by the reciprocal of the conversion of $2\frac{2}{3}$ |
| | $\frac{51}{16}$ | A1 | oe fraction or decimal |
| | $3\frac{3}{16}$ | B1ft | oe mixed number<br>ft correct conversion of their improper fraction to a mixed number |
| | **Alternative method 2** | | |
| | $\frac{17}{2}$ or $\frac{8}{3}$ | M1 | oe fractions |
| | $\frac{51}{6} \div \frac{16}{6}$ | M1 | conversion of both mixed numbers to improper fractions, correct conversion to improper fractions with a common denominator and division of the conversion of $8\frac{1}{2}$ by the conversion of $2\frac{2}{3}$ |
| | $\frac{51}{16}$ | A1 | oe fraction or decimal |
| | $3\frac{3}{16}$ | B1ft | oe mixed number<br>ft correct conversion of their improper fraction to a mixed number |

**The Additional Guidance for question 5 is on the next page**

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

| | Additional Guidance | |
|---|---|---|
| **5 cont** | Working with decimals | 0, 3 or 4 |
| | Ignore incorrect attempt to simplify a mixed number<br>eg $3\frac{3}{16} = 3\frac{1}{8}$ | M1M1A1B1 |
| | $3\frac{3}{16}$ seen, then $\frac{51}{16}$ on answer line | M1M1A1B0 |
| | $\frac{9}{2}$ and $\frac{8}{3}$, $\frac{27}{6} \div \frac{16}{6}$, $\frac{27}{16}$, $1\frac{11}{16}$ | M1M1A0B1ft |
| | $\frac{9}{2}$ and $\frac{8}{3}$, $\frac{27}{6} \div \frac{16}{6}$, $1\frac{11}{16}$ | M1M1A0B1ft |
| | $\frac{9}{2}$ and $\frac{4}{3}$, $\frac{27}{6} \div \frac{8}{6}$, $\frac{27}{8}$, $3\frac{3}{8}$ | M0M1A0B1ft |

| Question | Answer | Mark | Comments |
|---|---|---|---|
| 6 | **Alternative method 1** | | |
| | Correct reading of at least one value<br>at 0 hours [46, 50]<br>at 1 hour [63, 67]<br>at 2 hours [80, 84]<br>at 3 hours [96, 100]<br>at 4 hours [114, 118] | M1 | may be seen on graph |
| | $\frac{\text{subtraction of two values}}{\text{correct number of hours}}$ | M1 | division by 1 may be implied |
| | 17 | A1 | SC1 29 |
| | **Alternative method 2** | | |
| | A difference in the range<br>for 1 hour [15, 19]<br>for 2 hours [32, 36]<br>for 3 hours [49, 53]<br>for 4 hours [66, 70] | M1 | may be seen on graph |
| | $\frac{\text{difference}}{\text{correct number of hours}}$ | M1 | division by 1 may be implied |
| | 17 | A1 | SC1 29 |
| | **Additional Guidance** | | |
| | (119 – 42) ÷ 4 = 19.25 | | M0M1A0 |
| | for 2nd M1 in Alt 1, subtraction must be in the correct order unless recovered | | |
| | 17 does not imply three marks, so working must be checked<br>eg (110 – 42) ÷ 4 = 17 | | M0M1A0 |

| Question | Answer | Mark | Comments |
|---|---|---|---|
| 7 | **Alternative method 1** | | |
| | (5 – 2) × 180 or 3 × 180 or 540<br>or<br>180 – (360 ÷ 5) or (180 – 72)<br>or 108 | M1 | oe |
| | Ticks 'No' and 540<br>or<br>Ticks 'No' and 108 | A1 | |
| | **Alternative method 2** | | |
| | States that a pentagon cannot have five (or all) right angles<br>or<br>states that a pentagon can have five (or all) obtuse angles<br>or<br>states that the maximum number of right angles is three<br>or<br>draws a pentagon with exactly three right angles shown | M1 | |
| | Ticks 'No'<br>and<br>states that a pentagon cannot have five (or all) right angles or states that the maximum number of right angles is three or states that a pentagon can have five (or all) obtuse angles<br>and<br>draws a correct diagram of an attempted pentagon with four right angles shown or draws a pentagon with exactly three right angles shown or draws a pentagon with five obtuse angles | A1 | |

**The Additional Guidance for question 7 is on the next page**

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

| | | |
|---|---|---|
| **7 cont** | **Additional Guidance** | |
| | If comparing 72° to 90°, they must state that they are referring to the exterior angles | |
| | If 'Yes' is ticked, M1 can still be scored | |
| | If neither box is ticked, 'No' must be implied by the explanation for M1A1 | |

| | | | |
|---|---|---|---|
| **8(a)** | 8 and lowest (value)<br>or<br>8 and outlier | B1 | oe<br>Accept 102 for day 8 |
| | **Additional Guidance** | | |
| | 8 and '(Only 102 landed whereas) All the other days were over 140' | | B1 |
| | 8 and 'Fewer (less) planes landed (than the other days)' | | B1 |
| | 8 and 'It's an anomaly' | | B1 |
| | 8 and 'There was a (big) drop / reduction / decrease in the number of planes' | | B1 |
| | 8 and 'There were only 102 planes' | | B1 |
| | 8 and 'It's low' or 8 and 'It's lower' or 8 and 'It's too low' | | B1 |
| | 8 and 'It doesn't follow the trend (or pattern)' | | B1 |
| | 8 and 'It reduces a lot that day' | | B1 |
| | Ignore a non-contradictory statement with a correct statement<br>eg 8 and It's the lowest, it dropped by 53' | | B1 |
| | Do not award B1 with a numerical error in the statement<br>eg 8 and 'It's the lowest by 40' | | B0 |
| | 8 and 'There were 102 planes' | | B0 |
| | 8 and 'There's a drop of 53 (implies a point to point comparison)' | | B0 |
| | 8 and 'It's below average' | | B0 |
| | 8 and 'It's the odd one out' | | B0 |

| Question | Answer | Mark | Comments |
|---|---|---|---|
| 8(b) | **Alternative method 1** | | |
| | 150 × 24 ÷ 4 or 150 × 6 or 900 | M1 | oe |
| | their 900 × 365<br>or<br>their 900 × 7 × 4 × 12<br>or<br>their 900 × 7 × 52<br>or 302 400 or 360 000 | M1dep | for 365, allow 336, 360, 364, 366, 370 and 400 |
| | 324 000 or 327 600 or 328 500 or 329 400 or 333 000 | A1 | |
| | **Alternative method 2** | | |
| | 365 × 150 or 54 750<br>or<br>365 × any multiple of 150 | M1 | for 365, allow 336, 360, 364, 366, 370 and 400<br>for 54 750 allow 50 400, 54 000, 54 600, 54 900, 55 500 and 60 000 |
| | their 54 750 × 24 ÷ 4<br>or 302 400 or 360 000 | M1dep | |
| | 324 000 or 327 600 or 328 500 or 329 400 or 333 000 | A1 | |
| | **Alternative method 3** | | |
| | 365 × (24 ÷ 4) or 365 × 6 or 2190 | M1 | for 365, allow 336, 360, 364, 366, 370 and 400<br>for 2190, allow 2016, 2160, 2184, 2196, 2220 and 2400 |
| | their 2190 × 150<br>or 302 400 or 360 000 | M1dep | |
| | 324 000 or 327 600 or 328 500 or 329 400 or 333 000 | A1 | |

| Question | Answer | Mark | Comments |
|---|---|---|---|
| 8(c) | Ticks 'Her prediction could be too low or too high'<br>and<br>explains that fewer landings in winter would make it too low, but fewer landings at night would make it too high<br>or states that the actual numbers are not given | B2 | oe reason<br>B1<br>ticks 'Her prediction could be too low or too high' |
| | **Additional Guidance** | | |
| | Ticks 'Her prediction could be too low or too high' and states that there is not enough data | | B1 only |

| Question | Answer | Mark | Comments |
|---|---|---|---|
| 9 | **Alternative method 1** | | |
| | $(6^2 =)$ 36 or $(8^2 =)$ 64 or 100 or $\sqrt{100}$ | M1 | |
| | 10 | A1 | |
| | their 10 = $5a$ or (their 10)$^3 = 125a^3$ or $1000 = 125a^3$ or $8 = a^3$ | M1 | |
| | 2 | A1ft | ft their 10 with both method marks scored |
| | **Alternative method 2** | | |
| | 5 or $a$ | M1 | |
| | $5a$ | A1 | |
| | their $5a = \sqrt{100}$ or their $5a = 10$ | M1 | $(a =)\frac{\sqrt{100}}{5}$ or $(a =)\frac{10}{5}$ implies M1A1M1 |
| | 2 | A1ft | ft their $5a$ with both method marks scored |
| | **Additional Guidance** | | |
| | Use the scheme that gives the better mark<br>eg1 $\sqrt{14^2} = 5a$, $14 = 5a$, $a = 2.8$ scores M0A0M1A0 on alt 1 and M1A1M0A0 on alt 2<br>eg2 $\sqrt{100} = 5a^3$, $10 = 5a^3$, $a = \sqrt[3]{2}$ scores M1A1M0A0 on alt 1 and M1A0M1A1ft on alt 2 | | Award M1A1M0A0<br>Award M1A0M1A1ft |

| Question | Answer | Mark | Comments |
|---|---|---|---|
| 10 | **Alternative method 1** | | |
| | 280 – 80 or 200 | M1 | |
| | their 200 ÷ 80 (× 100)<br>or 2.5 (× 100) | M1dep | oe |
| | 250 | A1 | |
| | **Alternative method 2** | | |
| | 280 ÷ 80 or 3.5 | M1 | oe |
| | 280 ÷ 80 × 100 (– 100)<br>or their 3.5 × 100 (– 100)<br>or 350 (– 100)<br>or (their 3.5 – 1) (× 100)<br>or 2.5 (× 100) | M1dep | oe |
| | 250 | A1 | |
| 11 | A and D | B1 | |

| Question | Answer | Mark | Comments |
|---|---|---|---|
| 12 | **Alternative method 1** | | |
| | $(x + a)(x + b)$ | M1 | where $ab = \pm 12$ or $a + b = -1$ |
| | $(x - 4)(x + 3)$ | A1 | |
| | 4 and –3 | A1 | SC1<br>4 or –3 with no or one incorrect answer |
| | **Alternative method 2** | | |
| | $\frac{(- -)1 \pm\sqrt{((-)1)^2 - 4(1)(-12)}}{2(1)}$<br>or $\frac{1 \pm\sqrt{1 + 48}}{2}$ or $\frac{1 \pm\sqrt{49}}{2}$ | M1 | oe<br>allow one sign error |
| | $\frac{(- -)1 \pm\sqrt{((-)1)^2 - 4(1)(-12)}}{2(1)}$<br>or $\frac{1 \pm\sqrt{1 + 48}}{2}$ or $\frac{1 \pm\sqrt{49}}{2}$ | A1 | oe<br>fully correct |
| | 4 and –3 | A1 | SC1<br>4 or –3 with no or one incorrect answer |
| | **Alternative method 3** | | |
| | $\left(x - \frac{1}{2}\right)^2$ … | M1 | |
| | $\left(x - \frac{1}{2}\right)^2 - \left(\frac{1}{2}\right)^2 - 12 \ (= 0)$ | A1 | oe equation |
| | 4 and –3 | A1 | SC1<br>4 or –3 with no or one incorrect answer |
| | **Additional Guidance** | | |
| | 4 and –3 with no working | | M1A1A1 |
| | M1 can be scored amongst incorrect attempts to factorise | | |
| | Condone trailing bracket missing eg $(x - 4)(x + 3$ | | M1A1 |

| Question | Answer | Mark | Comments |
|---|---|---|---|
| **13** | **Alternative method 1** | | |
| | $2 \times 5 : 3 \times 5$ or $10 : 15$ and $5 \times 3 : 4 \times 3$ or $15 : 12$ | M1 | oe common value for $f$<br>eg $10 : 15 : 12$ or $\frac{2}{3} : 1 : \frac{4}{5}$ |
| | $10 : 12$ | M1dep | oe unsimplified ratio<br>condone fractions or decimals |
| | $5 : 6$ | A1 | |
| | **Alternative method 2** | | |
| | $3e = 2f$ and $4f = 5g$ | M1 | oe equations |
| | $6e = 5g$ | M1dep | oe equation |
| | $5 : 6$ | A1 | |
| | **Additional Guidance** | | |
| | Variables in an otherwise correct answer:<br>the same variable scores 2 marks, eg $5f : 6f$<br>different variables do not score, unless earlier marks can be awarded,<br>eg $5e : 6g$ with no working worth M1 or M1M1 | | M1M1A0<br><br>M0M0A0 |
| **14** | $1 – 0.3 – 0.15 – 0.35$ or $1 – 0.8$ or $0.2$<br>or<br>$0.15 + 0.35$ (+ 0.2) or $0.5$ (+ 0.2)<br>or<br>$1 – 0.3$<br>or<br>$A'$ U B clearly shaded on diagram | M1 | oe |
| | 0.7 | A1 | oe fraction, decimal or percentage |
| | **Additional Guidance** | | |
| | Do not award M1 for 0.15 + 0.35 or 0.5 if it is then used in an incorrect calculation<br>eg $0.15 + 0.35 = 0.5$, $0.5 + 0.3 = 0.8$ (no further working) | | M0 |

| Question | Answer | Mark | Comments |
|---|---|---|---|
| 15(a) | C and 'lowest median' | B2 | oe<br>B1 C |
| | **Additional Guidance** | | |
| | If the value of the median is given it must be 4 for B2 | | |
| | Accept midpoint oe for median | | |
| | Do not accept mean for median | | |
| | Only accept average for median if the value of 4 is also given | | |
| | Accept mention of the lowest lower quartile with correct mention of the median for B2, but do not accept mention of any extra statistical measure as part of their justification | | |
| 15(b) | B and 'lowest interquartile range'<br>or<br>B and 'lowest range' | B2 | oe<br>B1 B |
| | **Additional Guidance** | | |
| | If the value of the interquartile range is given it must be 2 for B2<br>If the value of the range is given it must be 5 for B2 | | |
| | For B2, do not accept non-statistical reasons, eg 'the narrowest box' | | |
| | For B2, do not accept mention of any extra statistical measure as part of their justification | | |

| Question | Answer | Mark | Comments |
|---|---|---|---|
| **16** | 27 000 | B1 | |
| **17** | $\left(\frac{4}{3}\right)^3$ or $\frac{4^3}{3^3}$ or $\left(\frac{27}{64}\right)^{-1}$ or $\frac{1}{\frac{27}{64}}$ or $\frac{1}{\left(\frac{3}{4}\right)^3}$ or $\frac{1}{0.75^3}$ or $\left(\frac{1}{0.75}\right)^3$ | M1 | |
| | $\frac{64}{27}$ or $2\frac{10}{27}$ | A1 | oe fraction, mixed number or decimal |
| | **Additional Guidance** | | |
| | $\frac{64}{27}$ followed by an incorrect attempt to convert to a mixed number | | M1A1 |
| | $\frac{27}{64}$ | | M0A0 |

| Question | Answer | Mark | Comments |
|---|---|---|---|
| 18 | **Alternative method 1** | | |
| | $\frac{1}{4}$ (completed) or $\frac{3}{4}$ (left) | M1 | oe<br>eg 25% (completed) or 75% (left) |
| | $\frac{1}{8} + \frac{1}{10}$ or $\frac{9}{40}$ | M1 | oe<br>eg 12.5% + 10% or 22.5% |
| | $\frac{3}{4} \div$ their $\frac{9}{40}$ | M1dep | oe<br>eg 75% ÷ their 22.5%<br>dep on M1M1 |
| | $3\frac{1}{3}$<br>or 4 days with correct working seen | A1 | oe |
| | **Alternative method 2 – assumes a number of pages (eg 80)** | | |
| | $\frac{3}{4}$ × their 80 or 60 | M1 | oe |
| | $\frac{1}{8}$ × their 80 or 10<br>and $\frac{1}{10}$ × their 80 or 8 | M1 | oe |
| | their 60 ÷ (their 10 + their 8) | M1dep | oe<br>dep on M1M1 |
| | $3\frac{1}{3}$<br>or 4 days with correct working seen | A1 | oe |
| | **Additional Guidance** | | |
| | 8 – 2 = 6, 10 – 6 = 4, answer 4 | | M0M0M0A0 |
| | In alt 1, for the third mark allow a build-up method in percentages, fractions or decimals showing that 3 days is not enough (and 4 is enough)<br>eg 47.5%, 70%, 92.5%, (115%), answer 4 | | M1M1M1A1 |

| Question | Answer | Mark | Comments |
|---|---|---|---|
| **19(a)** | $2(x + 5) = y + 8$<br>or $2x + 10 = y + 8$ | M1 | oe eg $\frac{x+5}{y+8} = \frac{1}{2}$ or $\frac{y+8}{x+5} = 2$ |
| | $2x + 10 = y + 8$<br>and $y = 2x + 2$ | A1 | |
| **19(b)** | $x + 10 = y + 1$ | M1 | oe |
| | Eliminates $x$ or $y$ from<br>their $(x + 10) = y + 1$<br>and $y = 2x + 2$ | M1 | their $(x + 10) = y + 1$ must be an equation in $x$ and $y$<br>eg<br>$x + 10 = y – 1$ (and $y = 2x + 2$)<br>followed by<br>$x + 11 = 2x + 2$ |
| | $x = 7$ and $y = 16$ | A1 | |
| | **Additional Guidance** | | |
| | $x = 7$ or $y = 16$ with no value or an incorrect value for the other unknown and no working worth M marks | | M0M0A0 |

| Question | Answer | Mark | Comments |
|---|---|---|---|
| **20** | **Alternative method 1** | | |
| | angle *QPR* = 27 | M1 | may be seen on diagram |
| | angle *XPS* = $\frac{180-50}{2}$ or 65 | M1 | may be seen on diagram |
| | angle *QPR* = 27<br>and<br>angle *XPS* = 65<br>and<br>angle *QPS* = 92<br>and<br>angle in a semicircle is a right angle | A1 | <br><br><br><br><br><br>oe accept 92 ≠ 90 |
| | all reasons for angle facts:<br>angles in same segment (are equal)<br>and<br>angle sum of triangle (is 180)<br>and<br>base angles of isosceles triangle (are equal) | A1 | <br>oe<br><br>oe<br><br>oe |

| Question | Answer | Mark | Comments |
|---|---|---|---|
| **20 cont** | **Alternative method 2** | | |
| | angle *SXR* = 180 – 50 or 130<br>and<br>angle *XRS* = 180 – their 130 – 27<br>and<br>angle *PQS* = their 23 | M1 | may be seen on diagram<br><br>angle *XRS* = 23 |
| | angle *XSP* = $\frac{180-50}{2}$ or 65 | M1 | may be seen on diagram |
| | angle *SXR* = 130<br>and<br>angle *XRS* = 23<br>and<br>angle *PQS* = 23<br>and<br>*XSP* = 65<br>and<br>angle *QPS* = 92<br>and<br>angle in a semicircle is a right angle | A1 | <br><br><br><br><br><br><br><br>oe accept 92 ≠ 90 |
| | all reasons for angle facts:<br>angles on a straight line (add up to 180)<br>and<br>angle sum of triangle (is 180)<br>and<br>angles in same segment (are equal)<br>and<br>base angles of isosceles triangle (are equal) | A1 | <br>oe<br><br>oe<br><br>oe<br><br>oe |

| Question | Answer | Mark | Comments |
|---|---|---|---|
| 21 | **Alternative method 1** | | |
| | (second differences =) 4<br>or $2n^2$ or $a = 2$ | M1 | second difference seen at least once and not contradicted |
| | $11 - 2 \times 1^2$ and $26 - 2 \times 2^2$ and $45 - 2 \times 3^2$ (and $68 - 2 \times 4^2$)<br>or<br>9 and 18 and 27 (and 36)<br>or $9n$ | M1dep | |
| | $2n^2 + 9n$ | A1 | oe |
| | **Alternative method 2** | | |
| | any two of<br>$a + b + c = 11$<br>$4a + 2b + c = 26$<br>$9a + 3b + c = 45$<br>$16a + 4b + c = 68$ | M1 | |
| | $3a + b = 26 - 11$<br>and $5a + b = 45 - 26$<br>or<br>$a = 2$ and $b = 9$ (and $c = 0$) | M1dep | oe<br>obtains two correct equations in same two variables from their equations |
| | $2n^2 + 9n$ | A1 | oe |
| | **Alternative method 3** | | |
| | (second differences =) 4<br>or $2n^2$ or $a = 2$ | M1 | second difference seen at least once and not contradicted |
| | $3a + b = 26 - 11$<br>and substitutes $a = 2$<br>or $b = 9$ or $9n$ | M1dep | |
| | $2n^2 + 9n$ | A1 | oe |

| Question | Answer | Mark | Comments |
|---|---|---|---|
| **22** | Any two of<br>$x(x-2)$ and $7(x+4)$<br>and $(x-2)(x+4)$ | M1 | oe<br>$x(x-2)$ and $7(x+4)$ cannot be denominators |
| | correct equation including<br>$x(x-2)$ and $7(x+4)$<br>and $(x-2)(x+4)$ | M1dep | |
| | $x^2 - 2x + 7x + 28 = x^2 + 4x - 2x - 8$ | M1dep | oe all brackets must be expanded |
| | –12 | A1 | |
| | **Alternative method 2** | | |
| | $\frac{x(x-2)}{x+4} + 7 = x - 2$ | M1 | |
| | $\frac{x(x-2)}{x+4} = x - 9$<br>or $x(x-2) = (x-9)(x+4)$ | M1dep | |
| | $x^2 - 2x = x^2 - 9x + 4x - 36$ | M1dep | oe all brackets must be expanded |
| | –12 | A1 | |
| | **Alternative method 3** | | |
| | $x + \frac{7(x+4)}{x-2} = x + 4$ | M1 | |
| | $\frac{7(x+4)}{x-2} = 4$<br>or $7(x+4) = 4(x-2)$ | M1dep | |
| | $7x + 28 = 4x - 8$ | M1dep | oe all brackets must be expanded |
| | –12 | A1 | |
| | **Additional Guidance** | | |
| | In Alt 1, do not allow $x \times x - 2$ or $7 \times x + 4$ unless recovered | | |

| Question | Answer | Mark | Comments |
|---|---|---|---|
| 23 | **Alternative method 1** | | |
| | $\sqrt{4}$ : $\sqrt{9}$ or 2 : 3 | M1 | length A : length B |
| | 30 ÷ their 3 × their 2 or 20 | M1dep | length A |
| | 480 ÷ their 20 or 24 | M1dep | area cross section A |
| | their 24 ÷ 4 × 9 | M1dep | |
| | 54 | A1 | |
| | **Alternative method 2** | | |
| | $\sqrt{4}$ : $\sqrt{9}$ or 2 : 3 | M1 | length A : length B |
| | $(\sqrt{4})^3$ : $(\sqrt{9})^3$ or 8 : 27 | M1dep | volume A : volume B |
| | 480 ÷ their 8 × their 27 or 1620 | M1dep | volume B |
| | their 1620 ÷ 30 | M1dep | |
| | 54 | A1 | |

| Question | Answer | Mark | Comments |
|---|---|---|---|
| 24 | **Alternative method 1** | | |
| | $\frac{2\sqrt{6}}{\sqrt{5}} \times \frac{\sqrt{5}}{\sqrt{5}}$ or $\frac{\sqrt{3}}{\sqrt{10}} \times \frac{\sqrt{10}}{\sqrt{10}}$ | M1 | |
| | $\frac{2\sqrt{30}}{5}$ or $\frac{4\sqrt{30}}{10}$ or $\frac{\sqrt{30}}{10}$ | M1dep | |
| | $\frac{3\sqrt{30}}{10}$ | A1 | |
| | **Alternative method 2** | | |
| | $\frac{2\sqrt{6}\sqrt{2}}{\sqrt{10}} - \frac{\sqrt{3}}{\sqrt{10}}$ or $\frac{2\sqrt{12}}{\sqrt{10}} - \frac{\sqrt{3}}{\sqrt{10}}$ | M1 | oe common denominator<br>eg $\frac{2\sqrt{60}}{\sqrt{50}} - \frac{\sqrt{15}}{\sqrt{50}}$ |
| | $\frac{4\sqrt{3}}{\sqrt{10}} - \frac{\sqrt{3}}{\sqrt{10}}$ or $\frac{3\sqrt{3}}{\sqrt{10}}$ | M1dep | oe common denominator and common surd in numerator<br>$\frac{4\sqrt{15}}{\sqrt{50}} - \frac{\sqrt{15}}{\sqrt{50}}$ or $\frac{3\sqrt{15}}{\sqrt{50}}$ |
| | $\frac{3\sqrt{30}}{10}$ | A1 | |
| | **Additional Guidance** | | |
| | Ignore an attempt at further simplification after $\frac{3\sqrt{30}}{10}$ | | M1M1A1 |

| Question | Answer | Mark | Comments |
|---|---|---|---|
| 25 | **Alternative method 1** | | |
| | $a(-3)^2 + b(-3) + c = 0$ or $a(3)^2 + b(3) + c = 0$ | M1 | oe |
| | any two of<br>$(-)6b = 0$, $c = 18$ and $9a + 18 = 0$ | M1dep | oe |
| | $y = 18 - 2x^2$ | A1 | oe equation |
| | **Alternative method 2** | | |
| | $y = 18 - 2x^2$ | B3 | oe equation<br>B2 correct equation missing $y =$<br>eg $18 - 2x^2$<br>B1<br>equation of a quadratic curve that passes through (–3, 0) or (3, 0) or (0, 18)<br>condone missing $y =$<br>eg $(y =) 18 - x^2$ or $(y =) (3 + x)(3 - x)$<br>or $(y =) x^2 - 2x - 3$<br>or $(y =) (x + 3)(x - 3)$ |
| | **Additional Guidance** | | |
| | Correct equations include<br>$y = 2(3 + x)(3 - x)$<br>$y = -2(x + 3)(x - 3)$<br>$y = (6 + 2x)(3 - x)$<br>$y = (3 + x)(6 - 2x)$ | | |
| | For B3, B2 or B1 ignore incorrect expansion after correct equation or expression seen | | |

| Question | Answer | Mark | Comments |
|---|---|---|---|
| 26 | **Alternative method 1** | | |
| | $0.5 \times 20 \times x \times \sin 60$<br>or $10x \sin 60$ or $5\sqrt{3}\,x$ | M1 | oe |
| | $0.5 \times 20 \times x \times \sin 60 = 25\sqrt{3}$<br>or $x = 5$ | M1dep | oe equation |
| | $(\text{their } 5)^2 + 20^2$<br>$- 2 \times \text{their } 5 \times 20 \times \cos 60$<br>or $25 + 400 - 200 \cos 60$<br>or 325 | M1 | oe<br>their 5 must be their value of $x$ |
| | $\sqrt{\text{their } 325}$ | M1dep | dep on 3rd M1<br>their 325 can be unsimplified |
| | $5\sqrt{13}$ | A1 | |
| | **Alternative method 2** | | |
| | $0.5 \times 20 \times h = 25\sqrt{3}$<br>or $h = \frac{5\sqrt{3}}{2}$ | M1 | oe any letter<br>$h$ is perpendicular height for 20 cm base |
| | $\sin 60 = \frac{\text{their } \frac{5\sqrt{3}}{2}}{x}$<br>or $x = 5$ | M1dep | oe |
| | $(\text{their } 5)^2 + 20^2$<br>$- 2 \times \text{their } 5 \times 20 \times \cos 60$<br>or $25 + 400 - 200 \cos 60$<br>or 325 | M1 | oe<br>their 5 must be their value of $x$ |
| | $\sqrt{\text{their } 325}$ | M1dep | dep on 3rd M1<br>their 325 can be unsimplified |
| | $5\sqrt{13}$ | A1 | |

| Question | Answer | Mark | Comments |
|---|---|---|---|
| **26 cont** | **Alternative method 3** | | |
| | $0.5 \times 20 \times h = 25\sqrt{3}$ or $h = \frac{5\sqrt{3}}{2}$ | M1 | oe any letter<br>$h$ is perpendicular height for 20 cm base |
| | $\tan 60 = \frac{\text{their } h}{c}$ or $c = \frac{5}{2}$ | M1dep | oe any letter<br>$c$ is part of 20 cm base |
| | $\left(\text{their } \frac{5\sqrt{3}}{2}\right)^2 + \left(20 - \text{their } \frac{5}{2}\right)^2$ or $\left(\text{their } \frac{5\sqrt{3}}{2}\right)^2 + \left(\frac{35}{2}\right)^2$ or 325 | M1dep | |
| | $\sqrt{(\text{their } \frac{5\sqrt{3}}{2})^2 + (20 - \text{their } \frac{5}{2})^2}$ or $\sqrt{\text{their } 325}$ | M1dep | |
| | $5\sqrt{13}$ | A1 | |
| | **Additional Guidance** | | |
| | Omitting 0.5 in area formula can score a maximum of M0M0M1M1A0 | | |
| | $\sqrt{(\text{their } 5)^2 + 20^2 - 2 \times \text{their } 5 \times 20 \times \cos 60}$ | | M0M0M1M1A0 |
| **27(a)** | $-k$ | B1 | |
| **27(b)** | $k$ | B1 | |