# GCSE
# MATHEMATICS

## PRACTICE PAPER SET 3

Higher Tier Paper 2

Mark Scheme

8300/2H

Version 1.0

Further copies of this Mark Scheme are available from aqa.org.uk

# 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 within the scheme 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 …** | Allow 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 candidate intended it to be a decimal point.

| Q | Answer | Mark | Comments |
|---|---|---|---|
| **1** | (0, –1) | B1 | |
| **2** | $a^7$ | B1 | |
| **3** | $\frac{3}{5}$ | B1 | |
| **4** | $15.75 \leqslant x < 15.85$ | B1 | |
| **5(a)** | $x^2 - 4x + 5x - 20$ | M1 | Allow one error |
| | $x^2 + x - 20$ | A1 | |
| | **Additional Guidance** | | |
| | | | |
| **5(b)** | 8 and –7 | B1 | |
| | **Additional Guidance** | | |
| | | | |
| **6(a)** | £1500 × $1.016^2$ | B1 | |

| Q | Answer | Mark | Comments |
|---|---|---|---|
| 6(b) | **Alternative method 1** | | |
| | [1548.38, 1548.39] | B1ft | ft their part (a) |
| | $1500 \times 1.018$ or 1527 | M1 | oe |
| | $1500 \times 1.018 \times 1.013$<br>or $1527 \times 1.013$<br>or [1546.85, 1546.86] | M1dep | oe |
| | [1548.38, 1548.39]<br>and [1546.85, 1546.86] and Dev's | A1ft | oe<br>ft their part (a) |
| | **Alternative method 2** | | |
| | $1.016^2$ or 1.032(256) or 1.0323 | M1 | |
| | 1.018 or 1.013 seen | M1 | |
| | $1.018 \times 1.013$ or 1.031(234) | M1dep | |
| | 1.032(256) and 1.031 and Dev's | A1 | |
| | **Additional Guidance** | | |
| | Note incorrect answers from part (a) for Alt 1<br>£1500 × 1.6 × 2 = £4800<br>$£1500 \times 1.6^2$ = £3840<br>£1500 × 1.016 × 2 = £3048 | | |

| | | | |
|---|---|---|---|
| 7(a) | $\frac{4}{3} \times \pi \times 9 \times 9 \times 9$ | M1 | oe |
| | [3052, 3054.1] or $972\pi$ or 3050 | A1 | |
| | **Additional Guidance** | | |
| | | | |

| Q | Answer | Mark | Comments |
|---|---|---|---|
| 7(b) | $\frac{4}{3} \times \pi \times 9 \times 9 \times 9 \times 7.8$<br>or their [3052, 3054.1] × 7.8<br>or $972\pi \times 7.8$<br>or 3050 × 7.8 | M1 | oe<br>ft their (a) |
| | [23 805, 23 822] or $\frac{37\ 908}{5}\ \pi$<br>or 23 790<br>or 23 800 | A1ft | oe<br>ft their (a) |
| | **Additional Guidance** | | |
| | | | |
| 8 | **Alternative method 1** | | |
| | 68 ÷ 16 or 4.25 | M1 | oe |
| | $\tan x = \frac{\text{their } 4.25}{16}$<br>or $90 - \tan^{-1} \frac{16}{\text{their } 4.25}$ | M1 | oe |
| | 14.87... or 14.88 or 14.9 or 15 | A1 | |
| | **Alternative method 2** | | |
| | 68 ÷ 16 or 4.25 | M1 | oe |
| | $\sin x = \frac{\text{their } 4.25}{\sqrt{16^2 + \text{their } 4.25^2}}$<br>or<br>$\cos x = \frac{16}{\sqrt{16^2 + \text{their } 4.25^2}}$ | M1 | oe |
| | 14.87... or 14.88 or 14.9 or 15 | A1 | |
| | **Additional Guidance** | | |
| | | | |

| Q | Answer | Mark | Comments |
|---|---|---|---|
| **9** | $0.99 \times 10^{-2}$ | B1 | |
| **10** | 2.5(0) × 11 or 27.5(0)<br>or 7.5(0) × 7 or 52.5(0)<br>or 12.5(0) × 2 or 25 | M1 | |
| | their 27.5(0) + their 52.5(0) + their 25<br>or 105 | M1dep | sum of $fx$ |
| | their 105 ÷ 20 or 5.25 | M1dep | |
| | 5.25 and correct conclusion | A1 | oe<br>eg 5.25 and women gave more |
| | **Additional Guidance** | | |
| | 105 ÷ 3 = 35 | | M1M1M0A0 |

| Q | Answer | Mark | Comments |
|---|---|---|---|
| 11 | **Alternative method 1** | | |
| | States or implies that 2 is one third of 6<br>and<br>States or implies that 5 is one third of 15<br>and $180 \div 3 = 60$ or $60 \times 3 = 180$<br>and Yes | B2 | B1 for<br>states or implies that 2 is one third of 6<br>or<br>states or implies that 5 is one third of 15<br>or $180 \div 3 = 60$ or $60 \times 3 = 180$ |
| | **Alternative method 2** | | |
| | $180 \div (1 + 2 + 3) \times 2 = 60$<br>or<br>$180 \div 6 \times 2 = 60$<br>and<br>$180 \div (4 + 5 + 6) \times 5 = 60$<br>or<br>$180 \div 15 \times 5 = 60$<br>and Yes | B2 | B1 for<br>$180 \div (1 + 2 + 3) \times 2 = 60$<br>or<br>$180 \div 6 \times 2 = 60$<br>or<br>$180 \div (4 + 5 + 6) \times 5 = 60$<br>or<br>$180 \div 15 \times 5 = 60$ |
| | **Alternative method 3** | | |
| | 30° and 60° and 90°<br>and<br>48° and 60° and 72°<br>and Yes | | B1 for<br>30° and 60° and 90°<br>or<br>48° and 60° and 72° |
| | **Additional Guidance** | | |
| | | | |

| Q | Answer | Mark | Comments |
|---|---|---|---|
| **12** | $\frac{y}{x+y}$ | B1 | |
| **13** | 82.5% or 0.825 used | M1 | M3 264 ÷ 0.825 or 320 |
| | $\frac{264}{82.5}$ or 3.2 | M1dep | |
| | their 3.2 × 100 or 320<br>or their 3.2 × 17.5 | M1dep | |
| | 56 | A1 | |
| | **Additional Guidance** | | |
| | | | |
| **14(a)** | [0.745, 0.749] with 3 dp | B1 | |
| | **Additional Guidance** | | |
| | | | |
| **14(b)** | [0.650, 0.744] with 3 dp | B1 | |
| | **Additional Guidance** | | |
| | | | |
| **14(c)** | [0.750, 0.754] with 3 dp | B1 | |
| | **Additional Guidance** | | |
| | | | |
| **14(d)** | [0.001, 0.649] or [0.755, 0.999] with 3 dp | B1 | |
| | **Additional Guidance** | | |
| | | | |

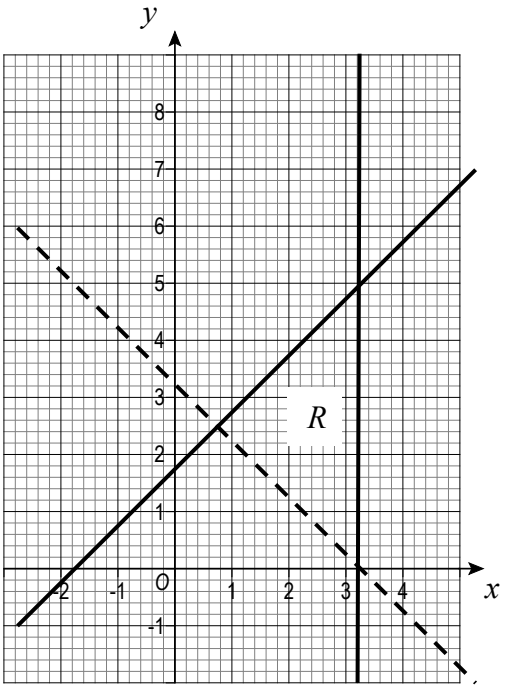
| Q | Answer | Mark | Comments |
|---|---|---|---|
| 15 | $\frac{1}{2}(PQ + SR) \times 8 = 48$ | M1 | oe |
| | $(PQ + SR =)\ 48 \times 2 \div 8$<br>or $(PQ + SR =)\ 12$ | M1dep | Implied by values on diagram<br>eg $PQ = 10$ and $SR = 2$ |
| | Set of points that fit $PQ + SR =$ their 12 | M1 | eg $P$ (2, 0) $Q$ (6, 0) $R$ (9, 8) $S$ (1, 8) |
| | Correct set of points such that<br>$PQ + SR = 12$ and $PQ > SR$ | A1 | eg $P$ (2, 0) $Q$ (9, 0) $R$ (8, 8) $S$ (3, 8) |
| | **Additional Guidance** | | |
| | $(PQ + SR) \times 8 = 48$<br>$PQ + RS = 6$<br>$P$ (1, 0) $Q$ (3, 0) $R$ (6, 8) $S$ (2, 8) | | M0<br>M0<br>M1 A0 |
| | $PQ + RS = 12$<br>$P$ (3, 0) $Q$ (11, 0) $R$ (5, 8) $S$ (9, 8) | | M1 M1<br>M1 A0 |
| | For a correct set of points<br>$P$ and $Q$ must each have $y$-coordinate 0<br>$R$ and $S$ must each have $y$-coordinate 8 | | |
| 16(a) | Pair of values of form $2x$ and $kx$<br>where $x$ is an integer > 5<br>and $k$ is an odd integer > 2 | B1 | eg 12 and 18 or 100 and 250 |
| | **Additional Guidance** | | |
| | | | |

| Q | Answer | Mark | Comments |
|---|---|---|---|
| 16(b) | Ticks No with valid reason including that one number could be 2 and that multiplying by an even number (or 2) gives an even answer | B2 | eg1 Ticks No and $a$ could be 2 and the others will be odd and even $\times$ odd $\times$ odd $=$ even<br>eg2 Ticks No (and $b$ could be 2) and $27 \times 4 \times 5 = 540$<br>eg3 Ticks No and $125 \times 9 \times 2 = 2250$<br>eg4 Ticks No and $a$, $b$ or $c$ could be 2 and multiplying by an even gives an even |
| | | B1 | B1 No with partial reason<br>eg1 Ticks No and $a$ could be even<br>eg2 Ticks No and $c = 2$<br>eg3 Ticks No and odd × odd × even is even<br>eg4 Ticks No and multiplying by an even gives an even |
| | **Additional Guidance** | | |
| | If a box is not ticked, No can be implied by the reason for B2 and B1<br>eg1 $a$ could be 2 and the others will be odd and even $\times$ odd $\times$ odd $=$ even<br>eg2 $b$ could be 2 and $27 \times 4 \times 5 = 540$ which is even<br>eg3 odd × odd × even is even | | <br>B2<br>B2<br>B1 |
| | Allow use of numbers that are not prime for B1<br>eg1 Ticks No and $b$ could be 2 and $1 \times 4 \times 5 = 20$<br>eg2 Ticks No and $4^3 \times 3^2 \times 2 = 1152$ | | <br>B1<br>B1 |

| Q | Answer | Mark | Comments |
|---|---|---|---|
| 17 | $128 \times 128$ ($\times 2$) or 16 384 or 32 768<br>or $128 \times 64$ ($\times 4$) or 8192 or 32 768 | M1 | Any one surface area of cuboid<br>May be implied |
| | $128 \times 128 \times 2 + 128 \times 64 \times 4$<br>or $16\ 384 \times 2 + 8192 \times 4$<br>or $32\ 768 + 32\ 768$<br>or 65 536 | M1dep | Total surface area of cuboid |
| | $\pi \times 32^2$ ($\times 2$) or $1024\pi$ or $2048\pi$<br>or [3215, 3217.41]<br>or [6430.7, 6434.82]<br>or $2 \times \pi \times 32 \times 256$ or $16\ 384\pi$<br>or [51 445.76, 51 478.53] | M1 | Any one surface area of cylinder<br>May be implied |
| | $18\ 432\pi$ or [57 876, 57 913.344] | A1 | Total surface area of cylinder |
| | 65 536 and [57 876, 57 913.344]<br>and cylinder | A1ft | ft M2 with at least one correct total surface area with correct conclusion |
| | **Additional Guidance** | | |
| | Cylinder by [7622.656, 7660] | | M1M1M1A1A1 |
| | Cylinder with no other working | | 0 |
| 18(a) | (12) 44 69 80 | B1 | cumulative frequencies<br>May be implied by points plotted<br>tolerance $\pm \frac{1}{2}$ square |
| | Points plotted with upper class boundaries and cf values | B1ft | ft their cumulative frequencies<br>tolerance $\pm \frac{1}{2}$ square |
| | Smooth curve or polygon through all their points | B1ft | ft their cumulative frequencies<br>Must be increasing and not a single straight line<br>tolerance $\pm \frac{1}{2}$ square |
| | **Additional Guidance** | | |
| | | | |

| Q | Answer | Mark | Comments |
|---|---|---|---|
| 18(b) | **Alternative method 1** | | |
| | 56 or 72 | M1 | Reads off a cf value for 50 min or 70 min<br>tolerance ± $\frac{1}{2}$ square<br>ft their cumulative frequencies and an increasing graph |
| | 15 or 16 or 17 | A1ft | ft their cumulative frequencies and an increasing graph |
| | **Alternative method 2** | | |
| | $11 \times \frac{10}{30}$ or 3 or 4 or 3.66… or 3.67<br>or<br>$25 \times \frac{10}{20}$ or 12 or 13 or 12.5 | M1 | oe |
| | 15 or 16 or 17 | A1 | |
| | **Additional Guidance** | | |
| | | | |
| 19(a) | $p = -2$ and $q = 6$<br>and $r = -3$ and $s = 3$ | B2 | B1 $p = -2$ and $q = 6$<br>or $r = -3$ and $s = 3$ |
| | **Additional Guidance** | | |
| | | | |

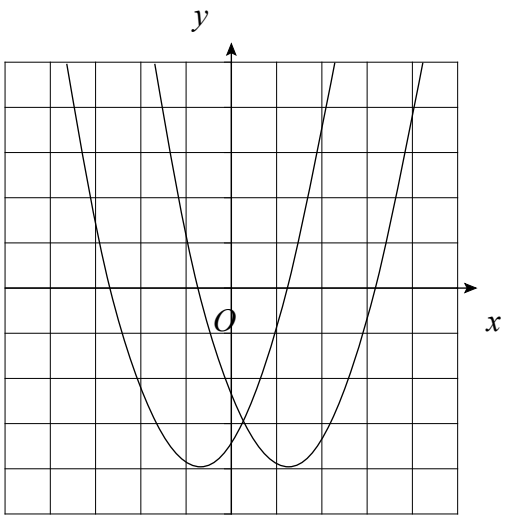
| Q | Answer | Mark | Comments |
|---|---|---|---|

| | | | |
|---|---|---|---|
| **19(b)** | Draws $y = 3 - x$ | B1 | Dashed or solid |
| | Draws $x = 3$ | B1 | Dashed or solid |
| | Draws $y = 3 - x$ as a dashed line and draws $x = 3$ as a solid line and identifies correct region R   | B1 | Correct region may be shaded in or out but accept the region that is labelled as R |
| | **Additional Guidance** | | |
| | | | |

| | | | |
|---|---|---|---|
| **20(a)** | 9 or 64 or $3^2 + 4^3$ | M1 | |
| | 73 | A1 | |
| | **Additional Guidance** | | |
| | | | |

| Q | Answer | Mark | Comments |
|---|---|---|---|
| **20(b)** | $\sqrt[3]{x}$ or $\sqrt[3]{-27}$ or $x^3 = -27$ | M1 | |
| | –3 | A1 | |
| | **Additional Guidance** | | |
| | | | |
| **20(c)** | $(3^{2x})^3$ | M1 | |
| | $3^{6x}$ | A1 | |
| | **Additional Guidance** | | |
| | | | |
| **20(d)** | C | B1 | |
| **21(a)** | Yes and full explanation involving areas<br>eg Yes, the extra areas are (about) the same as the areas that are left out | B2 | B1 for partial explanation<br>eg Some parts are included that shouldn't be and some parts are left out<br>B2 or B1 may be awarded from working on the diagram |
| | **Additional Guidance** | | |
| | | | |
| **21(b)** | 686 | B1 | |
| | **Additional Guidance** | | |
| | | | |
| **21(c)** | $2 \times 0.2$ or 0.4 or $\frac{10}{25}$ | M1 | oe |
| | 620 | A1 | |
| | **Additional Guidance** | | |
| | 1550 ÷ 25 × 10 | | M1 |

| Q | Answer | Mark | Comments |
|---|---|---|---|
| **22** | $(A =)$ 22 000 | B1 | |
| | 14 080 = their 22 000 $\times k^{-2}$ | M1 | oe |
| | $\sqrt{\frac{\text{their } 22\,000}{14\,080}}$ or $k^2 = \frac{\text{their } 22\,000}{14\,080}$ | M1 | |
| | $(k =)$ 1.25 or $\frac{5}{4}$ | A1ft | ft their 22 000 |
| | **Additional Guidance** | | |
| | | | |
| **23** | $\overrightarrow{FA} = 1.5\mathbf{a}$ or $\overrightarrow{AF} = -1.5\mathbf{a}$ | M1 | oe |
| | $\overrightarrow{AC} = 2\mathbf{b} - 3\mathbf{c}$ or $\overrightarrow{CA} = 3\mathbf{c} - 2\mathbf{b}$ or $\overrightarrow{FB} = 1.5\mathbf{a} + 2\mathbf{b}$ | M1 | oe |
| | $\overrightarrow{CF} = 3\mathbf{c} - 2\mathbf{b} - 1.5\mathbf{a}$ | M1 | oe<br>$\overrightarrow{CF} = 3\mathbf{c} - 2\mathbf{b} -$ their $\overrightarrow{FA}$ |
| | $6\mathbf{c} - 4\mathbf{b} - 3\mathbf{a}$ | A1 | oe |
| | **Additional Guidance** | | |
| | $\overrightarrow{CF} = 3\mathbf{c} - 2\mathbf{b} - 1.5\mathbf{a}$ implies | | M1M1M1 |

| Q | Answer | Mark | Comments |
|---|---|---|---|
| 24(a) | Given graph translated by $\begin{pmatrix}2\\0\end{pmatrix}$   | B1 | Graph must pass through the 5 integer points (±2 mm) |
| | **Additional Guidance** | | |
| | | | |

| | | | |
|---|---|---|---|
| 24(b) | $-3(-x)^2 + 4(-x) - 5$<br>or $-3x^2 - 4x - 5$ | M1 | oe |
| | $y = -3x^2 - 4x - 5$ | A1 | Must have $y =$ |
| | **Additional Guidance** | | |
| | $y = -(3x^2 + 4x + 5)$ | | M1 A1 |

SP/03/15