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Practice paper: mark scheme

GCSE Maths Higher, practice paper: Unit 1 (non-calculator) (WJEC style)

In the style of WJEC GCSE Mathematics (3300) Unit 1 Higher Tier

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This mark scheme was written by cookie with its practice paper. Each row gives the answer, the marks and how they are given; where an answer is worded differently but means the same, give the mark.

Key

- P process marks, for a correct step in solving a problem
- M method marks, for a correct method
- A accuracy marks, which depend on the method mark before them
- B unconditional accuracy marks, independent of method
- C communication marks
- ft follow through; oe or equivalent; cao correct answer only; isw ignore subsequent working

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Question	Answer and marking	Marks
1(a)	**Answer: $2^2 \times 3^3 \times 7$** M1 for a correct method (factor tree or repeated division) that produces at least 2 prime factors from the set {2, 2, 3, 3, 3, 7} before a second error A1 for 2, 2, 3, 3, 3, 7 (CAO; ignore 1s) B1 for $2^2 \times 3^3 \times 7$ (FT 'their primes' provided at least one index of 2 or more is used) *Allow $2^2 \times 3^3 \times 7^1$ and $2^2.3^3.7$. Do not FT non-primes. Inclusion of 1 as a factor gets B0. 2 × 2 × 3 × 3 × 3 × 7 scores M1 A1 B0.*	**3**
1(b)	**Answer: 98** B1 for 98 (FT 'their (a)' provided at least one index is not a multiple of 3) *In $2^2 \times 3^3 \times 7$ the 2 needs one more factor of 2 and the 7 two more factors of 7, so $n = 2 \times 7^2 = 98$: $756 \times 98 = 74\,088 = 42^3$. Do not accept 2×7^2 unevaluated. An answer of 74 088 (the cube number, not n) scores B0, as does 21 (the multiplier for a square number).*	**1**
2	**Answer: Yes: costs £80, takings £134.40, profit £54.40, which is more than 2/3 of £80 (£53.33…)** M1 for the cost of the ingredients: 48 ÷ 8 × 10.50 or 6 × 10.50 (= £63) or 10.50 ÷ 8 × 48 (OE) M1 for the takings: 42 × 3.20 (= £134.40) M1 for profit = their 134.40 − (their 63 + 17) (= £54.40), or for total costs of their 63 + 17 (= £80) together with 2/3 × their 80 A1 for £54.40 AND £53.33… (or 68% AND 66.7%, or 0.68 AND 0.666…) with the conclusion 'Yes, Gwen is correct' CAO OC1 Organisation and communication: candidates present a structured response, explain what each step is working out, lay out their working clearly and logically, and write a conclusion that draws their results together W1 Accuracy of writing: candidates show all their working, make few if any errors in spelling, punctuation and grammar, use correct mathematical form (e.g. £54.40, not £54.4) and use appropriate terminology and units *Allow the comparison done as profit ÷ costs: 54.40 ÷ 80 = 0.68 > 2/3. A correct comparison with a wrong conclusion, or a conclusion with no supporting figures, scores A0. Using the cost of 42 loaves only (£55.13…) scores M0 for the first mark but the other M marks are available, FT. OC1 and W1 may be awarded even when the mathematics is not fully correct, provided the response is a genuine attempt at the whole problem.*	**6**
3(a)	**Answer: 8×10^7** B1 for 0.8×10^8, or 80 000 000, or 0.8 and 10^8 seen B1 for 8×10^7 CAO *Mark the final answer. Taking $10^6 \div 10^{-2}$ as 10^4 (giving 0.8×10^4 or 8×10^3) scores B0. 80×10^6 scores B1 only (not in standard form).*	**2**
3(b)	**Answer: 5.78×10^4** B1 for 57 800, or 54 000 + 3800, or $5.4 \times 10^4 + 0.38 \times 10^4$ B1 for 5.78×10^4 CAO *57.8×10^3 scores B1 only (not in standard form).*	**2**

4 **Answer: 81** **4**

M1 for forming an equation, e.g. 4x + 6 = 5x − 3 (OE)
A1 for x = 9
M1 for their 4 × 9 + 5 × 9, or 9 × their 9, or 36 and 45 seen (FT their x)
A1 for 81 CAO
Alternative: the difference in the ratio (1 part) equals 6 + 3 = 9 people: M1 A1 for 1 part = 9, then M1 A1 as above. A trial method leading to 81 with a correct check (36 + 6 = 42 and 45 − 3 = 42) scores 4 marks; 81 with no working and no check scores SC2.

5(a) **Answer: 0.0225** **2**

M1 for 0.15 × 0.15
A1 for 0.0225 (OE, e.g. 9/400) ISW
0.15 + 0.15 = 0.3 scores M0 A0. Answers written as percentages (2.25%) are accepted.

5(b) **Answer: 0.255** **2**

M1 for 0.15 × 0.85 + 0.85 × 0.15, or 2 × 0.15 × 0.85
A1 for 0.255 (OE, e.g. 51/200) ISW
Alternative: $1 - 0.15^2 - 0.85^2 = 1 - 0.0225 - 0.7225$: M1 A1 (FT their (a) for M1). 0.15 × 0.85 = 0.1275 only (one order) scores SC1 if 0.1275 is the final answer.

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6 **Answer: 30.56 cm** **3**

M1 for 80/360 × 2 × 3.14 × 9 (OE, e.g. 2/9 × 56.52 or 4 × 3.14)
A1 for an arc length of 12.56 (cm)
B1 for their 12.56 + 18 (FT their arc length, provided it comes from an arc-length or circumference method), giving 30.56 (cm)
An exact answer 18 + 4π scores M1 A1 B0 (π was to be taken as 3.14). Using the full circumference (2 × 3.14 × 9 = 56.52) instead of the arc scores M0 A0 B1 FT for 56.52 + 18 = 74.52. Using the area of the sector (80/360 × 3.14 × 81, which is also 56.52) scores M0 A0 B0: check the method, not just the number. Forgetting the two radii (answer 12.56) scores M1 A1 B0.

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7 **Answer: Adult £11.50, child £5.50** **4**

M1 for 2a + 3c = 39.50 and 3a + 5c = 62 and a correct method to eliminate one variable, e.g. 6a + 9c = 118.5 and 6a + 10c = 124 subtracted (allow one error in one term, not in the eliminated term)
A1 for the first variable: c = 5.50 or a = 11.50
m1 for substituting their first value into one of the equations (or eliminating again)
A1 for the second value; both correct: adult £11.50, child £5.50
Working in pence (2a + 3c = 3950, 3a + 5c = 6200) is fine. Trial and improvement does not meet 'use an algebraic method': correct answers by trial score SC1 only. Answers the wrong way round (adult £5.50) score M1 A1 m1 A0 if the working is otherwise correct.

8(a) **Answer: $3n^2 - 2n + 1$** **3**

B1 for $3n^2$ (from a second difference of 6)
M1 for subtracting their $3n^2$ from the terms to find a linear remainder, e.g. −1, −3, −5, −7, −9 (FT their an^2)
A1 for $3n^2 - 2n + 1$ CAO
Alternative: $an^2 + bn + c$ with 3 simultaneous equations (a + b + c = 2, 4a + 2b + c = 9, 9a + 3b + c = 22): M1 for a correct set of equations and a correct elimination, B1

for a = 3, A1 for the full expression. Mark the final answer.

8(b) — **2**

Answer: The 10th term is 281 and the 11th term is 342, so 300 lies between two consecutive terms and is not a term.

M1 for the 10th and 11th terms, 281 and 342, or for setting $3n^2 - 2n + 1 = 300$ and attempting to solve (FT their (a) if quadratic)

E1 for a correct conclusion: 300 lies between the 10th and 11th terms (281 and 342), or n is not a whole number

The equation route: $3n^2 - 2n - 299 = 0$ has discriminant 3592, which is not a square number ($59^2 = 3481$, $60^2 = 3600$), so n is not a whole number: M1 E1. Continuing the sequence term by term (66, 97, 134, 177, 226, 281, 342) is acceptable for M1.

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9 — **3**

Answer: 7/22

M1 for two correct recurring decimals that subtract to give a terminating decimal or whole number, e.g. 1000x = 318.1818… and 10x = 3.1818…

A1 for 315/990 (OE, e.g. 31.5/99 or 3.15/9.9)

A1 for 7/22 CAO

Allow other correct pairs, e.g. 100x = 31.8181… and x = 0.3181… giving 99x = 31.5. The A marks need the subtraction to be shown. A correct method with no simplification scores M1 A1 A0.

10(a) — **2**

Answer: 1/16

B1 for a correct first step, e.g. $1/64^{2/3}$, or 4 (from the cube root), or 16 seen, or 1/4 seen

B1 for 1/16 (OE, e.g. 0.0625)

−16 or 16 as a final answer scores B1 only. Mark the final answer.

10(b) — **2**

Answer: $13 - 4\sqrt{3}$

M1 for 4 terms with at least 3 correct: 12, $-2\sqrt{3}$, $-2\sqrt{3}$, +1 (accept 4×3 or $(2\sqrt{3})^2$ for 12)

A1 for $13 - 4\sqrt{3}$ CAO

$(2\sqrt{3})^2$ written as $2 \times 3 = 6$ is an error in one term: M1 is still available if the other three are correct. 12 + 1 = 13 only (cross terms missing) scores M0 A0.

10(c) — **2**

Answer: $6\sqrt{5}$

B1 for $15/\sqrt{5} = 3\sqrt{5}$ or $\sqrt{45} = 3\sqrt{5}$ (either one correct)

B1 for $6\sqrt{5}$ CAO

$15\sqrt{5}/5$ seen is enough for the first B1. Accept k = 6.

11(a) — **2**

Answer: $(2x - 5)(3x + 4)$

B2 for $(2x - 5)(3x + 4)$

B1 for (2x … 5)(3x … 4), i.e. the right numbers with one sign wrong, or for brackets that expand to give two of the three terms correctly

Accept the brackets in either order.

11(b) — **1**

Answer: $x = 5/2$ or $x = -4/3$

B1 for $x = 5/2$ and $x = -4/3$ (OE, e.g. 2.5 and −1 1/3); strict FT from their two brackets in (a)

Both values are needed for the mark. Using the formula correctly also gains B1.

11(c) **Answer: (2x + 5)/(x + 3)** **3**

B1 for (2x − 5)(2x + 5)
B1 for (2x − 5)(x + 3)
B1 for (2x + 5)/(x + 3) CAO
Mark the final answer: further incorrect 'cancelling' (e.g. to 2x/x + 5/3) loses the final B1.

12(a) **Answer: 80** **2**

M1 for at least 3 correct frequencies from 12, 18, 20, 22, 8 (frequency density × class width)
A1 for 80 CAO
Adding the frequency densities (11.4) scores M0 A0.

12(b) **Answer: 17.5 minutes** **2**

M1 for identifying that the median (the 40th or 40.5th value) lies in the class $15 < t \leq 20$, with an attempt to find how far into the class it is, e.g. 15 + (40 − 30)/20 × 5 (FT their frequencies)
A1 for 17.5 (accept answers from 17.5 to 17.7)
Using the 40.5th value gives 15 + 10.5/20 × 5 = 17.625: accept. An answer of $15 < t \leq 20$ (the class only) scores SC1.

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13 **Answer: 192 cm^2** **3**

M1 for the length scale factor: $\sqrt[3]{(1024/250)}$ or $\sqrt[3]{(512/125)} = 8/5$ (OE, e.g. 1.6)
M1 for 75 × (their 8/5)^2, e.g. 75 × 64/25 (OE)
A1 for 192 (cm^2) CAO
75 × 1024/250 (using the volume ratio for area, = 307.2) scores M0 M0 A0. 75 × 8/5 = 120 (length ratio used for area) scores M1 M0 A0.

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14 **Answer: 25/3 cm (8 1/3 cm, or 8.33… cm)** **3**

B1 for 62.5 or 7.5 seen
M1 for upper bound of area ÷ lower bound of length: their 62.5 ÷ their 7.5
A1 for 25/3 (OE, e.g. 8 1/3 or 8.3 recurring; accept 8.33)
62.5 ÷ 8.5 (= 7.35…) or 60 ÷ 7.5 (= 8) scores B1 M0 A0. Bounds of 57.5 and 62.5 for the area, or 7.5 and 8.5 for the length, may be seen in any form.

15(a) **Answer: 112°; opposite angles of a cyclic quadrilateral add up to 180°** **2**

B1 for 112°
E1 for 'opposite angles of a cyclic quadrilateral add up to 180°' (OE)
The reason must mention a cyclic quadrilateral (or the angles being on the circle) and opposite angles. 'Angles in a quadrilateral add up to 360°' alone scores E0.

15(b) **Answer: 44°** **3**

B1 for angle BOD = 136° (the non-reflex angle), or for angle TBD = 68° or angle TDB = 68°
B1 for angle BTD = 44°: from 360° − 90° − 90° − their 136° in quadrilateral OBTD, or from 180° − 2 × their 68° in triangle TBD (FT)
E1 for correct reasons for every step of their route: for quadrilateral OBTD, 'the angle at the centre is twice the angle at the circumference', 'a tangent is perpendicular to the radius' and 'the angles of a quadrilateral add up to 360°'; for triangle TBD, 'the alternate segment theorem' together with 'tangents from an external point are equal' (or the alternate segment theorem used at both B and D) and 'the angles of a triangle add up to 180°'

Angle BCD = 112° from (a) can be used instead: angle BOD = 2 × (180° − 112°) or the reflex angle BOD = 224°, with the reasons. 44° with no reasons scores B1 B1 E0 only if the working (136° or 68°) is shown; an unsupported 44° scores B1.

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16 **Answer: m = (3n + 5k)/(5 − 2n)** **4**

M1 for expanding both brackets correctly: 5m − 5k = 2mn + 3n
M1 for collecting the terms in m on one side and the other terms on the other: 5m − 2mn = 3n + 5k (FT one error)
M1 for factorising: m(5 − 2n) = 3n + 5k (FT)
A1 for m = (3n + 5k)/(5 − 2n) (OE)
Accept the equivalent m = (−3n − 5k)/(2n − 5) or m = −(3n + 5k)/(2n − 5). Mark the final answer; 'm =' must be present or implied.

17(a) **Answer: (−3, −12)** **1**

B1 for (−3, −12)
(−1, −4) (the stretch applied to x) or (−3, −1) (3 added rather than multiplied) scores B0.

17(b) **Answer: (−9, 0) and (−5, 0)** **1**

B1 for (−9, 0) and (−5, 0) (both needed)
(−1, 0) and (3, 0) (a translation the wrong way) scores B0.

17(c) **Answer: (−6, −4)** **1**

B1 for (−6, −4)
(−1.5, −4) (the stretch the wrong way) or (−3, −2) (the y-coordinate halved) scores B0.

18(a) **Answer: 4/n × 3/(n − 1) = 1/11, so n(n − 1) = 132, so $n^2 - n - 132 = 0$** **3**

B1 for 4/n × 3/(n − 1) (OE, e.g. 12/(n(n − 1)))
M1 for equating their product to 1/11 and clearing the fractions, e.g. 12 × 11 = n(n − 1) or 132 = n(n − 1)
A1 for reaching $n^2 - n - 132 = 0$ convincingly, with no errors seen (answer given)
4/n × 4/n (with replacement) scores B0, and M1 is not available. Working backwards from n = 12 (4/12 × 3/11 = 1/11) does not show the equation: SC1.

18(b) **Answer: 12** **2**

M1 for (n − 12)(n + 11) = 0, or a correct substitution into the quadratic formula
A1 for n = 12 (with n = −11 rejected or not given as the final answer)
An answer of '12 or −11' with no rejection scores M1 A0. A correct answer from trial (12 × 11 = 132) with a check scores M1 A1. By the formula the discriminant is 1 + 528 = 529 = 23^2, so n = (1 ± 23)/2.

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19 **Answer: x = 6 or x = −3** **4**

M1 for multiplying through by (x + 2)(x − 2): x(x − 2) + 5(x + 2) = 2(x + 2)(x − 2) (allow one error)
A1 for $x^2 - 3x - 18 = 0$ (OE three-term quadratic = 0)
m1 for factorising their three-term quadratic, (x − 6)(x + 3) = 0, or a correct substitution into the formula
A1 for x = 6 and x = −3 CAO
Writing over a common denominator, $(x^2 + 3x + 10)/((x + 2)(x − 2)) = 2$, earns the first M1 when it leads to $x^2 + 3x + 10 = 2x^2 − 8$ (OE). Forgetting to multiply the right-hand side 2 by the denominator is not 'one error' for M1. Strict FT for m1 from

their three-term quadratic. Correct answers by trial with no algebra score SC1.

Total: 80 marks