



GCSE MARKING SCHEME

AUTUMN 2017

**GCSE
MATHEMATICS – NUMERACY
UNIT 2 - HIGHER TIER
3310U60-1**

INTRODUCTION

This marking scheme was used by WJEC for the 2017 examination. It was finalised after detailed discussion at examiners' conferences by all the examiners involved in the assessment. The conference was held shortly after the paper was taken so that reference could be made to the full range of candidates' responses, with photocopied scripts forming the basis of discussion. The aim of the conference was to ensure that the marking scheme was interpreted and applied in the same way by all examiners.

It is hoped that this information will be of assistance to centres but it is recognised at the same time that, without the benefit of participation in the examiners' conference, teachers may have different views on certain matters of detail or interpretation.

WJEC regrets that it cannot enter into any discussion or correspondence about this marking scheme.

GCSE Mathematics – Numeracy Unit 2: Higher Tier Autumn 2017 Final	Mark	Comment
<p>1(a) Midpoints 2.5, 7.5, 15, (25,) 40</p> $10 \times 2.5 + 16 \times 7.5 + 4 \times 15 + 1 \times 40$ <p>Intention their $\sum fx / 31$ 7.9(0...cm)</p>	<p>B1</p> <p>M1</p> <p>m1</p> <p>A1</p>	<p>Midpoint of $20 \leq s < 30$ (25) is not required for B1</p> <p>25 + 120 + 60 + 40 (= 245) FT their midpoints, including bounds, provided they fall within the classes including upper bounds.</p> <p>FT if 1 slip in one of 'their midpoints', (and only one, including 25) used outside the tolerance of bounds for M1, m1 only</p> <p>(245/31) Following correct working Accept 8 cm from correct working</p>
<p>1(b) FALSE FALSE TRUE TRUE</p>	<p>B2</p>	<p>B1 for any 3 correct</p>
<p>1(c) $(28 \times 9 - 63) \div 27$ or equivalent</p> <p>7 (cm)</p>	<p>M2</p> <p>A1</p>	<p>M1 for sight of 28×9 or 252</p> <p>Allow M2, A1 for an unsupported answer of 7(cm) Award M0, A0 for an answer of 7(cm) from sight of $63 \div 9$</p>

<p>2(a) An appropriate calculation that could lead to an answer of approximately 32 (acres), e.g. $13 \times 10000 \div 4046.86$ (=32.12367...) $13 \times 10000 \div 4050$ (=32.098...) $10000 \div 4046.8$ (≈ 2.5), 2.5×13 (= 32.5) $13 \times 10000 \div 4000$ (= 32.5) $13 \div 0.4$ (= 32.5)</p> <p>× any number between 4 and 6 inclusive</p> <p>Number of alpacas from appropriate correct calculation: Answer given as a whole number of alpacas in the inclusive range 128 to 195</p> <p>Statement of their assumption, e.g. ‘used the mid number 5 alpacas’, ‘used a range of numbers of alpacas’, ‘used the least number of alpacas per acre’, ‘used the greatest number of alpacas per acre’, ‘all the 13 hectares are suitable for keeping alpaca’, ‘used 1 acre as 4000m², ‘they left 6 alpacas in every acre’, ‘they would keep as many alpacas in every acre as they could’ (following use of ‘6’), ‘not all their land is suitable’</p>	<p>M2</p> <p>m1</p> <p>A2</p> <p>E1</p>	<p>M1 for a calculation such as</p> <ul style="list-style-type: none"> • $13 \div 4046.86$ (=0.0032...) • $13 \div 4050$ (=0.0032...) • 13×10000 (=130000) • $10000 \div 4046.8$ (≈ 2.5) <p>FT from M2 only</p> <p>Must be correct working FT from rounding to 32 (acres) Accept an answer as a range with bounds given as whole numbers</p> <p>Award A1 for</p> <ul style="list-style-type: none"> • 4 and 6 used, leading to one correct and one incorrect answer • a non-whole number answer in the range 128 to 195 • an answer as a range with bounds not given as whole numbers <p><i>Note: Only accept answers outside the given range if fully justified, e.g. 32.5 rounded to 33 with use of 6 alpacas to give 198 alpacas</i></p> <p>The assumption must match their working</p> <p>Allow, e.g. ‘as they could have many small fields, not possible to fit all the alpacas in’ (with 4 alpacas used) (fields not being hectares implied)</p> <p>Do not accept, e.g. ‘all alpacas weigh the same’, ‘they will be able to keep alpacas on 13 acres’, ‘alpacas not all the same size’, ‘they can afford all the alpacas’, ‘same amount of alpacas on each bit of land’ (unless accompanied by further explanation)</p>
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<p>2(b)(i) Line 6 cm \pm 2mm from the south fence AND Bisector from south and east fences ($\pm 2^\circ$), or Line 6cm \pm 2mm from the east fence</p> <p>Circle with radius 1.4cm \pm 2mm centred at the intersection of the 2 lines</p>	<p>B2</p> <p>B2</p>	<p>Mark intention Any lines must be of sufficient length to find the intersection for B2 Award B2 for the unsupported or unambiguous correct location indicated provided not from incorrect working, such as spurious or incorrect arcs</p> <p>B1 for sight of one of the following:</p> <ul style="list-style-type: none"> Line 6 cm \pm 2mm from the south fence Bisector from south and east fences ($\pm 2^\circ$) Line 6cm \pm 2mm from the east fence <p>FT 'their intersection' of two straight lines B1 for sight of one of the following:</p> <ul style="list-style-type: none"> a circle centred at the intersection of the 2 lines (outside tolerance) a circle of the correct radius seen (anywhere)
<p>2(b)(ii) (900 litres = 900 000 cm³) 900 000 = $\pi \times 70^2 \times \text{height}$ or $0.9 = \pi \times 0.7^2 \times \text{height}$ or equivalent</p> <p>(Height =) $\frac{900\,000}{\pi \times 70^2}$ or $\frac{0.9}{\pi \times 0.7^2}$</p> <p>Answers in the range 58.4 to 58.5 (cm)</p>	<p>M2</p> <p>m1</p> <p>A1</p>	<p>May be shown in stages M1 for sight of any 1 of the following:</p> <ul style="list-style-type: none"> $\pi \times 70^2 \times \text{height}$ $\pi \times 0.7^2 \times \text{height}$ $900\,000 = \pi \times 140^2 \times \text{height}$ $0.9 = \pi \times 1.4^2 \times \text{height}$ $900\,000 = \pi \times 70^2 \times \text{height}$ or $0.9 = \pi \times 0.7^2 \times \text{height}$ <i>with place value errors with digits 9 and/or 7</i> <p>FT from M1 or M2 Allow for correct rearrangement (intended calculation) including place value error with digits 9 and/or 7 and use of diameter as radius</p> <p>CAO, must be in centimetres Accept 58(cm) from correct working</p>
<p>2(c) $80 \times 19.20 \div 15.47$ + $20 \times 22.30 \div 15.21$ + $100 \times 24.50 \div 14.93$</p> <p>For any 2 of the 3 correct amounts of money (£)99.29, (£)29.32, (£)164.1(0) OR an answer in the inclusive range (£)292 to (£)293</p> <p>(£)99.29 + (£)29.32 + (£) 164.1(0) leading to (£) 292.71</p>	<p>M2</p> <p>A1</p> <p>A1</p>	<p>M1 for sight of any 1 year calculation seen (£99.288..., £29.322..., £164.099..)</p> <p>CAO not from incorrect working</p>

<p>3.</p> <p>(Balls of wool per pair) $135 \div 20$ ($\times 40$) 6.75 (balls) or 7 (balls) or 270 (balls) or 280 (balls)</p> <p>(Costs are $40 \times$) $1.42 \times 135 \div 20$ ($+(40 \times) 8$)</p> <p>(Profit = Sales – Costs), e.g. (Profit per pair) $18.95 - 1.42 \times 135 \div 20 - 8$ OR (Profit for 40 pairs) $40 \times 18.95 - 40 \times (1.42 \times 135 \div 20 + 8)$ OR Appropriate amounts used to calculate $(100 \times) \frac{\text{total sales}}{\text{total costs}} - 1(\times 100)$</p> <p>Use of appropriate amounts to calculate: (Percentage profit = $100 \times$) $\frac{\text{profit}}{\text{costs}}$ or $(100 \times) \frac{\text{sales}}{\text{costs}} - 1(\times 100)$</p> <p style="text-align: center;">7.8(%) or 5.6(%)</p> <p>See next page for OCW strands.</p>	<p>M1 A1</p> <p>m1</p> <p>M2</p> <p>m1</p> <p>A1</p>	<p>Accept rounding or truncation of 1/2p throughout</p> <p>FT $135 \div 20 = 6.75$ balls and 7 balls</p> <table border="1" data-bbox="901 369 1353 465"> <tr> <td>Costs</td> <td>1 pair</td> <td>40 pairs</td> </tr> <tr> <td>6.75 balls</td> <td>£9.585</td> <td>£383.40</td> </tr> <tr> <td>7 balls</td> <td>£9.94</td> <td>£397.60</td> </tr> </table> <p>M2</p> <table border="1" data-bbox="901 497 1353 656"> <tr> <td colspan="2">Profit using 6.75 balls</td> </tr> <tr> <td>1 pair</td> <td>$18.95 - 9.585 - 8 = 18.95 - 17.585 = £1.365$</td> </tr> <tr> <td>40 pairs</td> <td>$758 - 383.40 - 320 = 758 - 703.40 = £54.60$</td> </tr> </table> <table border="1" data-bbox="901 687 1353 846"> <tr> <td colspan="2">Profit £, using 7 balls</td> </tr> <tr> <td>1 pair</td> <td>$18.95 - 9.94 - 8 = 18.95 - 17.94 = £1.01$</td> </tr> <tr> <td>40 pairs</td> <td>$758 - 397.60 - 320 = 758 - 717.60 = £40.40$</td> </tr> </table> <table border="1" data-bbox="901 907 1353 1193"> <tr> <td>M1 for any 1 amount</td> <td>Amount, £</td> </tr> <tr> <td>Paying sister 40 prs</td> <td>320</td> </tr> <tr> <td>Total sales 40prs</td> <td>758</td> </tr> <tr> <td colspan="2">Total costs 40prs:</td> </tr> <tr> <td>6.75 balls</td> <td>703.4(0)</td> </tr> <tr> <td>7 balls</td> <td>717.6(0)</td> </tr> <tr> <td colspan="2">Total cost 1 pair:</td> </tr> <tr> <td>6.75 balls</td> <td>17.585</td> </tr> <tr> <td>7 balls</td> <td>17.94</td> </tr> </table> <p>OR</p> <p>M1 for any 1 of the following:</p> <ul style="list-style-type: none"> omitting to pay her sister: $18.95 - 1.42 \times 135 \div 20$ or $40 \times 18.95 - 40 \times (1.42 \times 135 \div 20)$ inconsistent use of $\times 40$: $40 \times 18.95 - 1.42 \times 135 \div 20 - 8$ or $18.95 - 40 \times (1.42 \times 135 \div 20 + 8)$ <p>m1 FT from previous M1 or M2 FT $18.95 - \text{'their cost per pair'}$ OR $\text{'40} \times \text{'their 18.95'}$ – $\text{'their total costs'}$ $\text{'their total costs'}$ OR equivalent</p> <p>A1 No other FT, must be 2 s.f. 7.8% CAO comes from use of 6.75 balls, 5.6% CAO comes from use of 7 balls</p>	Costs	1 pair	40 pairs	6.75 balls	£9.585	£383.40	7 balls	£9.94	£397.60	Profit using 6.75 balls		1 pair	$18.95 - 9.585 - 8 = 18.95 - 17.585 = £1.365$	40 pairs	$758 - 383.40 - 320 = 758 - 703.40 = £54.60$	Profit £, using 7 balls		1 pair	$18.95 - 9.94 - 8 = 18.95 - 17.94 = £1.01$	40 pairs	$758 - 397.60 - 320 = 758 - 717.60 = £40.40$	M1 for any 1 amount	Amount, £	Paying sister 40 prs	320	Total sales 40prs	758	Total costs 40prs:		6.75 balls	703.4(0)	7 balls	717.6(0)	Total cost 1 pair:		6.75 balls	17.585	7 balls	17.94
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<p>Organisation and communication</p> <p>Writing</p>	<p>OC1</p> <p>W1</p>	<p>For OC1, candidates will be expected to:</p> <ul style="list-style-type: none"> • present their response in a structured way • explain to the reader what they are doing at each step of their response • lay out their explanations and working in a way that is clear and logical • write a conclusion that draws together their results and explains what their answer means <p>For W1, candidates will be expected to:</p> <ul style="list-style-type: none"> • show all their working • make few, if any, errors in spelling, punctuation and grammar • use correct mathematical form in their working • use appropriate terminology, units, etc.
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<p>4(a) DG = 3.2 (m) and DH = 3.4 (m)</p> $(GH^2 =) 3.2^2 + 3.4^2$ $(GH)^2 = 21.8 \text{ or } (GH =) \sqrt{21.8}$ <p>4.7(m) or 4.67(m) or 4.66(9...m) or 4.6(m)</p>	<p>B1</p> <p>M1</p> <p>M1</p> <p>A1</p>	<p>May be seen on the diagram</p> <p>FT 'their 3.2' and 'their 3.4' provided they are $\neq 4.8$ and $\neq 6.8$(m)</p> <p>FT 'their 3.2' (DG) and 'their 3.4' (DH) including use of 4.8 and 6.8(m)</p> <p>Allow FT from M0, M1 including use of 4.8 and 6.8(m) to give 8.3(2...m) (i.e. B0, M0, M1, A1) FT from M1, M0 for the correctly evaluated square root of 'their 21.8' provided 'their answer' > 3.4 (cm)</p>
<p>4(b) (Perimeter) 4.669... + 3.2 + 3.4</p> <p>Cost 12 x 3.50</p> <p>(£)42</p> <p>Appropriate for the perimeter 70(cm) or 73.(095....cm) or 74(cm) or 80 (cm) left over</p>	<p>M1</p> <p>M1</p> <p>A1</p> <p>B1</p>	<p>(11.2m, 11.269..m, 11.27m or 11.3m) FT 'their derived 4.669...' (from (a)) + 'their DG <4.8' + 'their DH <6.8', however if no response in (a) accept 'their GH' if clearly stated provided >3.3 but <8.4 (m)</p> <p>FT 'their derived perimeter' provided:</p> <ul style="list-style-type: none"> the perimeter has been derived from the sum of 3 lengths, AND rounded up correctly to a whole number <p>Do not FT further for premature rounding of lengths to find 'their perimeter', no further marks (Otherwise FT)</p> <p>Strict FT 100 x ('their 12' – 'their correctly evaluated derived perimeter <12'), which leads to left over bit ≥ 0 e.g. 74(cm) from a perimeter 11.26m Answer must be in cm Accept use of rounded or truncated answers for 'their derived perimeter'</p> <p><i>A fully correct FT for rounding lengths up prematurely, e.g. if 4.7m used: 4.7 is 5 strips, 3.4 and 3.2 is 4 strips each, gives 13 m, so 13 x £3.50 = (£)45.5(0) with 170(cm) left over, this is awarded M0, M1, A0, B0</i></p>

<p>5. 7500×1.0031^n</p> <p>7500×1.0031^{21} (= (£) 8003.68(7105))</p> <p>21 (months)</p>	<p>B1</p> <p>M1</p> <p>A1</p>	<p>For any value of n ($7500 \times 1.0031 = (\text{£})7523.25$) May be implied Allow 7500×1.0031^{20} (=$\text{£}7978.95(2352)$) with convincing work that (£) 8000 will be reached the following month. Answer clearly seen, not embedded in their method.</p>
<p>6. Sight of appropriate 31° or 59° in the diagram OR appropriate use of these angles in their calculations</p> <p>(Distance from Molk to Lindat =)</p> $\frac{24}{\sin 59^\circ} \quad \text{OR} \quad \frac{24}{\cos 31^\circ}$ <p>= 27.9(992...) or 28 (km)</p> <p>(Time taken to sail from Molk to Lindat =)</p> $27.9(992...) \div 20$ <p>= 1.4 (hours) (= 1h 24m)</p> <p>(Arrival time =) 1:09pm or 13:09</p>	<p>B1</p> <p>M2</p> <p>A1</p> <p>M1</p> <p>A1</p> <p>A1</p>	<p>FT 'their 31°' or 'their 59°' provided the angle <90 for M2 or M1 only.</p> <p>A correct method for calculating the distance Molk to Nuir using trigonometry, followed by correct use of Pythagoras is awarded M2.</p> <p>M1 for $\sin 59^\circ = 24/\text{distance}$ OR M1 for $\cos 31^\circ = 24/\text{distance}$ CAO</p> <p>FT 'their derived 27.9(992...)' from the use of trigonometry. On FT, accept an answer that has been rounded to 1dp, but it needs to be correct to 1dp for 'their 27.9(9...)' ISW. (Allow 13:09pm). FT 'their 1.4 hours' correctly converted provided of equivalent difficulty. On FT, their answer needs to be correct to the nearest minute for 'their 1.4'</p>
<p>7(a) $\frac{14}{2800} (\times 100) \times 12$ OR $\frac{14.07}{2814} (\times 100) \times 12$</p> <p>= 6(%) or 0.06</p>	<p>M2</p> <p>A1</p>	<p>M1 for $\frac{14}{2800} (\times 100)$ OR $\frac{14.07}{2814} (\times 100)$ Or M1 for 0.005 or 0.5% A0 for 0.06%</p>
<p>7(b) $(1 + \frac{0.06}{12})^{12} - 1$ or equivalent</p> <p>= 6.17 (%)</p>	<p>M1</p> <p>A2</p>	<p>FT their final answer from (a)</p> <p>A1 for 0.061(67...) or 0.062, OR A1 for 6.1(67...%) or 6.2(%)</p> <p><i>Alternative methods:</i> M1 for 2800×1.005^{12} M1 for $\frac{2972.69(7873) - 2800}{2800} (\times 100)$ or equivalent FT 'their 2972.69(7873) provided previous M1 awarded. A1 for 6.17 (%), OR</p> <p>M1 for $(1 + \frac{0.06015}{6})^6 - 1$ A2 for 6.17 (%) A1 for 0.06(167...), or for a correct percentage but not correct to 2 dp.</p>

<p>8. (Length of circular arc =) $\frac{20}{360} \times 2 \times \pi \times 10$ $= 3.48(888\dots)$ to 3.5 (cm)</p> <p>(Length² =) $4^2 + (3.48(888\dots) \text{ to } 3.5)^2$ Length² = 28.1104 to 28.25 or (Length =) $\sqrt{(28.1104 \text{ to } 28.25)}$ (Length =) 5.3 to 5.32 (cm)</p> <p>(Total length of piping needed =) $\frac{360}{20} \times (5.3 \text{ to } 5.32)$ = 95.4 to 95.8 (cm)</p>	M1 A1 M1 A1 A1 M1 A1	Or equivalent (OR $10\pi/9$ or equivalent) FT 'their derived 3.48...' FT the square root of 'their 28...' provided their answer is the longest length of their triangle. On FT, accept an answer that is correct to 1dp for 'their 3.48(888...)'. FT 'their 5.3...' provided previous M1 awarded.
9(a) False True True False False	B2	B1 for 3 correct
9(b) <ul style="list-style-type: none"> • Number the engineers from 01 to 50 • Consider successive 2-digit numbers • Use numbers in the range 1 to 50 • Ignore repeats <p>(The engineers chosen would be) 29, 45, 07, 24, 39, 17, 03, 24, 49, 12 ISW</p>	E2 B1	All 4 needed for E2 Allow an equivalent numbering system e.g. 00 to 49. E1 for any 2 or 3 correct statements. Needs to be written in this order <i>Alternative method:</i> <ul style="list-style-type: none"> • <i>Number the engineers from 01 to 50</i> • <i>Consider successive 2-digit numbers</i> • <i>Divide each number by 50 and use the remainder to choose an engineer</i> • <i>Ignore repeats. When the remainder is 0, engineer 50 is selected</i> E2 for all 4 statements E1 for any 2 or 3 statements B1 for 29, 47, 45, 04, 29, 07, 24, 33, 39, 49 ISW

<p>9(c) Sight of 24.5 or 12.25 AND 43.5</p> <p>(S.area of half-hemisphere =) $(4 \times \pi \times 12.25^2) \div 4$ or equivalent</p> <p>(Curved surface area of cylinder =) $(\pi \times 24.5 \times 43.5) \div 2$ or equivalent</p> <p>(Total surface area =) $(4 \times \pi \times 12.25^2) \div 4 + (\pi \times 24.5 \times 43.5) \div 2 + (\pi \times 12.25^2) \div 2$ $= 2379.5 \text{ to } 2382 \text{ (m}^2\text{)}$</p> <p>(Number of tins needed =) $(2379.5 \text{ to } 2382) \div 39.5$ $= 61$</p>	<p>B1</p> <p>B1</p> <p>B1</p> <p>M2</p> <p>A1</p> <p>M1</p> <p>A1</p>	<p>Accept use of .49 repeated and 12.249 repeated throughout, but not .49 and 12.249</p> <p>(= 471 to 471.6... (m²)) FT 'their 12.25' provided it is ≥ 11.5 and ≤ 12.5</p> <p>(= 1673 to 1674.75 (m²)) FT 'their 24.5' or 'their 12.25' and 'their 43.5' including use of 24 or 12, 43 and their lower bounds.</p> <p>(Area of semicircle 235.5 to 235.8...) Upper bounds need to be correct. M1 for summing 3 terms, with 2 being correct.</p> <p>CAO</p> <p>(= 60.2... to 60.3) FT their total area provided at least M1 awarded.</p> <p>FT a correctly rounded up answer to their calculation.</p>
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