GCSE MARKING SCHEME

AUTUMN 2018

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

INTRODUCTION

This marking scheme was used by WJEC for the 2018 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.

WJEC GCSE MATHEMATICS - NUMERACY (3310U60-1)

AUTUMN 2018 MARK SCHEME

GCSE Mathematics – Numeracy Unit 2: Higher Tier	**Mark**	**Comment**
1(a) Idea that 4000 cycles is 80%	S1	Interpretation of link between 80% and 4000 cycles, e.g. sight of any one of the following, provided not with incorrect idea of using 20% or (95 – 80 =) 15% • 80% = 4000 (cycles) • 4000 ÷ (0.)80 • 4000/(0.)80
95 × 4000 ÷ 80 or 95 × 50 or equivalent 4750 (cycles)	M1 A1	
1(b)(i) Midpoints 1500, 2500, 3500, 4500	B1	
1500×3 + 2500×12 + 3500×9 + 4500×7 (= 4500 + 30 000 + 31500 + 31500 = 97500)	M1	FT 'their midpoints' provided each one lies within the appropriate group, including bounds throughout Use of lower bound gives 82 000 Use of upper bounds gives 113 000
÷ 31	m1	Use of lower bounds gives 2645(.16...) Use of upper bounds gives 3645(.16...)
3145(.16..cycles) or 3145.2 (cycles)	A1	
1(b)(ii) $3000 \leq b < 4000$	B1	
2(a)(i) $\frac{300}{2000} \times 60$ or $300 \div (2000 \div 60)$ or $60 \div (2000 \div 300)$ or equivalent	M1	May be seen in stages
9 (minutes)	A1	ISW Allow 9.1 (minutes) from premature approximation If no marks, awarded SC1 for an answer or sight of 3/20 or 0.15 (ignore units)

2(a)(ii) Assumption, e.g. 'he was walking in a straight line', 'no turning', 'he didn't stop', 'lawn mower didn't run out of petrol',	E1	Allow, e.g. 'lawn mower goes the same distance as Emyr', 'didn't push the mower faster than it was set', 'didn't hold the lawn mower back', '**Emyr** kept going at a constant / same speed' Do not accept, e.g. '(**lawn mower**) kept going at a constant / same speed' 'flat terrain', 'Emyr can walk fast enough to keep up with the mower'
2(a)(iii) Impact, e.g. 'it could take longer to cut', 'more time needed', 'the answer is shorter than it will be',	E1	Strict FT from (a)(ii) Allow, e.g. 'longer (time)', 'increased (time)' Do not accept e.g. 'shorter (time)', 'could have been shorter or longer time', 'time could have been affected / impacted', 'it could vary' Do not accept contradictions
2(b)(4.5 litres for 25 × 300=) 7500 (m) (Cutting 100 metre uses)100 × 4.5 ÷ 7500 0.06 (litres)	B1 M1 A1	Allow for (33.3... × 9 × 25 =) 7492.5 to 7500 (m) FT 'their 25 × 300'
2(b) Alternative method: *4.5 ÷ 25 (= 0.18)* *× 100 ÷ 300* *0.06 (litres)*	*M1* *m1* *A1*	*Allow use of 33.3(...) × 9 for 300* *FT allowed use of 33.3(...) × 9 for 300 leading to an answer of 0.06(... litres)*

2(c) Any of the following conversions • 1 litre ≈ 1.75 pints • 1 pint ≈ 568 ml • 1 gallon = 8 pints **AND** 1 gallon ≈ 4.5(46...) litres OR 1 litre ≈ 0.22 gallon Any of the following methods • 1(.)3(0) ÷ 1.75 • 1(.)3(0) × 568 ÷ 1000 • $\frac{1(.)3(0) \div 0.22}{8}$ • $\frac{1(.)3(0) \times 4.5(46...)}{8}$ Answer in the range (£)0.73 to (£)0.74(3) or 73 to 74(.3p) **AND** Conclusion 'No'	B1 M1 A1	Also accept the following throughout: • 1 litre ≈ 1.76 pints • 1 pint ≈ 567 ml • 1 pint ≈ 569 ml • 1 pint ≈ 570 ml • 1 gallon = 8 pints **AND** 1 litre ≈ 0.219 gallon Accept £0.74(...)p Do not accept 0.73p, 0.74(...)p, £73 or £74 Do not accept 'Yes' unless statement saying e.g. '74p is fairly close to 60p', i.e. a comparison stated
2(c) Alternative method 1: *1 litre ≈ 1.75 pints OR 1 pint ≈ 568 ml* *60 × 1.75 OR 60 × 1000 ÷ 568* *Answer in the range* *(£)1.05 or 105(p) to (£)1.06 or 106(p)* ***AND** conclusion 'No'*	*B1* *M1* *A1*	*Also accept the following throughout:* • *1 litre ≈ 1.76 pints* • *1 pint ≈ 567 ml* • *1 pint ≈ 569 ml* • *1 pint ≈ 570 ml* *Accept £1.05p or £1.06p* *Do not accept* *£105 or £106 or 1.05p or 1.06p* *Do not accept 'Yes' unless statement saying e.g. '(£)1.05 is fairly close to (£)1.30', i.e. a comparison stated*
2(c) Alternative method 2: *1 pint > 0.5 litre or 2 pints > 1 litre* *(But) 60 < 130 ÷ 2 or 60 < 65* *or 2 × 60 < 130 or equivalent in £s* *Conclusion 'No'*	*B1* *M1* *A1*	*May be expressed in words* *Accept 60p < £1.30 ÷ 2 etc. with correct units included* *Do not accept 'Yes' unless statement saying e.g. '60(p) is fairly close to 65(p)', i.e. a comparison stated*

3. (Change to CHF) 480 × 1.24 (No coins, so can buy only) 590 (CHF) (Cost to Amrit for 590 CHF is) 590 ÷ 1.24 OR 480 - (595.2 – 590) ÷ 1.24 (£) 475.81	M1 A2 M1 A1	(= 595.2 CHF) A1 for an answer of 595(.2 CHF) FT 'their whole number multiple of 10 CHF' ÷ 1.24 or 595 ÷ 1.24 Depends only on previous M1 awarded Do not FT from 595 ÷ 1.24 Must be to the nearest penny, do not accept (£)475.8(0) If no marks, due to **consistent** use of 1.28 then SC1 for sight of 610 CHF AND SC1 for (£)476.56
4(a) (Perpendicular height, h) (h^2 =) $1.8^2 - 0.7^2$ or $1.8^2 = h^2 + 0.7^2$ $h^2 = 2.75$ or (h =) $\sqrt{2.75}$ (Perpendicular height is) h = 1.658(...m) or 1.66 (m) or 1.7 (m) (Volume of Luned's tent =) ½ × (0.7+0.7) × 1.658.... × 2.5 or equivalent (Volume) Answer in the inclusive range 2.9 (m^3) to 2.98(m^3) or 3(.0m^3) Organisation and communication Writing	M1 A1 A1 M1 A1 OC1 W1	Accept $\sqrt{11}/2$ Accept $\sqrt{11}/2$ Do not accept truncation to 1.6(m) or 1.65 (m) (But FT allowed) FT from M1, A0 for the correctly evaluated square root of 'their 2.75' provided 'their answer' <1.8 (m) FT 'their derived 1.658(....)' provided ≠1.8 or ≠0.7 Check from correct working (in particular for an answer of 3(m^3)) FT 1.6m or 1.65m to an answer in the range 2.8(m^3) to 2.89(m^3) FT from previous M1 awarded for a similar range For OC1, candidates will be expected to: • 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 For W1, candidates will be expected to: • 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.
4(b) 200 000 cm^3	B1	

5(a) (Volume =) $9450 \div 2.7$ $3500\ (cm^3)$	M2 A1	M1 for $\frac{9450}{\text{Volume}} = 2.7$ CAO If no marks, award SC1 for an answer of either (steel $9450 \div 7.8$ =) $1211(.5...cm^3)$ or $1212\ (cm^3)$ or (carbon fibre $9450 \div 1.6$ =) $5906(.25\ cm^3)$
5(b) (Mass =) 1.6×3500 or $1.6 \times 9450 \div 2.7$ 5600 (g)	M2 A1	M1 for $\frac{\text{Mass}}{3500} = 1.6$ FT 'their 3500' throughout provided $\neq 9450$ Do not allow a FT answer of 9450(g)
6(a) 650 (steps)	B1	
6(b) (x =) $\tan^{-1} \frac{324}{800}$ (x =) 22(.047...°)	M2 A1	OR alternative **full** method (Pythagoras' Theorem followed by relevant trigonometry) (Note: Hypotenuse is 863.1... m) M1 for tan x = 324/800 OR for statement of 'their trig ratio', with values substituted, from alternative full method CAO
7(a)(i) 1910 – 1919	B1	
7(a)(ii) (Population of under-50s in 2011) $36000 \times 20 + 40000 \times 10 + 36000 \times 10 + 43000 \times 10$ = 1 910 000 (Increase in population =) 40 000 ISW	M1 A1 A1	*Note: check histogram for working* Allow M1 for one error only in reading the scale (36 000 read as 35 000 is 1 error) Allow M1 for the sum of any 3 correct products Ignore any additional calculations CAO FT 'their 1 910 000' provided they are working with the first 4 bars AND their answer is > 0 A percentage increase of 2.139…% implies M1A1A0 unless 40 000 seen
Alternative method: *6000×10 (+ 5000×10) – 1000×20 (− 5000×10)* *= 40 000 ISW*	*M2* *A1*	*Allow M1 for one error only in reading the scale* *Allow M1 for the sum of any 3 correct products* *Ignore any additional calculations* *CAO* *A percentage increase of 2.139…% implies M1A1A0 unless 40 000 seen*

7(a)(iii) $\frac{8(0\,000)}{30(0\,000)}$ (×100) = 27(%)	M1 A2	Place value of both numbers needs to be consistent Allow $\frac{76(000)}{285(000)}$ from use of width 9.5 Allow $\frac{72(000)}{270(000)}$ from use of width 9 Allow a method to find 8(0 000) as a % of 30(0 000). Needs to be convincing A1 for 26(%) or 26(.6…%), or A1 for 0.27
Alternative method: *$\frac{38(0\,000)}{30(0\,000)}$ (×100) − 1(×100)* *= 27(%)*	*M1* *A2*	*Place value of both numbers needs to be consistent* *Allow $\frac{361(000)}{285(000)}$ from use of width 9.5* *Allow $\frac{342(000)}{270(000)}$ from use of width 9* *Allow a method to find 38(0 000) as a % of 30(0 000) provided they show an intention to go on to subtract 100%* *Needs to be convincing* *A1 for 26(%) or 26(.6…%), or* *A1 for 0.27*
7(b) Valid reason e.g. 'She didn't know how wide to make the bars', or 'It doesn't tell Danielle how old the oldest people were'	E1	Allow e.g. 'The age group is not accurate. It doesn't say the oldest age in the group' Do not accept e.g. 'She wouldn't be able to fit it on the graph paper', or 'It's a small amount compared to the others', or 'It's not an accurate age group' (without further explanation)
7(c) Valid explanation that recognises there has been an increase in the population in this age group e.g. '(more) people (of this age group) came to live in Wales (than left Wales)'	E1	Do not accept an explanation that implies these are 2 different groups of people Do not accept e.g. 'Due to immigration and people leaving the country', or 'There has been an increase'
8(a)(i) (Number of grains of sand =) $\frac{3\times10^{11}}{1{\cdot}2\times10^{-3}}$ g or $\frac{3\times10^{8}}{1{\cdot}2\times10^{-6}}$ kg or $\frac{3\times10^{5}}{1{\cdot}2\times10^{-9}}$ t $= 2{\cdot}5\times10^{14}$	M2 A1	Or equivalent M1 for 3/1·2 with inconsistent place value CAO

8(a)(ii) (Vol of sand =) $2{\cdot}5\times10^{14}$ × $0{\cdot}32\div10^{9}$ or equivalent	M2	FT 'their $2{\cdot}5\times10^{14}$' from (a)(i) M1 for $2{\cdot}5\times10^{14}\times0{\cdot}32$ with place value errors M1 for $0{\cdot}32\div10^{9}$
= 80 000 or equivalent (m^3)	A1	FT from M2 only Be aware of 80 000 coming from incorrect workings
8(b) Sight or use of a correctly placed 48º or 42º	B1	Either in their diagram OR in their sin equation OR in their cos equation
(distance =) $\frac{200}{\sin48(º)}$ OR $\frac{200}{\cos42(º)}$	M2	FT 'their 48' or 'their 42' provided <90 AND clearly indicated on their diagram or stated M1 for $\sin48(º)=\frac{200}{x}$ OR $\cos42(º)=\frac{200}{x}$ OR M2 for alternative **full** method (trigonometry followed by Pythagoras) M1 for trigonometry followed by Pythagoras with values substituted correctly
= 269(·126… km)	A1	FT from M2 only Allow 270 (km) from correct workings
		If no marks, and no diagram seen, or a correct diagram with no angles seen, SC1 for sight of $\frac{200}{\sin42(º)}$ OR $\frac{200}{\cos48(º)}$
8(c) $45\times\frac{3\times30(0\,000)}{5\times25(0\,000)}$	M2	M1 for the appropriate use of 45 with any two of 3, 5, 30(0 000), 25(0 000) e.g. Time / Cranes / Tonnage 27 / 5 / 250 or 54 / 3 / 300 or 1 / 1 / $\frac{250\,000}{45\times3}$ (=1851.)
= 32·4 (hours)	A1	CAO
= 32 (hours) 24 (minutes)	A1	FT from M1 previously awarded, provided of equivalent difficulty

9(a) Tangent drawn at 60 seconds Idea of difference in y ÷ difference in x Correct gradient from difference in y ÷ difference in x	M1 m1 A1	 Allow one error in counting squares or in reading the scale for m1 only Accept the gradient as a proper fraction or decimal or percentage Allow negative values Mark final answer
9(b)(i) $\frac{1}{2} \times 20 \times (36 + 0 + 2(34 + 29 + 20))$ OR $\frac{1}{2} \times 20 \times (36 + 68 + 58 + 40)$ = 2020 (m)	M2 A1	Award M1 if only one reading incorrect FT from M1
Alternative method: $\frac{(36 + 34)}{2} \times 20 + \frac{(34 + 29)}{2} \times 20 + \frac{(29 + 20)}{2} \times 20 + \frac{(20 + 0)}{2} \times 20$ *= 2020 (m)*	*M2* *A1*	(= 700 + 630 + 490 + 200) *Each area may be seen as the sum of the area of a rectangle and triangle* *M1 for the sum of 4 areas with at least 2 correct* *FT from M1* *If no marks awarded and 8 strips used, SC2 for summing the areas (355+345+330+305+270+225+155+55) leading to an answer of 2040 (m)* *OR* *SC1 for summing the areas (355+345+330+305+270+225+155+55) but not arriving at an answer of 2040 (m)* *or* *SC1 for the sum of 8 areas with any 6 correct*
9(b)(ii) Explanation e.g. 'Increase the number of strips', or 'Use strips of smaller width'	E1	

10(a)		Accept any notation or word(s) for 'height'
(Volume of cone =) $\frac{1}{3} \times \pi \times 9^2 \times h$	B1	Or $27\pi h$, or $84\ldots h$
(Volume of cylinder =) $\pi \times 9^2 \times 4h$	B1	Or $324\pi h$, or $1017\ldots h$
$10\,000 = \frac{1}{3} \times \pi \times 9^2 \times h + \pi \times 9^2 \times 4h$	M2	(Or $10\,000 = 351\pi h$) *M1 for either:* • *the sum of 2 terms equated to 10 000 with 1 term correct, OR* • *the sum of 2 correct terms equated to 10^n where n is an integer and n > 0*
$h = \frac{10\,000 \times 3}{13 \times \pi \times 9^2}$ or $\frac{10\,000}{1102\ldots}$ or $\frac{10\,000}{351\pi}$	m1	FT from M1
h = 9·0 (cm) to 9·1 (cm)	A1	No FT from M1m1
(Total height =) 45·3 (cm) to 45·5 (cm) or 45 (cm)	B1	FT from M1 or M2 for 5 × 'their 9·0(68…)'
Alternative methods: $\frac{1}{3} \times \pi \times 9^2 \times \frac{h}{4}$	*B1*	*Or $6.75\pi h$, or $21\ldots h$*
$\pi \times 9^2 \times h$	*B1*	*Or $81\pi h$, or $254\ldots h$*
$10\,000 = \frac{1}{3} \times \pi \times 9^2 \times \frac{h}{4} + \pi \times 9^2 \times h$	*M2*	*(Or $10\,000 = 351\pi h/4$)* *M1 for either:* • *the sum of 2 terms equated to 10 000 with 1 term correct, OR* • *the sum of 2 correct terms equated to 10^n where n is an integer and n > 0*
$h = \frac{10\,000 \times 12}{13 \times \pi \times 9^2}$ or $\frac{10\,000}{275\ldots}$ or $\frac{40\,000}{351\pi}$	*m1*	*FT from M1*
h = 36·2 (cm) to 36·3 (cm)	*A1*	*No FT from M1m1*
45·3 (cm) to 45·5 (cm) or 45 (cm)	*B1*	*FT from M1 or M2 for $\frac{5}{4}$ × 'their 36·2(746…)'*

Alternative methods: *Vol of cone: vol of cylinder = 1:12* *10(000) ÷ 13* *(vol of cone =) 0·76(9… litres) or 0·77 or 769(·…cm^3) or 770 (cm^3)* *(vol of cone =) $\frac{1}{3} \times \pi \times 9^2 \times h$* $\frac{1}{3} \times \pi \times 9^2 \times h = 769(\cdot\ldots)$ *(h =) 9·0 (cm) to 9·1 (cm)* *(Total height =) 45·3 (cm) to 45·5 (cm) or 45(cm)*	*B1* *M1* *A1* *B1* *m1* *A1* *B1*	*This M1 implies previous B1* *Or 27πh, or 84…h* *FT 5 ×* 'their *9·0(68…)' provided previous M1 awarded*
10(b) • A curve of decreasing gradient for the first 2 seconds with positive gradient at time 2 seconds • A connecting straight line of constant gradient for the last 24 seconds up to the 'container full' line • The intention for the 2 sections of their graph to meet at (2, 1st notch)	B2	Allow the intention of the straight line B2 for meeting all 3 conditions B1 for meeting any 2 conditions, with their graph starting at (0,0) and ending at (26, full)