GCSE MARKING SCHEME

SUMMER 2017

GCSE (NEW)
MATHEMATICS NUMERACY - UNIT 2 (HIGHER)
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** **Summer 2017**	Mark	Comment
1. 850 × 0.76 (= £646) or equivalent × 0.87^6 or equivalent (£)280(.1225…)	M1 M1 A1	M1 marks can be awarded in either order (Note: If calculated first 850 × 0.87^6 = £368.58(22...) Accept answers in the inclusive range (£)280 to (£)281 Award M1, SC1 for an answer (850 × 0.76 × 0.87^7 = £) in the inclusive range (£)243 to (£)244
2. Sight of any 2 of: 25.5, 36.5, 47.5 OR sight of 25 + 36 + 47 + 1.5 or equivalent Greatest 109.5 (cm) or 109.499999... (cm)	B1 B1	Do not accept '.49' instead of '.5', but allow '.49 recurring' CAO, must be from correct working, or unsupported Allow an answer of 110(cm) from sight of 109.5(cm) Do not accept 109.49 (cm)
3. Perpendicular bisector drawn: Wrexham and Aberporth Caernarfon and Swansea Circle with radius 2cm ±2mm (20 miles) centred at the intersection of the perpendicular bisectors Correct region in Wales identified, from arc radius equivalent to 2cm ±2mm (20 miles)	 B1 B1 B1 B1	 Tolerance ±2mm and ±2° Tolerance ±2mm and ±2° Independent mark FT from the intersection of 'their 2 straight lines', i.e. following previous B0 B0 Independent mark FT provided 'their region' (arc of a circle) spans Wales **and** England to give a similar region which excludes England The region should not include England, shading or indicating the full circle is B0 (Common incorrect response: A circle of the correct radius drawn with the centre at the intersection of straight lines joining Wrexham with Aberporth and Caernarfon with Swansea is awarded B0 B0 B1 B0)

4. $\tan^{-1}$ 0.81(1…) or $\tan^{-1}$ 146/180 Angle of elevation is 39.(04…°) Statement e.g. '(not safe as) too far (from the foot of the cliff)', 'too far out at sea'	M2 A1 E1	M1 for tan (angle of elevation) = 146/180 FT '**their acute angle'** provided at least M1 previously awarded, **with** • <42° being too far out, or • >45° too near the cliff, or • between these angles it is safe *Alternative for M marks, e.g.:* *sin (elevation) =* $\frac{146}{\sqrt{(180^2 + 146^2)}}$ *(* $= \frac{146}{231.767..}$ *)* ***OR*** *cos (elevation) =* $\frac{180}{\sqrt{(180^2 + 146^2)}}$ *M1* $\sin^{-1}$ *0.62994.... OR* $\cos^{-1}$ *0.7766... M1* *If no marks:* *Award SC1 for an answer of 50.95…° or 51° AND 'too near'*
5.(a) (Length^2 =) $44^2 - 16^2$ or 44^2 = Length^2 + 16^2 (Length =) √1680 or Length^2 = 1680 41 (inches)	M1 A1 A2	 2 sig.fig. is required A1 for 41.0, 41.00 or 40.9878… rounded or truncated FT from M1 for the correctly evaluated square root of 'their 1680' provided 'their answer' < 44 (inches) for possible A2 or A1
5.(b) (100 ×) 710.40 ÷ 74 (£)960	M1 A1	
5.(c)(i) 23.52 p	B1	
5.(c)(ii) 27.44 p	B1	

6. (Old fish tank contains) $60 \times 40 \times 45$	B1	($108\,000\ cm^3$)
(New fish tank maximum volume is) $\pi \times 25^2 \times 70$	M1	
Answer in range 137375 to137500 (cm^3)	A1	
Conclusion, e.g. '137 375 > 108 000', 'Elin can be certain as the volume of the new tank is greater' 'it fits'	B1	FT 'their new fish tank calculation' conclusion provided 108 000 (cm^3) seen **and** at least M1 previously awarded *Alternative:* *(To find new fish tank water level)* *(Old fish tank contains) $60 \times 40 \times 45$* *B1* *(New tank) $\pi \times 25^2 \times$ 'water level'* *M1* *$60 \times 40 \times 45 = \pi \times 25^2 \times$ 'water level'* *m1* *(Water level) 55.(….cm) with conclusion that contents will be certain to fit* *(55 cm must be correct)* *A1* *Depends on all previous marks awarded*
Organisation and communication	OC1	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
Writing	W1	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.
7.(a) Method of systematic sampling, e.g. '(select one person from the first 12 people at random then) ask every (240÷20 =) 12th person'	E1	*Note to markers:* *There should really be mention of the first person being selected at random, however in this first assessment, with only 1 mark available, not doing so will be condoned in this mark scheme*

7. (b) Mid points 20.4, 21.3, 22.2, 23.1 20.4×2 + 21.3×3 + 22.2×10 + 23.1×5 (= 40.8 + 63.9 + 222 + 115.5 =)	B1 M1	FT 'their mid points' provided they are all within or at the bounds of the appropriate groups
(Sum of 20 hand spans is) 442(.2 cm)	A1	OR estimate of the mean (442.2÷20 =) 22(.11 cm) May be implied in further working
(Sum of all 30 hand spans is) 10×22.8 + 442(.2) (= 670(.2) cm)	M1	OR 10×22.8 + 20×22(.11) FT 'their derived 442.2' provided the correct method seen, including where **one** of 'their mid points' was outside the group
÷30	m1	Intention to divide the sum of 30 measurements by 30
22(.34 cm)	A1	Depends on M1, M1 and m1 previously awarded (Watch for an answer 22(.. cm) from $\frac{22.1(1) + 22.8}{2}$, award B1M1A1M0m0A0)
7. (c) Improvement suggestion, e.g. 'ask more people', 'take a bigger sample', 'ask every 5th person instead', 'collect more data (from different regions in Wales)', 'use all the raw data', 'do both hands', 'stratified sample on age', 'stratified sample on gender', 'by narrowing the groups in the table'	E1	Allow, e.g. 'ask people of different ages', Do not accept, e.g. 'measure more accurately'
8. AB or AC = 2.5 ÷ cos52° OR AB or AC = 2.5 ÷ sin38° OR AB or AC = 4(.06067… m)	M2	M1 for any of the following • cos52° = 2.5/ AB • cos52° = 2.5/ AC • sin38° = 2.5/AB • sin38° = 2.5/AC • equivalent full method without AB or AC as the subject
Total length 2 × 4(.06067…) (+ 6)	m1	FT 'their derived AB or AC' provided M1 awarded
14(.12… metres)	A1	FT from M1, m1 previously awarded
Cost per metre is 410 ÷ 14(.12…)	m1	FT from 'their total length' for m1 only Depends on previous M1
(£)29(.03…)	A1	CAO, i.e. (£)29.(….) (Note: 410 ÷14 = £29(.285…) Accept an answer that would round to (£)29 from correct working

9. 80 × (Number of pupils in Year 11) ÷ 690 (List of unrounded answers =) 35·5(942…), 27·7(101…), 16·6(956…) (Numbers invited =) 35, 28, 17	M1 A1 A1	Sight of this calculation for any one school Accept 'their 307 + 239 + 144' for 690 for M1 only Allow A1 for any 2 correct unrounded answers, OR for final answers of 36,28,17 OR 36,27,17 OR 36,28,16 if unrounded answers not seen CAO
10. Appropriate use of 12 and 2 in the AER formula Sight of 0·0385 and 0·0386 (AER Bannau =) $(1+0{\cdot}0385/12)^{12} - 1$ OR (AER Eryri =) $(1+0{\cdot}0386/2)^{2} - 1$ (AER Bannau =) 0·0391(866…) or 0·0392 OR 3·91(866…) % or 3·92 % AND (AER Eryri =) 0·0389(724…) or 0·0390 OR 3·89(724…) % or 3·9(0) % AND Correct statement e.g. 'Bannau offers better annual rate of interest'	B1 B1 M1 A2	Denominators AND powers Or 3·85/100 and 3·86/100 Do not accept 0·0391(866…)% or 0·0392% Do not accept 0·0389(724…)% or 0·0390% A1 for either correct AER If no marks awarded, SC2 for comparing correct end of year amounts (amount × 1·0392, amount × 1·0390) with a correct conclusion SC1 for calculating the correct end of year amount for one account
11.(a) (Length of arc) $\frac{50}{360} \times 2 \times \pi \times 5$ = 4·3(611…) to 4·4 (cm) OR $500\pi/360$ (cm) Perimeter = 14·3(611…) to 14·4 (cm)	M1 A1 B1	 Or $25\pi/18$. May be implied by B1 FT for adding 10 providing M1 awarded
11.(b) (Area ¼ circle =) 7·065 to 7·1 (cm^2) OR $9\pi/4$ (Area sector =) $\frac{50}{360} \times \pi \times 5^2$ = 10·9(027…) to 10·91 OR $125\pi/36$ (cm^2) (Surface area of badge =) $7 \cdot 06 \ldots + 10 \cdot 91 \ldots - \frac{50}{360} \times \pi \times 3^2$ (3·925 to 3·9275) = 14·0(427…) to 14·1 OR $161\pi/36$ (cm^2)	 B1 M1 A1 M1 A1	 May be implied in further working May be implied in further working FT 'their 7·06…' and 'their 10·91…' provided previous M1 awarded Needs to come from values that are correct to at least 1 decimal place *Alternative method:* *B1 for* ($\frac{20}{360} \times \pi \times 3^2$) *1·57 to 1·571 or π/2 (cm^2)* *(may be implied in further working)* *M1 for* $\frac{50}{360} \times \pi \times 5^2$ *A1 for 10·9(027…) to 10·91* OR $125\pi/36$ *(cm^2)* *M1 for* $10 \cdot 9 \ldots + (2 \times \frac{20}{360} \times \pi \times 3^2)$ *FT 'their 10·9' and 'their 1·57' provided previous M1 awarded* *A1 for 14·0(427…) to 14·1* OR $161\pi/36$ *(cm^2)*

12.(a) Sight of 805 (cm) or 405 (cm) (805 × 405) + (405 × 400) OR a consistent attempt at converting these into metres = 488 025 (cm^2)	B1 M2 A1	Do not accept 804·9 or 404·9, but allow 804·9 recurring or 404·9 recurring FT their upper bounds M1 for 805×405 + (400<n≤405 × 405) (Note: use of 805×405 + 405×405 leads to 490 050) OR 48·8(025) m^2. Allow 488 000 (cm^2) CAO. Ignore attempts to convert into m^2. *Alternative method:* *M2 for $805^2 - 400^2$* *Allow M1 for $805^2 – (395≤n<400)^2$* *A1 for 488 025 (cm^2)* *CAO. Ignore attempts to convert into m^2.*
12.(b) Conversion 48·8(025) (m^2) OR 0·00325 (g/cm^2) 32·5 × 48·8(025) OR 0·00325 × 488 025 = 1586(·08125) (g) AND Statement e.g. 'No, more than 1·5 kg (could be) needed'	B1 M1 A1	FT 'their 488 025' OR 'their 32·5' (805 × 405 + 405 × 405 = 490 050 (cm^2) or 49(·0050) m^2) FT 'their 32·5' provided it is greater than 30 and ≤35, and FT their area provided an attempt made at converting into g/cm^2 or m^2 Accept 1·6 kg from correct working FT 32·5 × 'their area' correctly converted into m^2 *Alternative method:* *M1 for* *0·0325×48·8(025) OR $3·25×10^{-6}$×488 025* *($kg/m^2 × m^2$) ($kg/cm^2 × cm^2$)* *FT 'their 32·5' provided it is greater than 30 and ≤35, and FT their area* *A1 for 1·58(60…) or 1·6 (kg) AND* *Statement e.g.* *'No, more than 1·5 kg (could be) needed'* *FT 32·5 × 'their area' correctly converted into m^2* *OR* *For candidates **clearly** considering the smallest area that could be seeded* *B1 for 1500 (g) OR 0·0325 (kg)* *FT 'their 32·5'* *M1 for 1500 ÷ 32·5 OR 1·5 ÷ 0·0325* *FT 'their 32·5' provided it is greater than 30 and ≤35 for M1 only* *A1 for 46(·15…) (m^2) AND* *Statement e.g.* *'No, more than 1·5 kg (could be) needed'* *FT their area,* *Only award A1 if their area has been correctly converted into m^2 for comparison*

13.(a) True False	B1	
13.(b) (lengths in ratio) 24 : 30 (= 4 : 5)	B1	Ratio can be reversed Or equivalent (e.g. scale factor = 1·25 or 30/24 OR 0·8 or 24/30)
(volumes in ratio) 13824 : 27000 (= $4^3 : 5^3$)	B1	Ratio can be reversed Or equivalent (e.g. 'Volume scale factor' = 1·9(53125) or $1{\cdot}25^3$ or $(30/24)^3$ OR 0·512 or $0{\cdot}8^3$ or $(24/30)^3$
Statement e.g. '125 is not double 64 (so the increase is not double)', or '64 is not half of 125', or 'Increase is 95(·3125)%'	E1	Depends on B2 provided 4^3 and 5^3 have been evaluated correctly or $1{\cdot}25^3$, $(30/24)^3$, $0{\cdot}8^3$ or $(24/30)^3$ evaluated correctly
13.(c) (Scale factor of heights =) $\sqrt{4}$ or 2 OR $\sqrt{\frac{1}{4}}$ or 0·5	B1	
$24 \div \sqrt{4}$ OR $24 \times \sqrt{\frac{1}{4}}$	M1	
= 12 (cm)	A1	*Alternative method:* *M1 for* $24^2 \div 4$ *A1 for* $height^2 = 144$ *or* $(height =) \sqrt{144}$ *A1 for 12 (cm)*

14.(a) (Hyp of triangle =) $1 \div (\sin 7{\cdot}1(°))$ $= 8{\cdot}0(9051\ldots)$ or $8{\cdot}1$ (m) $(AB^2 =) 5^2 + 8{\cdot}0(9051\ldots)^2$ $AB^2 = 90{\cdot}4(564\ldots)$ or $(AB =) \sqrt{90{\cdot}4(564\ldots)}$ $(AB =) 9{\cdot}5(108\ldots)$ (m)	M2 A1 M1 A1 A1	Or equivalent M1 for $\sin 7{\cdot}1(°) = 1 \div$ (Hyp of triangle) Accept 8 (m) from correct working FT their $8{\cdot}0(9051\ldots)$ provided trigonometry attempted FT their rounded $8{\cdot}0(9051\ldots)$ Do not accept $9{\cdot}4$ (m) from use of 8 (m) Needs to be correct to 1 d.p. FT from previous M1 for the correctly evaluated square root of 'their $90{\cdot}4(564\ldots)$' provided 'their answer' > 'their $8{\cdot}09(051\ldots)$' *Alternative method:* *Base of triangle = 1/tan7·1 (=8·0284…) M1* *$5^2 + 8{\cdot}0(284\ldots)^2$ (= 89·456…) M1* *Base diagonal = 9·4(581…) or 9·5 (m) A1* *$1^2 + 9{\cdot}4(581\ldots)^2$ M1* *FT 'their rounded 9·4(581…)'* *$AB^2 = 90{\cdot}4(564\ldots)$ or $(AB =) \sqrt{90{\cdot}4(564\ldots)}$ A1* *(AB =) 9·5(108…) (m) A1* *Needs to be correct to 1 d.p.* *FT from previous M1 for the correctly evaluated square root of 'their 90·4(564…)' provided 'their answer' > 'their 8·09(051…)'*
14.(b) $\sin^{-1}(1/9{\cdot}5(108\ldots))$ $= 6(\cdot0354\ldots)(°)$	M2 A1	FT 'their $9{\cdot}5(108\ldots)$' M1 for $\sin(\text{angle}) = 1/9{\cdot}5(108\ldots)$ Needs to be an answer that is < 7·1 Needs to be correct to 1 d.p. Do not penalise premature rounding on FT if already penalised in (a) *Alternative method:* *$\tan^{-1}(1/9{\cdot}4(581\ldots))$ M2* *$= 6{\cdot}0(354\ldots)(°)$ A1, OR* *$\cos^{-1}(9{\cdot}4(581\ldots)/9{\cdot}5(108\ldots))$ M2* *$= 6{\cdot}0(354\ldots)(°)$ A1 OR* *Alternative method:* *B1 for 'Delyth's route is going up 1(m) in (travelling) 8·0(9051… m).' OR 'The gradient of Delyth's route is (1/8·0(284…)) 0·12(455..)'* *B1 for 'Ioan's route is going up 1(m) in (travelling) 9·5(108…m)' OR 'The gradient of Ioan's route is (1/9·4(581…)) 0·10(572…)'* *B1 for 'So Ioan's route is less steep.'* *This B1 is dependent on previous B1B1 being awarded and provided Ioan's gradient is less steep than Delyth's* *FT their values from (a)*