GCSE MARKING SCHEME

AUTUMN 2016

MATHEMATICS - NUMERACY (NEW)
UNIT 2 - HIGHER TIER

3310U60-1

INTRODUCTION

This marking scheme was used by WJEC for the 2016 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 2016	Mark	Comment
1(a) $y = 5b/6x$	B1	
1(b) $2.6 \times 33.6/2.1$ or 2.6×16 41.6 (cm)	M1 A1	CAO *Award M1, A0 for an answer of 40.32 from PA (33.6 × 1.2 = 40.32)*
2. $34 \times 0.98^2 \times 1.06^5$ Answer in the range (£)43.67 to (£)43.7(0)	M2 A1	OR equivalent method to decrease by 2% and to increase by 6% on different amounts *(34 × 0.98^2 = 32.6536)* *(34 × 1.06^5 = 45.4996…)* M1 for sight of either $\times 0.98^2$ or $\times 1.06^5$ or equivalent calculations CAO, from correct working
3(a) (diagonal^2 =) $3.3^2 + 3.3^2$ diagonal^2 = 21.78 or diagonal = $\sqrt{21.78}$ diagonal is 4.7 (cm)	 M1 A1 A1	*Scale drawings are not accepted in Q3* FT from M1 for the correctly evaluated square root of 'their 21.78' provided 'their answer' > 3.3 (cm) Must be to 1 d.p. Accept an unsupported 4.7(cm)
3(b) 11 × 4.6(669…) × 9.5 × 4.6(669…) or 11 × 4.7 × 9.5 × 4.7 or 104.5 × (4.7)^2 (Area =) 2276(.01cm^2)	M2 A1	FT for 'their derived diagonal', but not 3.3 cm M1 for sight of either 11 × 4.6(669…) or 9.5 × 4.6(669…) *(Height 44.3355… cm; width 51.3359…cm)* Accept answers in the range 2211 (cm^2) to 2308.41 (cm^2) from appropriate working *(Note: e.g. use of a diagonal such as 5.27(cm) allow appropriate calculation with 5.2 (cm) or 5.3 (cm) for M2, A1; however use of 5 throughout is a possible M2, A0)*

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4(a) Sight of 31.2 **and** 3 or 180	B1	
$\frac{31.2}{3}$ OR (9.6 km/h =) 0.16 (km/min) with $\frac{31.2}{180}$	M2	Allow 31.2/7 ÷ 3/7 FT ' their total distance' 'their total time in hours' M1 for 'their total distance' 'their total time in minutes' allow 31.2/7 ÷ 180/7
10.4 (km/h) OR 0.17(3.. km/min)	A1	FT from 1 arithmetic error in calculating either 31.2 or 3, i.e. one of these values needs to be correct Do not FT from denominator in minutes unless 0.16 (km/min) seen Allow a final answer from a correct method that rounds to 10.4, e.g. 10.3(54..km/h) from PA *(Note: 31.2 ÷ 7 = 4.45714…* *3 ÷ 7 = 0.42857…* *180 ÷ 7 = 25.71428…)* *If no marks so far, allow SC1 for evaluating 'a distance ÷ time in hours' correctly* *(Sun to Sat : 10.615.., 10.45, 11, 10.6286, 10.8, 9.4286, 9.2727…)*
% improvement 100 × (10.4 – 9.6) ÷ 9.6 or 100 × 10.4 ÷ 9.6 - 100 or equivalent	M1	FT 'their 10.4' provided it is >9.6 OR FT 'their 0.17(3…)' provided it is >0.16
8(.333…%)	A1	*(Note: use of 10.354… leads to 7.85%)* *If previously M0, A0 for % improvement, allow SC1 for an answer of 108%, or similar from FT*
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.

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4(b) tan elevation = $\frac{200}{1600}$ or equivalent Angle of elevation is 7(.125….°)	M1 A2	 A1 for $\tan^{-1}$ 0.125 or $\tan^{-1}$ (200/1600)
4(c)(i) run = $\frac{300}{\sin 10°}$ 1727(.631… m) or 1728(m) Assumption, e.g. 'road is straight', 'used a right-angled triangle', 'the road is smooth', 'Gwenda runs in a straight line'	M2 A1 E1	M1 for sin10° = 300/run ISW Accept reasonable estimates (rounding or truncation) following correct working, e.g. 1700, 1730, 1750 Depends on a previous attempt to use right-angled triangle trigonometry or Pythagoras' theorem Accept 'Gwenda doesn't zigzag up the hill'
4(c)(ii) Impact, e.g. 'run could be longer', 'it is an under estimate', 'bumps could make it longer'	E1	Independent of (c)(i) Allow 'it is inaccurate' Do not accept 'shorter' alone However, accept 'shorter than the actual length'
5(a)(i) Mid points : 1.5, 3, 4.5, 7 1.5 × 2 + 3 × 6 + 4.5 × 8 + 7 × 4 (= 3 + 18 + 36 + 28 = 85) ÷ 20 4.25 (microns)	B1 M1 m1 A1	 FT 'their mid points' provided each one lies within the appropriate group, including bounds Accept 4.3 from correct working, i.e. 85 ÷ 20 seen in working Do not accept 4.2 unless 4.25 or 85 ÷ 20 seen in working
5(a)(ii) 45 dust particles means 3×7 : 3×8 21 : 24 or 21 in total equivalent (A further) 13 (dust particles)	M1 m1 A1	Accept 7×45/(7+8) : 8×45/(7+8) Allow M1, m1, A0 for sight of 8 + 13 = 21 *Alternative:* *Trial & improvement, e.g.* *18 : 27 (is 2 : 3 incorrect)* *19 : 26 (incorrect)* *20 : 25 (is 4 : 5 incorrect)* *21 : 24 (is 7 : 8 correct!!)* *M1 for sight from the above list:* *a trial with correct simplification shown* ***AND*** *--- either for a second trial with correct simplification shown* *--- or the second trial has clearly been dismissed* *m1 Selection of 21 : 24* *A1 (a further) 13 (dust particles)*

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5(b) (Circumference) $5 = 2 \times \pi \times r$ or $5 = \pi \times d$ Radius of the cylinder $\frac{5}{2\pi}$ Volume $\pi \times (5/2\pi)^2 \times 2$ 4 (microns^3)	M1 A1 m1 A2	($5/2\pi = 0.79577\ldots$) FT 'their r' provided M1 awarded provided 'their r' $\neq 5/\pi$ A1 for $25/2\pi$ or 3.9(…) or 4.0 (microns^3)
6(a) (Total =) 640 75 × (number of staff in a job type) ÷ 640 (List of unrounded answers =) 14·0625, 37·5, 6·5625, 16·875 (Number in sample =) 14, 37, 7, 17	B1 M1 A1 A1	 Sight of this calculation for any one job type FT 'their total' Allow A1 for any 2 correct CAO
6(b) 'Each doctor is given a 3-digit number from 001 to 120' 'Use the table to select numbers in the range (1 to 120), ignoring repeats' (Working in rows would produce) 032, 021, 081, ~~032~~, 055, 105 (Working in columns would produce) 032, 055, 021, ~~032~~, 119, 081	 B1 B1 B1	 Or any 120 different numbers OR Each doctor is given a number from 1 to 120, and the random numbers are then partitioned in groups of 3 If they are not working in rows or columns, they need to explain how they are working (Note: the numbers have to be used one at a time) *Alternative:* *B1 for 'the 3-digit number is divided by 120 with the remainder used, a remainder of zero means that doctor 120 is chosen, ignore the numbers 000 and 961 – 999 and repeats, OR 960 – 999 ,and repeats'* *B1 for* *(working in rows would produce)* *032, 040, 021, 084, ~~032~~, 027 OR* *(working in columns would produce)* *032, 062, 117, 055, ~~062~~, 040*
7. Sight of 65 500 000 or equivalent Sight of 243 500 65 500 000 ÷ 243 500 = 268(·993…) or 269 (population/km^2)	B1 B1 M1 A1	Allow use of 65 499 999 or equivalent throughout Accept 270 from correct working

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8(a) Identifying the length 1·7 on a correct triangle	S1	May be seen or implied If (a) is unanswered, may be awarded from (b)
(Angle =) $\tan^{-1}(2{\cdot}1/1{\cdot}7)$	M2	If hypotenuse used, a complete method needed M1 for tan(angle) = 2·1/1·7
= 51(·009…)(°)	A1	Allow an answer that rounds to 51(°)
8(b) (Slant height of triangular face^2 =) $2{\cdot}1^2 + 1{\cdot}7^2$	M1	
Height^2 = 7·3	A1	
(Height =) 2·7(018…) OR √7·3 (cm)	A1	FT from M1 for the correctly evaluated square root of 'their 7·3' provided 'their answer' > 2·1 (cm) *Alternative methods:* *M2 for (Height =) 2·1/sin 51(·009…)(°)* *OR M2 for (Height =) 1·7/cos 51(·009…)(°)* *FT 'their derived 51(·009…)(°)'* *M1 for sin 51(·009…)(°) = 2·1/Height* *OR M1 for cos 51(·009…)(°) = 1·7/Height* *A1 for 2·7(018…) (cm)*
(Total s. area =) $4\times\frac{1}{2}\times3{\cdot}4\times2{\cdot}7(018\ldots) + 3{\cdot}4^2$ OR $4\times\frac{1}{2}\times3{\cdot}4\times\sqrt{7{\cdot}3} + 3{\cdot}4^2$	M1	FT 'their derived 2·7(018…)' Note: $3{\cdot}4^2 = 11{\cdot}56$
= 29·9(325…)(cm^2)	A1	
(Cost of chocolate =) 2·39(46…) or 2·4 (p)	B1	FT 0·08×'their 29·9(325…)' provided at least one of the previous M1 marks awarded Allow an answer of 2 (p) from correct working If units are given, they must be correct
9(a) Volume of hemisphere = $\frac{2}{3}\times\pi\times4{\cdot}8^3$ OR $\frac{2}{3}\times\pi\times(12r)^3$	B1	Allow for sight of 231·5 to 231·7
(Tot vol=) $\frac{2}{3}\pi\times4{\cdot}8^3 + \pi\times0{\cdot}4^2\times6 + \frac{1}{3}\pi\times0{\cdot}4^2\times3{\cdot}6$ (231·… + 3·0… + 0·6…)	M2	M1 for summing 3 terms with any 2 correct, OR M1 for use of *r* in a correct method
= 235 to 235·3 (mm^3)	A1	OR 74·88π. FT from M1
No. of nails = 18 000 ÷ 235(·3) or equivalent	M1	Allow M1 for 18 000 ÷ 'their 235(·3)' provided previous M1 at least awarded
= 76	A1	Needs to be a whole number, and be the result of rounding down their answer
9(b) True True False False	B2	B1 for 3 correct

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10(a)(i) 0·0198	B1	
10a(ii) Banc Padarn For use of n = 12 (AER=) $(1 + 0{\cdot}0198/12)^{12} - 1$ = 0·01998(0…) OR 1·998(0…) % Banc Padarn's savings account would give most interest per annum.	 B1 M1 A1 E1	 FT 'their 0·0198' for M1 only Allow 0·02(00..) OR 2(·00) % Do not accept 0·01998 % or 0·02(00..) % FT 'their AER for Banc Padarn' provided at least M1 awarded AND they are comparing like percentages or decimals *Alternative method:* *B1 for monthly interest rate of 0·00165* *M1 for the method of calculating the value of an investment for Banc Padarn after a year (initial investment × $1{\cdot}00165^{12}$) and Banc Teilo (initial investment × 1·0199)* *A1 for accurate values for both banks (with appropriate rounding)* *E1 for Banc Padarn chosen*
10(b)(i) 0·00165	B1	
10(b)(ii) (31st May OR 1st June) (Interest =) (0·00165 × 150 000) (£)247.5(0) (30th June OR 1st July) (Interest =) (0·00165 × 150 247.5(0)) (£)247.90(84) OR Total interest of (£)495.40(84) (31st July OR 1st August) (Interest =) (0·00165 × 150 495.40(84)) (£)248.31(74) OR Total interest of (£)743.72(58) (Tax to pay =) ('their 743.72(58)' – 500) × 0·4 31st July OR 1st August AND (£)97.49(032)	 B1 B1 B1 M1 A1	 FT 'their 247.5(0)' FT 'their 247.90(84)' *Alternative method:* *B1 for (1·00165×150 000) (£)150247.5(0)* *B1 for ($1{\cdot}00165^2$×150 000) (£)150495.40(84)* *This B1 implies the 1st B1* *B1 for ($1{\cdot}00165^3$×150 000) (£)150743.72(58)* *The last B1 implies the previous two B1 marks* FT 'their 743.72(58)' provided compound interest attempted Allow 'End of July' OR '30th July' for the date Allow (£)97.48 from rounding down of the monthly interest payments