GCSE MARKING SCHEME

AUTUMN 2019

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

INTRODUCTION

This marking scheme was used by WJEC for the 2019 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

AUTUMN 2019 MARK SCHEME

GCSE Mathematics – Numeracy **Unit 2: Higher Tier**	**Mark**	**Comments**
1. (Change to £) 550 × 0.53 (£)291.5(0) (Only £10 and £20 notes available so he can buy) (£)290	M1 A1 A1	FT 'their (£)291.5(0)' (provided not a multiple of 10) rounded down to nearest multiple of 10 Accept stated or implied as (£)1.50 can't be converted Sight of (£)290 with no incorrect working implies previous A1
(Fewest number of notes making up £290,) 14 £20 (notes) and 1 £10 (notes)	A1	FT 'their £290' provided it is a multiple of 10 Must be fewest number of notes Sight of correct notes with no incorrect working implies previous A1
(Cost in $ to buy £290 is) 290 ÷ 0.53 or 550 – 1.5(0) ÷ 0.53 (= 550 – 2.83...)	M1	FT 'their whole number multiple of £10' ÷ 0.53 Ignore attempt at any further calculation if 290 ÷ 0.53 seen
($)547.17	A1	Must be <($)550 **and** depends on M1 M1 previously awarded Must be to the nearest cent Mark final answer If final M0 A0, then award SC1 for ($)2.83 (left) or similar FT

2(a)  in any orientation	B1	Allow: • intention of straight lines and right angles • two equal rectangles joined Do not accept if end elevation also drawn, unless plan view is labelled
2(b)(i) (Concrete costs) 66 × 39(p) or equivalent	M1	(=£25.74) Allow M1 for sight of a multiplication involving the **digits 66...** with 39(p) or equivalent
(Builder charges) 27 + ⅓ × 27 or equivalent	M1	(= £36) Allow methods breaking down the hour to find the cost for 20 minutes provided sufficient evidence seen Do not allow: • 27 + 0.3 × 27 = 27 + 8.10 = £35.10 • 27 + ⅓ × 27 = 27 + 8.10 = £35.10 Allow 27 + 0.33 × 27 = £35.91 or better
(Total cost of making the step) (£) 61.74	A1	CAO
2(b)(ii) (Area cross-section) as sum of two products: 50 × (20+25) – 24×25 (= 2250 – 600) or (20+25) × (50–24) + 20×24 (= 1170 + 480) or 50×20 + 25×(50–24) (= 1000 + 650) OR (Area cross-section) as sum of three products: 24×20 + 26×20 + 26×25 (= 480 + 520 + 650)	M2	Check diagram for working Accept a similar method given by an equation or expressions M1 for sight of either: • difference or sum of 2 products, with 1 correct • sum of 3 products with 2 correct • all products correct but no attempt to sum
(Area cross-section) 1650 (cm^2)	A1	CAO
(Length = Volume ÷ area cross-section) 66 000 ÷ 1650	M1	FT 66000 ÷ 'their 1650' provided 'their 1650' is dimensionally correct
40 (cm)	A1	ISW FT 66000 ÷ 'their 1650' only allowing rounding or truncation of decimals

3(a)(i) 11 to 15	B1	
3(a)(ii) Midpoints 3, 8, 13, 18 3×3 + 8×7 + 13×12 + 18×18 (9 + 56 + 156 + 324 = 545) ÷ 40 13.6(25 mugs)	B1 M1 m1 A1	 FT 'their midpoints' provided at least 3 of 'their 4 midpoints' lie within the appropriate group, including lower and upper bounds Use of lower bound gives 465 Use of upper bounds gives 625 Allow 13 or 14 (mugs) from correct working Use of lower bounds gives 11.625 (allow 11 or 12) use of upper bounds gives 15.625 (allow 15 or 16)
3(b) (Volume) $\pi \times 4.3^2 \times (11.8 - 2)$ or equivalent Answer in the range 568 (cm^3) to 569.4 (cm^3)	M2 A1	Accept methods shown in stages Allow M1 for sight of $\pi \times 4.3^2 \times 11.8$ or $\pi \times 4.3^2 \times 2$, including if embedded or included with incorrect working. CAO. Accept $\frac{90601\pi}{500}$ or $181.2(02..)\pi$ Provided M1 previously awarded then also award SC1 for an answer in the range • 684.8 to 686 (cm^3) (for the volume of the mug ignoring the 2 cm) or • 682.8 to 684 (cm^3) (for the volume of the mug subtract 2 cm) but **do not ignore** further working in either case

4(a)(i) (Circumference of a wheel) π × 6.4 or π × 0.064	M1	Ignore inclusion of '×4' (for 4 wheels) for M1 M2 (A0)
(Number of revolutions is) 2340 × 100 ÷ (π × 6.4) or 2340 ÷ (π × 0.064) or equivalent	M2	FT 'their circumference' provided 'their calculation of circumference' includes π in the calculation (with consistent place value for M2, with inconsistent place value for M1) M1 for appropriate calculation but containing a place value error, e.g. 2340 ÷ (π × 6.4) or 234000 ÷ (π × 0.064) or 2340 ÷ (π × 0.64)
(Number of revolutions is) Answer in the range 11636(.69...) to 11644(.1083)	A1	CAO, except allow an answer of 11700 (from premature approximation of circumference to 20cm) Mark final answer (Do not ignore further work such as ÷ 4)
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.
4(a)(ii) Assumption, e.g. 'rode all the way', 'didn't carry the skateboard', 'was able to use his skateboard' 'skated in a straight line', 'each wheel rotates the same number of times' 'wheels perfectly circular', 'no wear on the wheels', 'the wheels are all on the ground throughout'	E1	Allow, e.g 'went directly to Sab's house' Do not accept, e.g. '2340m is not exact', 'he doesn't stop on his journey', 'constant speed'

4(b) (Mass of Finbar's skateboard deck) 2.6 × 1800 × 1.2 AND (Mass of Sab's skateboard deck) 0.7 × 1600 × 1.4	M3	Accept shown in stages but not if embedded within incorrect working M2 for one of the following provided **not embedded** within incorrect working, may be shown in stages: (Mass of Finbar's skateboard deck) 2.6 × 1800 × 1.2 OR (Mass of Sab's skateboard deck) 0.7 × 1600 × 1.4 M1 for any one of the following, including embedded within incorrect working, may be shown in stages: • (Finbar's deck volume) 1800 × 1.2 (= 2160) • (Sab's deck volume) 1600 × 1.4 (= 2240) • (g per cm) 2.6 × 1800 (= 4680) • (g per cm) 0.7 × 1600 (= 1120)
(Mass of Finbar's skateboard deck) 5616 (g) **AND** (Mass of Sab's skateboard deck) 1568 (g)	A1	CAO
(Difference is) 4048 (g)	A1	Answer must be in grams FT 'their 5616' – 'their 1568' provided M2 previously awarded

5(a)(i) Height of the gate 110 (cm) or 1.1(0 m)	B1	Allow other estimates of height of the gate (100 cm to 110 cm inclusive) If units are given they must be correct If incorrect conversion of units seen later, B0 and FT for possible M1 A1 A1
(Diagonal^2 =) $2^2 + 1.1^2$ or $200^2 + 110^2$	M1	FT 'their derived 110 or 1.1(0)' provided units are consistent in the application of Pythagoras' Theorem Allow use of 190 cm to 200 cm for the width of the gate in calculating the diagonal length
Diagonal^2 = 5.21 or (Diagonal =) $\sqrt{5.21}$ or Diagonal^2 = 52100 or (Diagonal =) $\sqrt{52100}$ or 228.(...cm)	A1	
(Diagonal =) 2.28(...m) or 2.3(m)	A1	Answer must be in metres Allow truncation to 2.2(m) Do not accept truncation to 2(m) FT from M1 for the correctly evaluated square root of 'their 5.21' provided 'their answer' > 2 (m) for possible A1
5(a)(ii) Assumption, e.g. 'diagonal plank went to each end', 'thought of the planks as lines', 'that it is a right angle (triangle)', 'it goes from corner to corner'	E1	Allow, e.g. 'no thickness' (allow as implying width) 'width (or length) of gate is not exact' (could mean diagonal plank not quite touching across full width of the gate) Do not accept, e.g. 'all planks have the same thickness' (as not an assumption whether meaning width or not), 'the gaps are not exact' (as question defines the gaps) 'lengths are not exact', 'that this diagonal plank is longer than the others', 'it's straight' **Ignore** additional spurious comments

5(b) (Cost of 1 horizontal plank is) (£) 3 × 8.55 ÷ 5 OR (Cost of 1 diagonal plank is) (£) 4 × 8.55 ÷ 5	M1	Accept for sight of (£)5.13 Accept for sight of (£)6.84
(Total cost of gate is) 2 × 8.55 + 5 × 3 × 8.55 ÷ 5 + 4 × 8.55 ÷ 5 or 2 × 8.55 + 5 × 5.13 + 6.84 17.10 + 25.65 + 6.84	m2	m1 for 2 out of the 3 terms correct
(=) (£) 49.59	A1	CAO If no marks, award SC1 for sight of (8.55 ÷ 5 = £)1.71 or ((3+4+5) × 8.55 ÷ 5 = £)20.52
Alternative method *(2 × 5 + 5 × 3 + 4)* *× 8.55* *÷ 5* *(£) 49.59*	*M1* *m1* *m1* *A1*	 *m1 in either order* *CAO*
6. Sight of 7450 (kg) AND 92.5 (kg)	B1	Allow sight of 92.4999… throughout but not 92.49
$\frac{7450}{92.5}$	M1	FT for 7400 $\leq$ t < 7500 and 90 < b $\leq$ 95 Allow convincing arguments using multiples of 92.5
= 80 (bags)	A1	CAO

7. $\frac{485}{\tan 41(º)}$ or $\tan 49(º) \times 485$ or $\frac{485}{\sin 41(º)} \times \sin 49(º)$ OR $\frac{485}{\tan 27(º)}$ or $\tan 63(º) \times 485$ or $\frac{485}{\sin 27(º)} \times \sin 63(º)$ (Horizontal distances from Snowdon =) 557.9(…) or 558 (m) 951.8(…) or 951.9 or 952 (m)	M2 A1 A1	M1 for $\tan 41(º) = \frac{485}{d}$ or $\tan 49(º) = \frac{d}{485}$ or $\frac{d}{\sin 49(º)} = \frac{485}{\sin 41(º)}$ OR M1 for $\tan 27(º) = \frac{485}{d}$ or $\tan 63(º) = \frac{d}{485}$ or $\frac{d}{\sin 63(º)} = \frac{485}{\sin 27(º)}$
(Distance between boats =) 393.8 to 394.1 (m)	B1	FT 'their 557.9(…) and 'their 951.8(…) provided M1 or M2 awarded Answer needs to be correct for their values
Alternative method for final 3 marks: *Distance between boats =) 485(tan63 – tan49)* *OR* $485\left(\frac{1}{\tan 27} - \frac{1}{\tan 41}\right)$	*M2*	*FT provided M2 previously awarded*
(Distance between boats =) 393.8 to 394.1 (m)	*A1*	*Answer needs to be correct for their values*
Alternative full method: *Correct use of sin or cos to find the lengths of 1 or 2 hypotenuse e.g.* $\frac{485}{\sin 41}$ *AND/OR* $\frac{485}{\cos 63}$ *(=739(.26…))* *(=1068(.3…))*	*M2*	*Only award these M marks if they clearly go on to attempt to calculate the distance between the boats using the sine rule (only 1 needed) or cosine rule or 2 applications of Pythagoras (both needed)* *M1 for a correct expression for 1 of the hypotenuse if they go on to use the cosine rule or 2 applications of Pythagoras*
$\frac{739(.26…)}{\sin 27} \times \sin 14$ *OR* $\frac{1068(.3…)}{\sin 139} \times \sin 14$ *OR* $\sqrt{(739(.26..)^2+1068(.3..)^2 - 2\times 739(.26..)\times(1068(.3..)^2\times\cos 14)}$ *OR* $\sqrt{1068(.3..)^2 - 485^2} - \sqrt{739(.26\ldots)^2 - 485^2}$	*M2*	*FT from M1 previously awarded if possible* *M1 for the unrearranged versions of the sine or cosine rule with correct substitution*
(Distance between boats =) 393.8 to 394.1 (m)	*A1*	*CAO*

8(a) $3 \times \frac{5}{9} \times \frac{143\,(000)}{26\,(000)}$ OR $3 \times 0.555\ldots \times 5.5$ or equivalent = 9.16(6…) or 9.2 (mins) = 9 mins 10 sec or 9 mins 12 sec OR e.g. 'which is less than 9.25 (mins)'	M2 A1 A1	A table method altering all 3 at the same time is M0 M1 for the correct use of 3 with either 5/9 or 143(000)/26(000) e.g. Time 16.5 Engines 5 Gallons 143 000 OR $1^2/_3$ 9 26 000 CAO FT from M1 or M2 previously awarded, provided of equivalent difficulty A correct comparison needed
Alternative method 1: *$5 \times \frac{3\ (\text{or } 180)}{9.25\ (\text{or } 555)} \times \frac{143\,(000)}{26\,(000)}$ OR* *$5 \times 0.324\ldots \times 5.5$ or equivalent OR* *$5 \times 0.3278\ldots \times 5.5$ or equivalent if 9.15 used* *= 8.9(18…) (engines) AND a statement e.g.* *'9 engines would do it quicker'*	*M2* *A2*	*A table method altering all 3 at the same time is M0* *Allow use of 9.15 for 9.25 for M marks only* *M1 for the correct use of 5 with either 3/9.25 or 143(000)/26(000)* *e.g. Engines 27.5 Time 3 Gallons 143 000* *OR 1.6216.. 9.25 26 000* *OR 1.639.. 9.15 26 000 (using 9.15)* *CAO* *A1 for 8.9(18…) (engines) without a correct statement* *OR* *A1 for 'their 8.9(18…) from premature approximation with a correct statement*
Alternative method 2: *$26000 \times \frac{9}{5} \times \frac{9.25\ (\text{or } 555)}{3\ (\text{or } 180)}$ OR* *$26000 \times 1.8 \times 3.08\ldots$ or equivalent OR* *$26000 \times 1.8 \times 3.05$ or equivalent if 9.15 used* *= 144 300 (gallons) AND a statement e.g.* *'quicker to pump 143 000 (gallons)'*	*M2* *A2*	*A table method altering all 3 at the same time is M0* *Allow use of 9.15 for 9.25 for M marks only* *M1 for the correct use of 26(000) with either 9/5 or 9.25/3* *e.g. Gallons 46800 Engines 9 Time 3* *OR 80166.6.. 5 9.25* *OR 79300 5 9.15 (using 9.15)* *CAO* *A1 for 144 300 (gallons) without a correct statement* *OR* *A1 for 'their 144300' from premature approximation with a correct statement*
Alternative method 3: *$\frac{26\,000}{5 \times 3}$ AND $\frac{143\,000}{9 \times 9.25}$* *= 1733.3(3…) (galls/engine/min) AND = 1717.7… (galls/engine/min) AND* *Statement e.g.* *'last week's rate was quicker'*	*M2* *A2*	*M1 for 1 correct calculation* *Allow use of 9.15 for 9.25 for M marks only* *Must come from M2* *A1 for 2 correct rates without a correct statement OR* *A1 for 1 correct rate with a correct statement*

8(b) Valid reason e.g. 'Engines may not deliver water at the same rate' or 'May not have enough water available', or 'Not enough room for 9 engines', or 'Not enough water pressure available', or 'They may not be able to work for that long', or 'One (or more) of the engines may be faulty'	E1	Ignore additional spurious comments Do not allow e.g. 'The fire may have gone out'

9. (Area factor =) 1.96 or equivalent OR 100/196 (Scale factor =) $\sqrt{1.96}$ (= 1.4) or equivalent OR $\sqrt{100/196}$ (Height of larger flag =) $40 \times \sqrt{1.96}$ or 40×1.4 OR $40 \div \sqrt{100/196}$ = 56 (cm)	 B1 B1 M1 A1	Use of an area factor of 96 or 0.96 can at most be awarded B0B1M1A0 on FT Sight of 1.96 is sufficient for this B1 mark Note: 100/196 = 0.51(02…) FT 'their 1.96' for values of 96 or 0.96 only Note: $\sqrt{100/196}$ = 0.71(42…) CAO
10(a) (£) 2000×1.0095^2 or equivalent	B1	(£)19 added followed by (£)19.18(05)
10(b) (£)3000×1.0102^n 3000×1.0102^{18} (= (£)3601.(25…) OR 1.0102^{18} (=1.2004) 54 (months) OR 4 years 6 months (Date =) 30th June or 1st July, 2021	B1 M1 A1 A1	e.g. $3000 \times 1.0102 = 3030.6(0)$ Allow $3000 \times 1{\cdot}0102^{17}$(=(£)3564.(89…)) with convincing work that (£)3600 will be reached in 3 months' time. ISW on 54 (months). May be implied CAO. Allow 31st June, 2021 This A1 implies the previous A1
11(a) (Area ABC =) $\frac{1}{2} \times 155 \times 170 \times \sin 107(^\circ)$ OR (Area ACD =) $\frac{1}{2} \times 164 \times 190 \times \sin 94.9(^\circ)$ Area ABC = 12 599(…) or 12 600 (m^2) AND Area ACD = 15 523(…) (m^2)	M1 A2	 ISW A1 for each correct area
11(b) Strategy of finding DF and using it in the cosine rule to find AF (AF =) $\sqrt{(164^2+(190-17.9)^2-2\times164\times(190-17.9)\times\cos 94.9(^\circ))}$ (= $\sqrt{61336.(09…)}$) = 247.6(…) or 247.7 or 248 (m) 84 (posts needed)	S1 M2 A1 B1	 Allow use of 18 instead of 17.9 AND/OR 95 instead of 94.9 for M2 only M1 for (AF^2 =) $164^2 + (190-17.9)^2 - 2\times164\times(190-17.9)\times\cos 94.9(^\circ)$ (AF^2 = 61336.09…) OR M1 for use of 190 instead of (190–17.9) CAO. Can only be awarded if (190–17.9 =) 172.1 and 94.9 used in the cosine rule FT 'their derived 247.6(…)' ÷ 3 (rounded up) + 1 provided rounding required OR FT 'their derived 247.6(…)' ÷ 3 (rounded down) + 2 provided rounding required

12(a)	0.002	B1	
12(b) (M =) $\frac{0.002 \times 135\,000}{1 - (1 + 0.002)^{-12 \times 30}}$		M2	FT from (a) M1 for one error in substitution OR for 1 slip in the formula, but 'their 0.002' must be correctly substituted The use of 25 instead of 30 is M0 as this is a check for the monthly payments for 25 years
	= (£) 526.42(08…)	A1	ISW FT from M2 only Rate of 0.24 leads to (£) 32 400 Rate of 0.024 leads to (£) 3240.63(4…) Rate of 0.00002 leads to (£) 376.35(5…) Rate of 0.2 leads to (£) 27 000
526.42 × 360 – 598.86 × 300		M1	(£)189511.2(0) – (£)179658 FT 'their (£)526.42'
	= (£) 9853.2(0)	A1	Only FT provided their answer > 0 Allow the following Use of unrounded 526.42(0..) leads to (£)9853.50(4..) Use of unrounded 526.42(0…) AND 598.85(6…) leads to (£)9854.61(5…)