GCSE MARKING SCHEME

SUMMER 2022

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

INTRODUCTION

This marking scheme was used by WJEC for the 2022 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

SUMMER 2022 MARKING SCHEME

Unit 2: Higher Tier	Mark	Comments
1(a)(i) $100 \le x < 150$	B1	
1(a)(ii) Midpoints 40, 70, 90, 125, 175 40×4 + 70×8 + 90×11 + 125×12 + 175×17 (= 160 + 560 + 990 + 1500 + 2975 = 6185) ÷ 52 118.9(4..miles) or 119 (miles)	B1 M1 m1 A1	Check the table FT 'their midpoints' provided at least 4 lie within the appropriate group, including bounds throughout
1(b) (Number of miles next month is) 440 × 1.12 (Increased cost of fuel is) 1.3(0) × 1.1(0) (Number of miles next month is) 492.8 (miles) **AND** (Increased cost per litre of fuel is) (£) 1.43 (Cost of fuel next month is) $\frac{440 \times 1.12}{11} \times 1.3(0) \times 1.1(0)$ or $\frac{492.8}{11} \times 1.43$ (£) 64.06(4)	M1 M1 A1 m1 A1	Or equivalent, e.g. 440 + 440 × 12 ÷ 100 (=440 + 52.80 = 492.80) Penalise, A0, if prematurely approximated in further working, but FT for possible final A1 Penalise any premature approximation in the 1st A0 FT provided M1, M1 previously awarded ISW. *Allow an answer of (£)64.1(0) or (£)65* *Allow correctly evaluated answers from correct working which may include premature rounding or truncation, e.g. (£)64 to (£)64.10, (£)64.35*
1(b) Alternative method 1 *(Cost of fuel last month) 1.3(0) × 440 ÷ 11* *or 1.3(0) × 40* *(£) 52* *(Cost of fuel next month) 52 × 1.1(0) × 1.12* *(£) 64.06(4)*	*M1* *A1* *m2* *A1*	 *May be implied in further working* *Penalise, A0, if prematurely approximated in further working, but FT for possible final A1* *FT 'their 1.3(0) × 440 ÷ 11'* *m1 for one of the following:* • *52 × 1.1(0) (= 57.20)* • *52 × 1.12 (= 58.24)* *ISW. Allow an answer of (£)64.1(0) or (£)65* *FT only m2, no FT from m1.* *Allow correctly evaluated answers from correct working which may include premature rounding or truncation, e.g. (£)63.84, (£)64.02*

1(b) <u>Alternative method 2</u> *(Fuel next month) 1.12 × 440 ÷ 11* *or 1.12 × 40*	*M1*	
44.8 (litres)	*A1*	*May be implied in further working* *Penalise, A0, if prematurely approximated in further working, but FT for possible final A1*
(Cost of fuel next month) 44.8 × 1.3(0) × 1.1(0)	*m2*	*FT 'their 1.12 × 440 ÷ 11'* *m1 for one of the following:* • *44.8 × 1.3(0) (= 58.24)* • *44.8 × 1.1(0) (= 49.28)*
(£) 64.06(4)	*A1*	*ISW. Allow an answer of (£)64.1(0) or (£)65* *FT only m2, no FT from m1.* *Allow correctly evaluated answers from correct working which may include premature rounding or truncation, e.g. (£)63.84, (£)64.02*
1(b) <u>Alternative method 3</u> *(Cost of fuel next month)* $\frac{440 \times 1.12}{11} \times 1.3(0) \times 1.1(0)$	*M4*	***Must be** shown as one complete calculation to be followed by a final answer*
(£) 64.06(4)	*A1*	*ISW. Allow an answer of (£)64.1(0) or (£)65*
2(a) $\frac{114}{1.45}$ or $114 \div (87/60)$ or $114 \times \frac{60}{87}$ or equivalent	M2	M1 for one of the following: • idea of distance/time, e.g. 114/1.27, 114/87, 114/5220, 114/1hr 27 minutes, including approximated as 114/1.5, may be implied by answers to these calculations (see note) provided not from incorrect working • sight of 1.45 (hours)
78.6(2…) (km/h)	A1	Accept 79 (km/h) provided not from incorrect working Do not FT from M1
2(b) (Conversion to Japanese yen) 800 × 135.72	M1	
108 576 (Japanese yen)	A1	
(Can buy) 108 000 (Japanese yen)	B1	Allow for an equivalent amount given using the notes available, e.g. 21 5000 (yen) **and** 3 1000 (yen), or equivalent using only 5000 and 1000 yen notes FT 'their derived 108 576' provided evidence of rounding down to nearest 1000
(Cost in pounds is) 108 000 ÷ 135.72 or (800 –) 576 ÷ 135.72	M1	FT 'their derived 108 576' and 'their derived 108 000' provided 'their 108 000' in whole number of 1000s (including from rounding 108 576 up)
(£) 795.76	A1	ISW. Allow (£)795.75 Allow on FT rounded or truncated to a penny

2(c) (Number of 0-to-64-year olds) 0.75×270400 or $270400 - 0.25 \times 270400$ 202800 (Number of 0-to-14-year olds) $9 \times 202800 \div (9+41)$ or 9×4056 36504	M1 A1 M1 A1	 May be implied in further working FT 'their derived 202800', not 270400
2(c) <u>Alternative method 1</u> *(Proportion)* $9 \times 270400 \div (9+41)$ *48672* *(Number of 0-to 14-year olds)* 0.75×48672 *or* $48672 - 0.25 \times 48672$ *or* $48672 - 12168$ *36504*	 *M1* *A1* *M1* *A1*	 *May be implied in further working* *FT 'their derived 48672', not 270400*
2(c) <u>Alternative method 2</u> *(Overall ratio)* $(9 : 41 :)\ \dfrac{9 + 41}{3}$ $(9 : 41 :)$ *16.66666....* *(Number of 0-to 14-year olds)* $9 \times 270400 \div (9+41 + \tfrac{1}{3}(9 + 41))$ *36504*	 *M1* *A1* *M1* *A1*	 *Allow 16.6(...) or 16.7* *May be implied in further working* *FT 'their* $\tfrac{1}{3}(9 + 41)$*'* *Do not FT from rounding or truncation of 50/3*

3. (Let x be the initial angle of lean) (Let y be the final angle of lean) sin x = 30/110 sin y = 60/110 (x =) $\sin^{-1}$(30/110) or (x =) $\sin^{-1}$ 0.2727... OR (y =) $\sin^{-1}$(60/110) or (y =) $\sin^{-1}$ 0.5454... 15.8266...(°) **AND** 33.0557....(°) (and statement or calculation to show 33.0557....(°) > 2 × 15.8266...(°))	 M1 M1 M1 A2	 Allow M marks for • same variable is used for both angles of lean • an appropriate statement of the sine rule, e.g. 30/sin x = 110/sin 90 or sin y/60 = sin 90/110 Also implies appropriate previous M1 Accept rounded or truncated angles for A2 or A1 A1 for 15.8266...(°) or 33.0557....(°)
<u>3. Alternative method 1</u> *(To find initial angle of lean)* *Sin x = 30/110* *(x =) $\sin^{-1}$(30/110) or (x =) $\sin^{-1}$ 0.2727...* *(x =) 15.8266...(°)* *(To find horizontal lean if angle of lean was doubled)* *sin ((2 × 15.8266...(°)) = horizontal lean/110 or* *(Horizontal lean =) 110 × Sin (2 × 15.8266...(°))* *57.725 (cm) (and statement that < 60 cm)*	 *M1* *M1* *A1* *M1* *A1*	 *Allow for an appropriate statement of the sine rule, 30/sin x = 110/sin 90 or sin x/30 = sin 90/110* *Also implies previous M1* *Accept rounded or truncated angles* *FT rounded or truncated double 'their derived 15.8266...(°)'* *FT answer must be < 60 (cm)*
<u>3. Alternative method 2</u> *(To find final angle of lean)* *Sin y = 60/110* *(y =) $\sin^{-1}$(60/110) or (y =) $\sin^{-1}$0.5454…* *(y =) 33.0557...(°)* *(To find horizontal lean if angle of lean was halved)* *sin (1/2 × 33.0557...(°)) = horizontal lean/110 or* *(Horizontal lean =) 110 × Sin(1/2 × 33.0557...(°))* *31.29…(cm) (and statement that > 30 cm)*	 *M1* *M1* *A1* *M1* *A1*	 *Allow for an appropriate statement of the sine rule, 60/sin y = 110/sin 90 or sin y/60 = sin 90/110* *Also implies previous M1* *Accept rounded or truncated angles* *FT rounded or truncated ½ 'their derived 33.0557...(°)* *FT answer must be > 30 (cm)*
Organisation and communication Writing	OC1 W1	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.

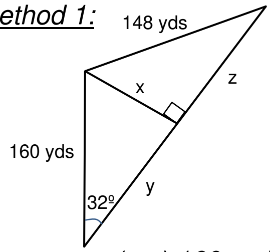
4. (80 litres = 80 000 cm^3) 80 000 = $\pi \times 36^2 \times$ height or equivalent	M2	May be shown in stages, but place value must be correct for the award of M2 M1 for sight of any 1 of the following: • (80 litres =) 80 000 (cm^3) • $\pi \times 36^2$ ($\times$ height) • sight of $\pi \times 36^2$ ($\approx$ 4069 to 4072) • sight of ($\pi \times 36^2 \approx$) 4069 to 4072 • 80 000 = $\pi \times 36^2 \times$ height with place value errors with digits 8 and/or 36 Allow for sight of $\pi \times 36^2$ or 80 000 (cm^3) even if embedded, contradicted in further working or not used
(Height =) $\dfrac{80\,000}{\pi \times 36^2}$ or equivalent	m1	For a correct rearrangement, provided the denominator is a multiple of π Allow if the intended calculation includes a place value error with digits 8 and/or 36 Also possible FT from M1
Answers in the range 19.6 to 19.7 (cm)	A1	CAO, must be in centimetres Accept 20(cm) from correct working
5. (Income taxed at Basic rate) 2400 × 100 ÷ 20 or 2400 ÷ 0.2 or 2400 × 5 or equivalent	M1	May be seen in stages Allow for sight of, e.g. • 10% of 12000 • 12000 × 0.8 = 9600
12000 (dollars)	A1	Allow an embedded answer e.g.12000 × 0.2 = 2400 Accept if found by trial and improvement or reverse working for M1 A1, e.g. • 10% of 12000 = 1200 with an answer 12000 • 12000 × 0.8 = 9600 with an embedded answer 12000 – 9600 = 2400 Allow M1 A1 for a final answer of 12000, provided not from incorrect working.
(Khalida's income) 12000 + 5000	M1	FT their derived 12000' provided 2400 < 'their 12000' < 20000, i.e. 'their income taxed at Basic rate' + 5000
17000 (dollars)	A1	Mark final answer. The answer given in the answer space takes precedence.

6.		M marks may be awarded from working with multiples of e.g. 77.5 and/or 97.5 to reach e.g. 5750
$\frac{5750}{97.5 - 20}$ or $\frac{5750}{77.5}$	M3	M2 for $\frac{\text{length}}{\text{width} - 20}$, where $5700 < \text{length} \le 5800$ and $95 \le \text{width} < 100$ M1 for $\frac{5750}{97.5}$
$- \frac{97.5}{97.5 - 20}$ or $- \frac{97.5}{77.5}$ $\left(\textit{May be seen as } \frac{5750 - 97.5}{97.5 - 20} \textit{ or } \frac{5652.5}{77.5}\right)$	m1	FT from M2 for 'their 97.5'
= 72.9(3…) or 73	A1	FT is possible from m0 provided M3 or M2 previously awarded From M3, 5750 ÷ 77.5 = 74.19(3…) rounded down to 74 (boards) is awarded M3m0A1 unless further correct working seen
(Number of boards needed =) 74 (boards)	A1	FT from M2m1A1 for a correct evaluation using their bounds, rounded up and +1 If no marks awarded, and from a misinterpretation of the question, SC4 for an **answer of 69 boards** from $\frac{5650}{102.5 - 20} - \frac{102.5}{102.5 - 20} + 1$ or $\frac{5547.5}{82.5} + 1$ OR SC3 for an **answer of 67(.242…) or 68** from $\frac{5650}{102.5 - 20} - \frac{102.5}{102.5 - 20}$ or $\frac{5547.5}{82.5}$ OR SC2 for a correct evaluation (rounded, truncated or unrounded) of the calculation $\frac{\text{length} - \text{width}}{\text{width} - 20}$, where $5600 \le \text{length} < 5700$ and $100 < \text{width} \le 105$ OR SC1 for an **answer of 68(.484…) or 69 boards** from $\frac{5650}{102.5 - 20}$ or $\frac{5650}{82.5}$ OR If no marks awarded, SC1 for sight of 97.5 and 5750

6. Alternative method: $\frac{5750}{97.5-20}$ or $\frac{5750}{77.5}$ $-\frac{20}{97.5-20}$ or $-\frac{20}{77.5}$ $\left(May\ be\ seen\ as\ \frac{5750-20}{97.5-20}\quad or\quad \frac{5730}{77.5}\right)$ *(Number of boards needed =) 74 (boards)*	M3 m1 A2	*M marks may be awarded from working with multiples of e.g. 77.5 and/or 97.5 to reach e.g. 5750* *M2 for* $\frac{length}{width-20}$, *where* $5700 < length \le 5800$ *and* $95 \le width < 100$ *M1 for* $\frac{5750}{97.5}$ *FT from M2 for 'their 97.5'* *FT from M2m1 for a correct evaluation using their bounds, rounded up* *A1 for 73(.9354…)* OR *A1 on FT from M3m0 for 74.19(3…) or 75* *An answer of 74.19(3…) rounded down to 74 (boards) is awarded M3m0A1 unless further correct working seen* OR *A1 on FT from M2m1 for an unrounded correct evaluation using their bounds* *If no marks awarded, and from a misinterpretation of the question* *SC4 for an* ***answer of 69 boards*** *from* $\frac{5650}{102.5-20} - \frac{20}{102.5-20}$ or $\frac{5630}{82.5}$ OR *SC3 for an* ***answer of 68(.2424…) boards*** *from* $\frac{5650}{102.5-20} - \frac{20}{102.5-20}$ or $\frac{5630}{82.5}$ OR *SC2 for a correct evaluation (rounded, truncated or unrounded) of the calculation* $\frac{length-20}{width-20}$, *where* $5600 \le length < 5700$ *and* $100 < width \le 105$ OR *SC1 for an* ***answer of 68(.484…) or 69 boards*** *from* $\frac{5650}{102.5-20}$ or $\frac{5650}{82.5}$ OR *If no marks awarded,* *SC1 for sight of 97.5 AND 5750*

7. Strategy of using trigonometry to find DB (or DC) followed by Pythagoras to find AB (or AC)	S1	Or equivalent full method
(DB =) $\frac{3.5}{\cos 65}$ OR (DB =) $\frac{7 \times \sin 65}{\sin 50}$	M2	Or a complete method to find DB using the vertical height of the triangle and Pythagoras M1 for $\cos 65 = \frac{3.5}{DB}$ OR $\frac{DB}{\sin 65} = \frac{7}{\sin 50}$ or equivalent
= 8.28(1…) or 8.3 (cm)	A1	CAO Award A0 but FT if e.g. 8 or 8.2 used in next step
(AB^2 =) $13^2 + 8.28(1…)^2$	M1	FT 'their 8.28(1…)' provided trigonometry attempted to find DB
AB^2 = 237.58(6…) or 237.6 OR (AB =) $\sqrt{237.58(6...)}$ or $\sqrt{237.6}$ or 15.4(138…) (cm)	A1	FT for similar accuracy Note: use of DB = 8.2 leads to AB^2 = 236.24 OR AB = $\sqrt{236.24}$ or 15.37(01…) use of DB = 8.3 leads to AB^2 = 237.89 OR AB = $\sqrt{237.89}$ or 15.4(236…)
(Length of tear strip needed =) 37.8(2…) or 37.83 or 38 (cm)	B1	FT the correct evaluation of 'their $\sqrt{237.58(6...)}$' × 2 + 7 provided previous M1 awarded Note: use of DB = 8.2 leads to an answer of 37.7(40…cm) use of DB = 8.3 leads to an answer of 37.8(47…cm)
7. Alternative method: *Strategy of using trigonometry to find the vertical height of the triangle followed by 3-D Pythagoras*	*S1*	*Or equivalent full method*
(h =) 3.5 × tan65 OR (h =) $\frac{3.5 \times \sin 65}{\sin 25}$	*M2*	*M1 for* $\tan 65 = \frac{h}{3.5}$ *OR* $\frac{h}{\sin 65} = \frac{3.5}{\sin 25}$ *or equivalent*
= 7.5(057…) (cm)	*A1*	*CAO* *Award A0 but FT if e.g. 7 or 8 used in next step*
(AB^2 *=)* $7.5(057…)^2 + 3.5^2 + 13^2$	*M1*	*FT 'their 7.5(057…)' provided trigonometry attempted to find h*
AB^2 = 237.58(6…) or 237.6 OR *(AB =)* $\sqrt{237.58(6...)}$ *or* $\sqrt{237.6}$ or 15.4(138…) (cm)	*A1*	*FT for similar accuracy*
(Length of tear strip needed =) *37.8(2…) or 37.83 or 38 (cm)*	*B1*	*FT the correct evaluation of* 'their $\sqrt{237.58(6...)}$' × 2 + 7 provided previous M1 awarded

8. (£)850 × 1.0048^n 850 × 1.0048^{34} (= (£)1000.(29…) OR 1.0048^{34} (=1.1768…) 34 (months) OR 2 years 10 months (Date =) 31st October or 1st November 2024	B1 M1 A1 A1	e.g. 850 × 1.0048 = (£)854.08 CAO May be implied by (850 × 1.0048^{34} =) (£)1000.(29…) Allow 30th October A correct answer of 31st October or 1st November 2024 implies the previous A1 If no marks awarded, SC1 for a date of 31st March or 1st April 2050 from using a multiplier of 1.00048
9(a) Sight of $\sqrt{2.25}$ OR Area scale factor = 1.5^2 OR Area scale factor = 2.25 AND scale factor = 1.5 (Height =) 12 ÷ $\sqrt{2.25}$ or 12 ÷ 1.5 or 12 × 2/3 = 8 (cm)	M1 m1 A1	 Must be from convincing working
9(b) (Base area of large can =) 144 ÷ 8 × 2.25 or 18 × 2.25 = 40.5 (cm^2)	M1 A1	Note: 2.25 could be written as 1.5^2
9(b) Alternative method 1: *(Base area of large can =)* *144 ×* $\sqrt{2.25}^3$ *÷ 12 or 144 ×* 1.5^3 *÷ 12* *= 40.5 (cm^2)*	*M1* *A1*	
9(b) Alternative method 2: *(Radius of large can =)* $\sqrt{\frac{144}{8\times\pi}} \times \sqrt{2.25}$ *or* $\sqrt{\frac{18}{\pi}} \times 1.5$ *(=3.59 to 3.592)* *(Base area of large can =) 40.5 (cm^2)*	*M1* *A1*	 *From* $\pi \times (\sqrt{\frac{18}{\pi}} \times 1.5)^2$
10(a) Sight of (2 ×) $\frac{x}{360}$ × 2 × **π** × 160 or equivalent (x =) $\frac{65 \div 2 \times 360}{2 \times \pi \times 160}$ or equivalent = 11.6 (º)	B1 M1 A2	 Allow for sight of $\frac{65 \times 360}{2 \times \pi \times 160}$ or equivalent CAO A1 for 11.6366… to 11.6441… or 585/16**π** OR A1 for a final answer of 23.3(º) from failing to halve their sector angle If no marks awarded, SC1 for a final answer of 23.3(º) from use of diameter 160 cm and halving their sector angle

10(b) (Angle at hole =) $\sin^{-1}\left(\frac{\sin 32}{148} \times 160\right)$	M2	M1 for $\frac{\sin(\text{Angle at hole})}{160} = \frac{\sin 32}{148}$ or equivalent
(Angle at hole =) 34.9(5…) or 35 (º)	A1	CAO
(3rd Angle = 180–32–34.9(5…) =) 113(.048…) (º)	B1	FT 180 – 32 – 'their 34.9(5…)' provided sine rule attempted
(Length of single shot =) $\frac{148}{\sin 32} \times \sin 113(.048…)$ OR	M2	FT 'their derived 113.04(8…)' provided it is clearly their 3rd angle for any of the 3 possible methods M1 for $\frac{\text{single shot}}{\sin 113(.048…)} = \frac{148}{\sin 32}$ or equivalent OR
$\frac{160}{\sin 34.9(5…)} \times \sin 113(.048…)$ OR		FT 'their derived 34.9(5…)' provided it is clearly their angle at the hole M1 for $\frac{\text{single shot}}{\sin 113(.048…)} = \frac{160}{\sin 34.9(5…)}$ or equivalent OR
$\sqrt{148^2 + 160^2 - 2 \times 148 \times 160 \times \cos\ 113(.048\ …)}$		M1 for $\text{shot}^2 = 148^2+160^2-2\times148\times160\times\cos 113(.048…)$
$(= \sqrt{66045(.770\ …})$ = 256.7 to 257.1 (yards)	A1	
10(b) Alternative method 1:  		*Only award these marks if a clear intention made to split the triangle this way, and a full method attempted to find the length of the single shot* *Allow answers to be suitably rounded* *Only penalise the final A1 mark if their answer from using rounded values does not lie in the range given*
(x =) 160 × sin 32 *= 84.7(787…) or 84.8 (m)*	*M1* *A1*	
(y =) 160 × cos 32 OR $\sqrt{160^2 - 84.7(787\ …)^2}$	*M1*	*FT 'their 84.7(787…)' provided 1st M1 awarded*
= 135.6(876…) or 135.7 (m)	*A1*	
(z =) $\sqrt{148^2 - 84.7(787\ …)^2}$	*M1*	*Or a full alternative method* *FT 'their 84.7(787…)' provided 1st M1 awarded*
= 121.3(060…) (m)	*A1*	
(Length of shot = 135.6(876..) + 121.3(060…)=) *256.8 to 257.15 (yards)*	*A1*	*FT 'their 135.6(876…)' and 'their 121.3(060…)' provided M1M1M1 previously awarded and at least one A1 previously awarded*

10(b) Alternative method 2: *Strategy to form a quadratic equation and solve*	*S1*	
$148^2 = 160^2 + shot^2 - 2 \times 160 \times shot \times cos32$	*M1*	
$Shot^2 - 320cos32 \times shot + 3696 = 0$	*A1*	*Note: 320cos32 = 271.375…*
(Shot =) $\dfrac{271.375\ldots \pm \sqrt{271.375^2 - 4 \times 1 \times 3696}}{2 \times 1}$	*M1*	*FT 'their 320cos32'* *Must be seen*
(Shot =) $\dfrac{271.375\ldots \pm \sqrt{58860.60272}}{2}$	*A1*	
(Shot =) 256.99… or 257 (m) (or 14.38… (m))	*A2*	*Implies previous A1* *A1 if 256.99… clearly not identified as being their answer*