GCSE MARKING SCHEME

AUTUMN 2021

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

INTRODUCTION

This marking scheme was used by WJEC for the 2021 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 2021 MARK SCHEME

Unit 2: Higher Tier	Mark	Comments
1. (Height) 1.18 × 1.5 or equivalent	M1	
1.77(m)	A1	CAO. Ignore any units given
(Area of skin) 1.9(m²)	A1	CAO. Ignore any units given
2(a) 37 + 34 + 20 + 28 + 21	M1	Allow M1 for • any 4 of the 5 readings correct in a sum of 5 non-zero readings, or • for a total (≠140 but) 140 ± 2 • total of 140 seen with further working with 'their' final answer ≠ 140
140 (students)	A1	Mark final answer
2(b) 10 (seconds) to 15 (seconds)	B2	Allow if considering the 0.5(n+1)th term throughout FT 'their 140' provided 'their 140' > 100 throughout Not from incorrect working Allow for an inclusive or exclusive range of times B1 for any of the following: • appropriate sight of 70 or 140 ÷ 2 • the answer 12.5 seconds
2(c) Selects or unambiguously implies '**Yes**' with a reason, e.g. 'no students in group 30 to 35 seconds', 'last students started in 25 to 30 second range'	E1	Allow the term 'finished' as meaning 'finished starting the task', e.g. 'Yes' with 'no student finished after 30 seconds' Allow, 'yes' with a reason, e.g. 'all students started before 30 seconds', 'data stopped after 30 seconds', 'no students in the last group' Allow selection of 'Can't tell' with a reason based on thinking 30 seconds may be included in the group 25 to 30, so some students could have taken exactly 30 seconds to start and not started within 30 seconds, that is thinking 'within 30 seconds' does not include '30 seconds' Do not accept 'Yes' with a reason, e.g. 'no students after 27.5 seconds', 'all students between 27.5 and 32.5 seconds could start within 30 seconds'

2(d) $\frac{37}{140}$ (× 100)   or   0.25 × 140
 	
    or   0.25 × (37 + 34 + 20 + 28 + 21)
 	
    or $\frac{37}{37 + 34 + 20 + 28 + 21}$ (× 100)
	M1	FT 'their derived 140' from (a) provided >100 with numerator 37 or 'their 37' if seen in (a)

26(.42...%) or 35 (students) AND '**No**' indicated	A1	Accept 0.26(...) only if 0.25 is seen

3. (To spend on $)   OR   (Convert to $)
    13/20 × 500   500 × 1.36
     = (£) 325   = ($) 680
	M1
	
	A1
		May be embedded in further calculation

(Buying $) 13/20 × 500 × 1.36 ($) 442	M1 A1	FT 'their incorrectly evaluated 13/20 × 500'
(As lowest note $5 can only buy) ($) 440	B1	Allow equivalent given unambiguously in possible notes FT 'their derived 442' rounded down to the nearest multiple of 5 If ($)442 in the answer space, only award if clearly showing 'buying $440'

(This will cost) 440 ÷ 1.36
          or   13/20 × 500 – (442 – 440) ÷ 1.36
          or   325   –   2 ÷ 1.36
 	
                      (£) 323.53 or (£)323.52(9…)
	M1
	
	A1
		FT 'their derived 442' and 'their derived 440' provided it is a multiple of 5

(Money left to buy euros 500 – 323.53) (£)176.47	A1	FT provided to the nearest penny Do not FT from incorrect rounding of 'their £323.52(9…)' Note: 500 – 323.52 = (£)176.48 is A0 *If unambiguous and clear correct response seen in working, ignore a slip in transferring (£)176.47 to the answer space.* *Ignore answers reversed in the answer space*

3. Alternative method:
   (To spend on $)   OR   (Convert to $)
     13/20 × 500   500 × 1.36
      = (£) 325   = ($) 680
	M1
	
	A1
		May be embedded in further calculation

(Buying $) 13/20 × 500 × 1.36 *($) 442*	*M1* *A1*	FT 'their incorrectly evaluated 13/20 × 500'
(As lowest note $5 can only buy) ($) 440	*B1*	Allow equivalent given unambiguously in possible notes *FT 'their derived 442' rounded down to the nearest multiple of 5* *May be implied by use of $2*
($2 is worth) (442 – 440) ÷ 1.36 or 2 ÷ 1.36 *(£) 1.47(05..)*	*M1* *A1*	FT 'their derived 442' and 'their derived 440' provided it is a multiple of 5
(Money left to buy euros 500 – 325 + 1.47) (£)176.47	*A1*	*FT provided to the nearest penny* *Do not FT from incorrect rounding of 'their £1.47(05...)'* *If unambiguous and clear correct response seen in working, ignore a slip in transferring (£)176.47 to the answer space.* *Ignore answers reversed in the answer space*

4. (Volume of a jug) π × 5² × 28	M1	
Answer in the range 2198 (cm³) to 2200 (cm³)	A1	May be implied in further working
or 700π (cm³)		
(Number of jugs needed) 170 × 80 ÷ 2199.(...)	M1	FT 'their derived volume of a jug' provided
		> 'their 170 × 80' ÷10
6.1(84… jugs) or 6.2 (jugs) or 6 (jugs)	A1	
3 (full jugs left over)	A1	FT 10 – 'their 6.18…' (depends on previous M1)
		Note: For final M and A marks, allow if found from listing the capacity of a number of jugs
4. Alternative method 1:		
(Volume of 10 jugs) 10 × π × 5² × 28	*M1*	
Answer in the range 21980 (cm³) to 22000 (cm³)	*A1*	*May be implied in further working*
or 7000π (cm³)		
(Volume left over = volume 10 jugs – 80 servings)	*M1*	*(= 21980 – 13600)*
= 10 × π × 5² × 28 – 80 × 170		*FT 'their derived volume of 10 jugs' provided*
		> 'their 170 × 80'
		(Note: Correct answer is the range 8380 to 8394 cm³)
(Number of jugs left over) 8380 ÷ 2199.(...)	*m1*	*(= 3.81...)*
		FT 'their derived volume of 10 jugs' provided
		> 'their 170 × 80'
3 (full jugs left over)	*A1*	*Note: For final M and A marks, allow if found from listing the capacity of a number of jugs*
4. Alternative method 2:		
(Volume of a jug) π × 5² × 28	*M1*	
Answer in the range 2198 (cm³) to 2200 (cm³)	*A1*	*May be implied in further working*
or 700π (cm³)		
(Number of jugs left over) 10 – 80 ÷ (2199.(..) ÷ 170)	*M2*	*FT 'their derived volume of a jug' provided*
(= 10 – 80 ÷ 12.935...)		*> 'their 170 × 80' ÷10*
		M1 for sight of
		80 ÷ (2199.(..) ÷ 170) (=6.1(84...))
3 (full jugs left over)	*A1*	*Do not allow A1 from truncation of 12.9(...) to 12*
4. Alternative method 3:		
(Volume of 10 jugs) 10 × π × 5² × 28	*M1*	
Answer in the range 21980 (cm³) to 22000 (cm³)	*A1*	*May be implied in further working*
or 7000π (cm³)		
(Number of glasses not needed)	*M1*	*(= 21980 ÷ 170 – 80 = 49.29...)*
10 × π × 5² × 28 ÷ 170 – 80		*FT 'their derived volume of 10 jugs' > 'their 170 × 80'*
(Number of jugs left over)	*m1*	*(= 3.81...)*
49.29... ÷ (2199.(...)÷170)		*FT 'their 10 × π × 5² × 28 ÷ 170 – 80'*
or 49.29.... ÷ 12.9...		
3 (full jugs left over)	*A1*	*Do not allow A1 from truncation of 12.9(...) to 12*
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.

5(a) (Length² =) 4.2² + 1.1²	M1	Or alternative **full** method
Length² = 18.85 or (Length =) √18.85	A1	
(Length) 4.3(416…m)	A1	FT from M1, A0 for the correctly evaluated square root of 'their 18.85' provided 'their answer' > 4.2 (m) If 4.3(4...) not seen, this A1 may be implied by the sight of choice of panel 4.4(m) Do not accept an unsupported answer of 4.3 (m)
Selects 4.4 m length	A1	May be implied by use of £24 in further working FT where possible the length immediately > 'their 4.3416...' provided M1 previously awarded and 'their 4.3416...' has not been rounded down or truncated to give a different length from the table
(Number of panels needed is) 7 (panels)	B1	Allow B1 for 8 (panels) (thinking overlap may be as much as approximately ¼ of the width of a panel) Do not award B1 for 7 or 8 panels if incorrect logic from misinterpretation seen, e.g. working with area 26.05m² so buy 7 of the 4.1m panels with area 28.7m²
(Cost of the shelter roof £24 × 7) (£) 168	B1	FT provided B1 previously awarded FT 'their derived 4.4' provided > 4.2 m $\begin{array}{\|c\|c\|c\|} \hline 4.3 \text{ m} & 23 \times 7 & (£)161 \\ \hline 4.5 \text{ m} & 25 \times 7 & (£)175 \\ \hline 4.6 \text{ m} & 26 \times 7 & (£)182 \\ \hline \end{array}$ Allow for 8 panels: $\begin{array}{\|c\|c\|c\|} \hline 4.3 \text{ m} & 23 \times 8 & (£)184 \\ \hline \mathbf{4.4 \text{ m}} & \mathbf{24 \times 8} & \mathbf{(£)192} \\ \hline 4.5 \text{ m} & 25 \times 8 & (£)200 \\ \hline 4.6 \text{ m} & 26 \times 8 & (£)208 \\ \hline \end{array}$
5(b) tan angle between roof and wall = $\dfrac{4.2}{1.1}$	M1	Or alternative **full** method
75.3(°)	A3	Ignore incorrect units Must be to 3 significant figures A2 for 75.32(3…°) or 75(°) OR A1 for $\tan^{-1}\dfrac{4.2}{1.1}$ From an alternative full method, award A2 maximum for 'their accurate answer' with errors due to rounding or truncation in stages of working, if the final answer is given correct to 3 significant figures, or A1 otherwise *Note:* *Use of tan angle between roof and wall = 1.1/4.2 is awarded M0 A0* *If no marks, award SC1 for 'their derived angle' given correctly to 3 significant figures* *(tan⁻¹ 1.1/4.2 = 14.7(°) to 3 significant figures)*

6(a) (Arc length =) $\dfrac{145}{360} \times \pi \times 3 \times 2$ or equivalent
 	
                  $(= 29\pi/12$ or 7.58 to 7.6)
 	
       + 1.5 + 1.5 + 4 + 4
 	
                      = 18.58 to 18.6   (cm)
	M2
	
	m1
	
	A1
		M1 for $\dfrac{145}{360} \times \pi \times 3$ or equivalent
		
		                            $(= 29\pi/24$ or 3.79 to 3.8)
		
		FT from M1
		
		CAO. Accept an answer of $29\pi/12 + 11$
		Allow a final answer of 19 (cm) provided 18.58 to 18.6 seen

6(b)(i) (Area of sector =)
   $\dfrac{145}{360} \times \pi \times 1.5^2$ (×2)
                  $(=29\pi/16$ or 5.68 to 5.7)
 	
     +   4 × 1.5
 	
               = 11.6(9…)   (cm^2)
	M1
	
	m1
	
	A1
		$\dfrac{145}{360} \times \pi \times 1.5^2$ $(= 29\pi/32$ or 2.84(5…) to 2.85)
		
		CAO. Accept values in the range 11.68 to 11.7 (cm^2)
		Accept an answer of $29\pi/16 + 6$
		Allow a final answer of 11.6
		Allow a final answer of 12 (cm^2) provided 11.6 or values from 11.68 to 11.7 seen

6(b)(ii) $11.6(9…) \times 200^2$
             $\div 100^2$ or equivalent
                 = 46.7(765…)   (m^2)
	M1
	m1
	A1
		FT 'their 11.6(9…)' from (b)(i)
		
		Accept values in the range 46.7 to 46.8
		Accept an answer of $29\pi/4 + 24$
		Allow a final answer of 46.4 (from use of 11.6)
		Allow 47 (m^2) from correct working
		If no marks awarded, then 'their 11.6(9…)' × 4 with a place value error implies M1m0A0

6(b)(ii) Alternative method 1:
(Area of sector =)
   $\dfrac{145}{360} \times \pi \times 300^2$ *(×2)* + *800 × 300*
 	
        ÷ 100^2 *or equivalent*
            = 46.7(765…)   *(m^2)*
	M1
	
	m1
	A1
		$\dfrac{145}{360} \times \pi \times 300^2 \times 2 = 227650$ *to 227795*
		
		CAO. Accept values in the range 46.7 to 46.8
		Accept an answer of $29\pi/4 + 24$
		Allow 47 (m^2) from correct working

6(b)(ii) Alternative method 2:
(Area of sector =) $\dfrac{145}{360} \times \pi \times 3^2$ *(×2)*
 	
       + *8 × 3*
        = 46.7(765…)   *(m^2)*
	M1
	
	m1
	A1
		$\dfrac{145}{360} \times \pi \times 3^2 \times 2 = 22.765$ *to 22.8*
		
		CAO. Accept values in the range 46.7 to 46.8
		Accept an answer of $29\pi/4 + 24$
		Allow 47 (m^2) from correct working

6(c)
  (£)9.72
       ÷ 0.9   OR   ÷ 90 × 100   (=(£)10.8(0))
        ÷ 0.8   OR   ÷ 80 × 100
 	
                 = (£) 13.5(0)
	M1
	M1
	
	A1
		These M1 marks may be awarded in any order
		The intermediate answer if done in reverse order is (£)12.15
		OR M2 for $9.72 \div 0.72$
		CAO
		
		If no marks awarded,
		SC1 for an answer of (£)13.88 or (£)13.89
		(from $9.72 \div 0.7$)

7(a)	225º	B1	

7(b)(i) (AC =) $\sqrt{215^2 + 165^2 - 2 \times 215 \times 165 \times cos69(º)}$ $(= \sqrt{48023(.7 ...)}\,)$		M2	M1 for AC^2 = 215^2 + 165^2 − 2×215×165×cos69(º) or M1 for AC^2 = 48023(.7…)
= 219(.1…) (km)		A1	
(Average speed =) $\dfrac{219(.1…)}{0.5}$ or equivalent		M1	FT 'their 219(.1…)' provided sine/cosine rules attempted
= 438(·286…) (km/h)		A1	Ignore a subsequent attempt to convert units

7(b)(ii) (*BAC* =) $\sin^{-1}\left(\frac{sin69(º) \times 165}{219(.1…)}\right)$ or $\cos^{-1}\left(\frac{215^2 + 219(.1…)^2 - 165^2}{2 \times 215 \times 219(.1…)}\right)$		M2	FT 'their 219(.1…)' If their speed from (b)(i) is used for 'their 219(.1…)' then FT for a possible M2A0M0A0 only M1 for • $\frac{sinBAC}{165}$ = $\frac{sin69(º)}{219(.1…)}$ or $\frac{165}{sinBAC}$ = $\frac{219(.1…)}{sin69(º)}$ • sin*BAC* = $\left(\frac{sin69(º) \times 165}{219(.1…)}\right)$ or • 165^2 = 215^2+219(.1…)^2 − 2×215×219(.1…)×cosBAC or • cos*BAC* = $\left(\frac{215^2 + 219(.1…)^2 - 165^2}{2 \times 215 \times 219(.1…)}\right)$
= 44.6 to 44.7 (º) or 45 (º)		A1	
(Bearing =) 360 – (180 – 114 – 44.6(6…))' or 360 – (21.3(…) to 21.4)		M1	FT 'their derived 44.6(6…)' Or full alternative method starting with the calculation of ACB
= 339 (º)		A1	Allow 338.6(6…) to 338.7 (º)

7(b)(ii) Alternative method: *(ACB =)* $sin^{-1}\left(\frac{sin69(°) \times 215}{219(.1…)}\right)$ *or* $cos^{-1}\left(\frac{165^2 + 219(.1…)^2 - 215^2}{2 \times 165 \times 219(.1…)}\right)$		M2	*FT 'their 219(.1…)'.* *If their speed from (b)(i) is used for 'their 219(.1…)' then FT for a possible M2A0M0A0 only* *M1 for* • *$\frac{sinACB}{215}$ = $\frac{sin69(º)}{219(.1…)}$ or $\frac{215}{sinACB}$ = $\frac{219(.1…)}{sin69(º)}$* • *sinACB = $\left(\frac{sin69(°) \times 215}{219(.1…)}\right)$ or* • *215^2 = 165^2+219(.1…)^2 − 2×165×219(.1…)×cosACB or* • *cosACB = $\left(\frac{165^2 + 219(.1…)^2 - 215^2}{2 \times 165 \times 219(.1…)}\right)$*
= 66.3 to 66.43 (º) or 66 (º)		*A1*	
(Bearing =) 360 – (66.3(…) – (114 – 69)) *or 360 – (66.3(…) – 45)*		*M1*	*FT 'their derived 66.3(…)'* *Or full alternative method starting with the calculation of BAC*
= 339 (º)		*A1*	*Allow 338.6(6…) to 338.7 (º)*

8. (Difference in monthly payments =) $$\frac{0.0025 \times 17000}{1 - (1 + 0.0025)^{-48}} \ or \ \frac{0.0025 \times 17000}{1 - (1 + 0.0025)^{-60}}$$	M1	Each expression may be seen in stages
$=$ (£)376.28(…) or (£)305.46(7…)	A1	
$$\frac{0.0025 \times 17000}{1 - (1 + 0.0025)^{-48}} - \frac{0.0025 \times 17000}{1 - (1 + 0.0025)^{-60}}$$	M1	
$= $ (£)70.81	A1	Accept (£)70.82 or (£)70.815(8…) if accurate monthly payments used If no marks awarded, SC1 for a final answer of (£)0.08 or (£)0.09 or (£)0.088(2…) from using 0.25 instead of 0.0025 OR SC1 for a final answer of (£)62.09 or (£)62.094(…) from using 0.025 instead of 0.0025 OR SC1 for a final answer of (£)851.05 or (£)851.06 or (£)851.053(…) from using the correct rate with $n = 4$ and $n = 5$
9(a) (Hzntl distance from C to A =) 450 (cm)	B1	

$(AB =) \sqrt{400^2 + 450^2 + 480^2}$	M3	May be seen in stages
		FT 'their 450' provided < 600 AND provided not an underived 300 or 400 or 480
		
		M2 for
		• $\sqrt{400^2 + 'their\ 450'^2 + 480^2}$ where $600 \le$ 'their 450' < 1200 OR 'their 450' = an underived 300 or 400 or 480, or
		• $400^2 + 450^2 + 480^2$ with the same FT as for M3
		
		M1 (may be embedded in further working), with the same FT as for M3, for
		• $400^2 + 450^2$ OR $450^2 + 480^2$ OR $400^2 + 480^2$ or
		• $\sqrt{400^2 + 450^2}$ OR $\sqrt{450^2 + 480^2}$ OR $\sqrt{400^2 + 480^2}$
		  $(= \sqrt{362500})$ $(= \sqrt{432900})$ $(= \sqrt{390400})$
		  $(=602.0(7…))$ $(=657.9(5…))$ $(=624.8(1…))$

$(AB =)$ 770 (cm)	A1	CAO. Must be from $\sqrt{592900}$ Note: an answer of 770.0 (cm) is evidence of rounding an incorrect answer and is awarded A0
9(b) $2 \times 770 \div 45$ $(=34.222…)$ (Number of strips =) 35	M1 A1	FT 'their 770' from (a) Needs to be correctly rounded up If FT 'their 770', must come from doubling then rounding, not rounding then doubling Note: if $2 \times$ 'their 770' $\div 45$ results in an integer, then award M1A0