GCSE MARKING SCHEME

AUTUMN 2021

GCSE
MATHEMATICS – NUMERACY
UNIT 1 – HIGHER TIER
3310U50-1

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 1: Higher Tier	Mark	Comments
1(a) 20 000 ft³	B1	
1(b) 1.55 × 10⁸	B1	
2(a)(i) Explanation, e.g. 'data is grouped', 'not raw data', 'table only gives group information' '15 days with less than 6mm of rain, but we don't know if there was no rain on any of these days', 'only results between 0 – 6mm', 'doesn't give days of 0mm rain, it has 0 – 6mm'	E1	Allow, e.g. 'because it shows 0 ≤ r < 6 is equal to 15', 'doesn't say if the 15 belongs to 0 or to less than 6', 'the table doesn't give you exactly how many mm in the days' Do not accept, e.g. 'Can't tell' without further explanation as to why, 'doesn't give you enough information', 'it's not accurate enough', 'no column with daily rainfall with no rain option', 'table only shows daily rainfall, not the number of days without rain', 'doesn't show if it actually rained or not', 'no section for 0 rainfall', 'doesn't show a day in the table when there is no rain', 'doesn't say if the 15 belongs to 0 or to the 6' 'no record of the number of days it did not rain'

2(a)(ii) Mid points 3, 9, 15, 21
 	
 3×15 + 9×11 + 15×3 + 21×1
(45 + 99 + 45 + 21 = 210)
 	
                     ÷ 30
                                          7 (mm)
	B1
	
	M1
	
	m1
	A1
		Note: Check the table
		
		FT their midpoints provided they fall within the classes including both bounds.
		FT if 1 slip in one of 'their midpoints', used outside the tolerance of bounds for M1, m1 only
		
		FT from M1 for intention 'their 210'/30
		Following correct working
		On FT from incorrect mid points allow rounding or truncation of 'their final answer'

2(b)   25 × 4.4   (= 110)
                 ÷ 30
                       3.67 (mm)
	M1
	m1
	A2
		
		CAO
		A1 for 3⅔ (mm) or 3.6(66...mm) which allows 3.6(....), 3.7 (mm)
		Allow A1 for a correct FT from an error in calculating 25 × 4.4 provided rounding to give 3 significant figures required and correct (e.g. 25 × 4.4 as 120 leading to an answer of 4 is A0)

3.	For all methods		**If an evaluation is given with incorrect units, award A0 on the first occasion then FT**
3. (Cost to make 150 boxes) (150 ÷ 25) ÷ 2 or 6 × 50 or equivalent		M1	
(£)3 or 300(p)		A1	
(Cost of the chocolates) 150 × 4 × 7 or 600 × 7 or equivalent		M1	
4200(p) or (£) 42		A1	
(Profit) 0.2 × (3 + 42) or equivalent		M1	FT 0.2 × ('their cost of boxes + their cost of chocolates')
(£) 9 or 900(p)		A1	ISW
3. Alternative method 1: *(Each box of chocolates costs) 4 × 7 + 50 ÷ 25*		*M1*	
30(p)		*A1*	
(Each box of chocolates sells for) 30 × 1.2		*M1*	*FT 'their derived 30p' (including omitting the box)*
36(p)		*A1*	
(Profit) (36 – 30) × 150		*M1*	*FT 150 × 'individual (sales – cost)'*
(£)9 or 900(p)		*A1*	*ISW*
3. Alternative method 2: *(Each box of chocolates costs) 4 × 7 + 50 ÷ 25*		*M1*	
30(p)		*A1*	
(Profit for one box of chocolates) 30 × 0.2		*M1*	*FT 'their derived 30p' (including omitting the box)*
6(p)		*A1*	
(Profit) 6 × 150		*M1*	*FT 150 × 'their profit per box'*
(£)9 or 900(p)		*A1*	*ISW*
3. Alternative method 3: *(25 boxes of chocolates cost) 4 × 7 × 25 + 50*		*M1*	
750 (p) or (£)7.50		*A1*	
(Profit for 25 boxes of chocolates) 7(.)50 × 0.2		*M1*	*FT 'their derived 7(.)50' (including omitting the box)*
(£)1.50 or 150(p)		*A1*	
(Profit) 1(.)50 × 150 ÷ 25		*M1*	*FT 'their profit for 25 boxes' × 150 ÷ 25*
(£)9 or 900(p)		*A1*	*ISW*
3. Alternative method 4: *(25 boxes of chocolates cost) 4 × 7 × 25 + 50*		*M1*	
750 (p) or (£)7.50		*A1*	
(Total cost to make) 7(.)50 × 150 ÷ 25		*M1*	*FT 'their derived 7(.)50' (including omitting the box)*
(£)45 or 4500(p)		*A1*	
(Profit) 45 × 0.2 or 4500 × 0.2		*M1*	*FT 0.2 × 'their total cost to make'*
(£)9 or 900(p)		*A1*	*ISW*
3. Alternative method 5: *(Each box of chocolates costs) 4 × 7 + 50 ÷ 25*		*M1*	
30(p)		*A1*	
(Total cost to make) (0.)30 × 150		*M1*	*FT 'their derived 30p' (including omitting the box)*
(£)45 or 4500(p)		*A1*	
(Profit) 45 × 0.2 or 4500 × 0.2		*M1*	*FT 0.2 × 'their total cost to make'*
(£)9 or 900(p)		*A1*	*ISW*

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. $4.2 \times (3 \div 2)$ or 4.2×1.5 or $4.2 \div \dfrac{2}{3}$		M1	
(Height) 6.3 (cm)		A1	
$3.9 \div (3 \div 2)$ or $\dfrac{3.9}{1.5}$ or $3.9 \times \dfrac{2}{3}$		M1	
(Pin length) 2.6 (cm)		A1	Do not penalise any answers reversed in the answer space

5(a)	$t \leq 12$	$t \leq 16$	$t \leq 20$	B1	
	46	**52**	**54**		

5(b) Correct cumulative frequency diagram drawn, with points joined with a straight line or a curve	B2	FT only **cumulative** entries from (a) B1 for either • correct plots (but not joined or with spurious or incorrect straight line or curve), or • 'their plots' joined provided 5 or 6 plots are correct
5(c) 23 (patient appointments)	B2	STRICT FT 'their **cumulative** graph', i.e. correctly evaluated '60 – their 37' B1 for sight of 60 – 'their 37' If 'their graph' is **not** cumulative or shows bars, FT for '60 – their 37' provided a unique reading for 10 minutes (60 – 'their reading at 10 minutes) but award B1 only (not B2) If no marks, award SC1 for 23 (patient appointments) calculated or unsupported, when not from 'cumulative frequency graph', e.g. (18/2 + 6 + 2 + 6 =) 23
5(d) $\dfrac{6}{60}$ (× 100) or (100 ×) 1 - $\dfrac{54}{60}$ (× 100) 10 (%)	M1 A1	FT 'their 54' (reading for t ≤ 20) provided > 28 Do not accept an answer with incorrect units, e.g. '10 people'
5(e) Difference in medians 3 (minutes)	B2	Allow if calculated from the information in the table Must be correct to the nearest minute for 'their cumulative frequency graph' FT 'their **cumulative** frequency graph' Do not accept an answer from incorrect working, including without a cumulative graph seen B1 for either • sight of Monday median 8.3 to 8.7 (minutes), or • an answer for the difference in the medians in the range 2.8 to 3.2 (minutes) (from working with Monday median in the range 8.3 to 8.7 minutes) Apply the same tolerance of ±0.2 (minutes) when following through from 'their graph' On FT, if 'their answer' ≠ whole number of minutes, it must be rounded to the nearest minute

5(f) Sight of any one of: - $\dfrac{4 + 24 + 18}{60}$ (× 100) - $\dfrac{46}{60}$ (× 100) - 0.8 × 60 or equivalent - 0.2 × 60 or equivalent	M1	FT 'their 46' from an incorrect cumulative total in (a) (i.e. 'their value in the table for t ≤ 12')

Conclusion, 'no (target not met)'
AND a correct evaluation:
- 76.666(%) rounded or truncated
- 48 (appointments)
- 12 and (60 – 12 =) 48 (appointments)
  OR
    12 and (6 + 2 + 6 =) 14 (appointments)
	A2	FT for correctly evaluated use of 'their 46'
		Allow for sight of
		46 ÷ 60 = 0.76(…) or 100 × 46 ÷ 60 = 76(%)
		Allow, e.g. 'over 0.7' or 'over 70(%)' only **provided** the correct conclusion 'no' is given
		
		If 48 is not evaluated, accept the time from 'their graph' for 48 appointments instead
		
		A1 for a correct evaluation:
		- 76.(66...%) rounded or truncated
		- 'over 70%' or 'over 0.7'
		- 0.76(...) or 0.77
		- 48 (appointments)
		- 12 (appointments)

6(a) (Volume of cylinder =) $\pi \times 20^2 \times 1000$ (= 400 000π)	B1	(= 1256000 to 1257000) May be implied in further work
(Volume of sphere =) $\dfrac{4}{3} \times \pi \times 5^3$	B1	Or $\dfrac{500\pi}{3}$. (= 523 to 524)
(Number of spheres made =) $\dfrac{\pi \times 20^2 \times 1000}{4/3 \times \pi \times 5^3}$ or equivalent	M2	e.g. $\dfrac{400\,000\pi}{166.6(6)\pi}$ or $\dfrac{100\,000\pi}{41.6(6)\pi}$ or equivalent M1 for $4/3 \times \pi \times 5^3 \times$ number of spheres $= \pi \times 20^2 \times 1000$
= 2400 (spheres)	A1	CAO
6(b) $4 \times \pi \times r^2 = 320\pi$ $r^2 = \dfrac{320\pi}{4\pi}$	M1 m1	May be implied in further working
or (r =) $\sqrt{\dfrac{320\pi}{4\pi}}$ or equivalent		
(r =) $\sqrt{80}$	A1	May be implied in further working
= $4\sqrt{5}$ (mm)	B2	For B2, FT 'their derived 80' if possible For B1, FT 'their derived 80' if possible B1 for writing 80 as a product of 2 or more factors where one of the factors OR the product of 2 of their factors is a square number e.g. 16 × 5, 4 × 20, 2 × 8 × 5, OR B1 for writing $\sqrt{80}$ as a product of 2 or more factors where one of the factors OR the product of 2 of their factors is a whole number e.g. $\sqrt{16} \times \sqrt{5}$, $\sqrt{4} \times \sqrt{20}$, $\sqrt{2} \times \sqrt{8} \times \sqrt{5}$

7(a)		
250×0.8 + 100×2 + 50×2.8 + 50×4 + 200×0.7 (= 200 + 200 + 140 + 200 + 140)	M1	Allow M1 for the sum of 5 products with any 3 correct
= 880 (batteries)	A1	CAO

7(b)		FT 'their 880' ÷ 4 and 'their 250×0.8' for all marks provided their lower quartile is in the 2nd group, i.e. 'their 250×0.8' < 'their 880' ÷ 4 < 'their 250×0.8'+200
Search for lower quartile in the 550 – 650 group 2x = 880÷4 – 250×0.8 OR $\frac{880÷4 – 250×0.8}{200}$ × 100	S1 M1	May be seen on the diagram
or 2x = 20 OR $\frac{20}{200}$ × 100		
(x =) 10	A1	
(lower quartile = 550 + 10 =) 560 (hours)	A1	If no marks awarded, SC2 for an answer of 730 (hours) from using the upper quartile e.g. 750 – 80/200×50 OR 700 + 120/200×50 SC1 for searching in the 700 – 750 group provided sight of 880 ÷ 4 (×3)

7(b) Alternative method:		FT 'their 880' ÷ 4 and 'their 250×0.8' for all marks provided their lower quartile is in the 2nd group, i.e. 'their 250×0.8' < 'their 880' ÷ 4 < 'their 250×0.8'+200
Search for lower quartile in the 550 – 650 group 2x = (250×0.8+200) – 880÷4 OR $\frac{(250×0.8+200) – 880÷4}{200}$ × 100	S1 M1	May be seen on the diagram
or 2x = 180 OR $\frac{180}{200}$ × 100		
(x =) 90	A1	
(lower quartile = 650 – 90 =) 560 (hours)	A1	If no marks awarded, SC2 for an answer of 730 (hours) from using the upper quartile e.g. 750 – 80/200×50 OR 700 + 120/200×50 SC1 for searching in the 700 – 750 group provided sight of 880 ÷ 4 (×3)

8(a) Tangent drawn at t = 2 seconds	M1	Attempt to draw a tangent at time t = 2 seconds	
Idea of increase in y ÷ increase in x	m1	Allow one error in counting squares or in reading the scale for m1 only	
Correctly evaluated gradient for their tangent	A1	Accept the gradient as an improper fraction or decimal or percentage If their answer is a fraction, it needs to be in its lowest terms Mark final answer	
m/s^2 or ms^{-2}	U1		

8(b)(i) (Area =) $\frac{1}{2}$ × 1 × (0+0 + 2(14+24+30+32+30+24+14)) OR $\frac{1}{2}$ × 1 × (28+48+60+64+60+48+28) or equivalent = 168 (m)	M2 A1	Award M1 for at most one repeated error FT from M1

8(b)(i) Alternative method: $\frac{(0 + 14)}{2}$ × 1 + $\frac{(14 +24)}{2}$ × 1 + $\frac{(24 + 30)}{2}$ × 1 + $\frac{(30 + 32)}{2}$ × 1 + $\frac{(32 + 30)}{2}$ × 1 + $\frac{(30 + 24)}{2}$ × 1 + $\frac{(24 + 14)}{2}$ × 1 + $\frac{(14 + 0)}{2}$ × 1 *or equivalent* *[= 7 + 19 + 27 + 31 + 31 + 27 + 19 + 7]* *= 168 (m)*	*M2* *A1*	*Each area may be seen as the sum of the area of a rectangle and triangle* *M1 for the sum of these 8 areas with 1 one (possibly repeated) error in reading the scale* *FT from M1*

8(b)(ii) (Average velocity in mph =)
144
 ÷ 6
  ÷ 1000
   × 60 × 60
 	
$\frac{× 5}{8}$ or ÷ 1.6   or equivalent
 	
= 54 (mph)
	
	M1
	M1
	M1
	
	M1
	
	A1
		These M1 marks may be awarded in any order
		(144 ÷ 6 = 24)
		(144 ÷ 1000 = 0.144)
		(144 × 60 × 60 = 518400)
		
		(144 × 5 ÷ 8 = 90)
		
		CAO

9. (Total SA of pillars =) 14 × 4 × 18　　　(=1008)	B1	
(Total SA of other flat faces =) 100 × 12 × 2　−　$\dfrac{\pi \times 10^2 \times 8}{2}$　　or equivalent (=2400 − 400π)	B2	B1 for 100×12 − $\dfrac{\pi \times 10^2 \times 4}{2}$　(=1200 − 200π) OR B1 for $\dfrac{\pi \times 10^2 \times 8}{2}$　(=400π)
(Total curved SA =) $\dfrac{\pi \times 20 \times 4 \times 4}{2}$　　or equivalent (=160π)	B1	
(Total surface area =) 14×4×18 + 100×12×2 + $\dfrac{\pi \times 20 \times 4 \times 4}{2}$ − $\dfrac{\pi \times 10^2 \times 8}{2}$ or equivalent	M2	M1 for the addition/subtraction of at least 3 correct terms
= 3408 − 240π　　(m²)	A1	CAO. ISW
9. Alternative method: *(Area of front and back faces =)* *100 × 26 × 2 − 4 × $\dfrac{(\pi \times 10^2 + 14 \times 20)}{2}$ × 2* *or equivalent* *(= 5200 − 400π − 2240)*	*B2*	*B1 for 100×26 − 4×$\dfrac{(\pi \times 10^2 + 14 \times 20)}{2}$　　　OR* *B1 for 4 × $\dfrac{(\pi \times 10^2 + 14 \times 20)}{2}$ × 2*
(Total curved SA =) $\dfrac{\pi \times 20}{2}$ × 4 × 4　　or equivalent *(=160π)*	*B1*	
(Inside of pillars =) 14 × 4 × 8　　　(=448)	*B1*	
(Total surface area =) *100×26×2 − 4×$\dfrac{(\pi \times 10^2 + 14 \times 20)}{2}$×2 + $\dfrac{\pi \times 20}{2}$ ×4×4* *+ 14 × 4 × 8　　　or equivalent*	*M2*	*M1 for the addition/subtraction of at least 4 correct terms*
= 3408 − 240π　　(m²)	*A1*	*CAO. ISW*