GCSE MARKING SCHEME

AUTUMN 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

AUTUMN 2022 MARK SCHEME

<table>
<tr><th>Unit 2: Higher Tier</th><th>Mark</th><th>Comments</th></tr>
<tr><td>1.
(Tax at 22%) 0.22 × 15000 or
0.22 × (25000 – 10000) or equivalent

(Tax at 35%) 0.35 × 3000 or
0.35 × (28000 – 25000) or equivalent

(Total tax due 3300 + 1050 =) 4350 (euros)

(Tax still owed 4350 – 3600 =) 750 (euros)</td><td>M2

M2

A2

B1</td><td>Ignore £ for € throughout
M1 for appropriate sight of 25000 – 10000 (= €15000)

M1 for 28000 – 25000 (= €3000)

CAO
A1 for sight of 3300 (euros) or 1050 (euros)

FT for positive answers only,
'their derived 4350' – 3600, provided
3300 + ... or ... + 1050 seen, i.e. sum of two amounts with at least one amount correct

<u>If no marks, for special cases award one of the following:</u>

<table><tr><td>(0.22 × (28000 – 3600 – 10000) =)
(0.22 × (24400 – 10000) =)
(0.22 × 14400 =)
(€) 3168</td><td>SC2</td></tr><tr><td>0.22 × (28000 – 3600 – 10000) or
0.22 × (24400 – 10000) or
0.22 × 14400</td><td>SC1</td></tr></table></td></tr>
<tr><td>Organisation and communication

Writing</td><td>OC1

W1</td><td>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.</td></tr>
</table>

2(a) (Direct^2 =) $200^2 + 350^2$ Direct^2 = 162500 or (Direct =) $\sqrt{162500}$ (Direct =) 403(.11... m) or $50\sqrt{65}$ (m) or $\sqrt{162500}$ (m) (Extra distance =) 200 + 350 – 403(.1...) or 200 + 350 – $50\sqrt{65}$ or 200 + 350 – $\sqrt{162500}$ 146.8(87....m) or 146.9(m) or 147(m)	M1 A1 A1 M1 A1	 FT from M1 for the correctly evaluated square root of 'their 162500' provided 'their answer' > 350 (m) May be implied in further working Mark final answer or the answer they go on to use, but then FT FT 'their derived 403(.11…)' > 350 and from an attempt to use Pythagoras' Theorem
2(b)(i) Selects or unambiguously implies 'No' with a reason, e.g. 'the median is in group >200m to 1000m (and he lives 200m away)', 'median is more than 200m away (but Ronnie is 200m away)'	E1	Needs to compare 200(m) with median >200(m) The 200(m) can be implied from selecting 'No' Ignore additional spurious statements Allow 'No' with a reason, e.g. 'Ronnie's distance is in the first group, the median is in the second group' 'Ronnie only travels 200m which is less than the median (distance)' 'because the median distance travelled is between 200m and 1000m' 'Ronnie doesn't travel the distance of the 17.5(th) person' 'Ronnie doesn't travel the distance of the 17(th) (or 18th) person' 'the median 17.5(th)' 'the median 17(th) (or 18(th))' 'he only walks 200m when the (median) distance is higher' 'he only walks 200m which is less than the median' 'can't estimate exact number from the group 200< d ≤ 1000' 'the median **could** be 880' '9 less than half of 35' '26 students walk further than him' Do not accept 'No' with a reason e.g. 'Ronnie's distance is in the first group' 'the median **is** 250m'
2(b)(ii) Midpoints 150, 600, 2000, 5000 150×9 + 600×10 + 2000×15 + 5000×1 (= 1350 + 6000 + 30000 + 5000 = 42350 m) ÷ 35 1210 (m)	B1 M1 m1 A1	Check the table Sight of 7750 implies correct midpoints FT 'their midpoints' provided at least 3 are within or at the bounds of the appropriate groups Answer space takes precedence
2(c) (140 ÷ 7 =) 20 or 140 ÷ 20 = 7 or 7 × 20 = 140 1 2 3 4 5 6 7 **2 22 42 62 82 102 122**	B1 B1	May be implied by any of the following: • consistent position patterns + 20 indicated for at least 4 consecutive positions e.g. (2,) 20, 40, 60, 80, 100, 120 • sight of 22 for student 2 with no further working or entries CAO

3(a) $4500 \times (1 - 0.2(0)) \times (1 - 0.14)^9$ or $4500 \times 0.8(0) \times 0.86^9$ or equivalent	M2	For M2, do not ignore any additional years considered, unless 10 years selected or implied in later working M1 for equivalent of one of the following (which may be embedded in other working): • $4500 \times (1 - 0.2(0))$ (= 3600) • $4500 \times 0.8(0)$ (= 3600) • $4500 \times (1 - 0.14)^9$ (= 1157.97...) • 4500×0.86^9 (= 1157.97...)
An answer in the range (£)926.35 to (£)926.40	A1	An answer for 10 years (not beyond) must be selected Allow an answer of (£)926 provided not from rounding an amount outside the range given Award M1, SC1 for an answer $(4500 \times 0.8 \times 0.86^{10} =)$ (£)796.68(5....) or (£)796.69 or (£)796.70 or (£)797
3(b) $100 \times 750 \div 125$ or $100 \times \frac{750}{125}$ or equivalent	M1	
(£) 600	A1	Answer space takes precedence
3(c)		Accept equivalents using the sine rule throughout '½ width' may be referred to by any unknown
Sight of appropriate 80 (cm) (height of triangle)	B1	Check if indicated on the diagram
(½ width =) $\frac{80}{\tan 33°}$ or (½ width =) $80 \times \tan(90° - 33°)$	M2	(= 123.189... cm or 123.2 cm) FT 'their 80' provided ≤ 120 and ≠ 90 M1 for sight of $\tan 33° = \frac{80}{\text{½ width}}$ or $\tan(90° - 33°) = \frac{\text{½ width}}{80}$
× 2	m1	FT provided at least M1 previously awarded, i.e. for intention to double 'their ½ width'
(Width of garage is) 246(cm) to 246.4(cm)	A1	CAO. ISW
3(d) (Maximum space =) 555 – 395 – 70 or 550 – 400 + 2 × 5 – 70 or equivalent	M2	Check the diagram M1 for any of the following • use of 550 < 'their 555' ≤ 560 AND 390 ≤ 'their 395' < 400 • for sight of 555 and 395 • for sight of 550 – 400 + 2 × 5
90 (cm)	A1	CAO Award M1 and SC1 for an answer of (555 – 395 =) 160 (cm)

4(a) (Population in 1964) $\frac{100 + 682}{100} \times 30000$ or 7.82×30000 or $30000 + 30000 \times \frac{682}{100}$ or equivalent (Population in 2014) $\frac{100 + 20}{100} \times 234600$ or 1.2×234600 281520 (people)	M1 M1 A1	(= 234600 people) M0 for 6.82×30000 (= 204600) or 1.682×30000 (= 50460) FT 'their derived 234600' including 1.2×204600 (= 245520) 1.2×50460 (= 60552) CAO
4(b) $287\,106 \div 432$ 660 (people per km^2)	M1 A2	A1 for sight of 664.597…. rounded or truncated
4(c) $1442 \times 1000 \div 1\,000\,000$ 1.4(42 g/cm^3)	M1 A1	Mark final answer Allow M1 A1 for $1442 \div 1000 = 1.4(42)$ Do not accept from incorrect working, e.g. M0 A0 if 1.442 seen with an incorrect statement, e.g. • "1 g = 1000 kg" • "g to kg is ÷ 1000"
5. $(180 -) \tan^{-1}(64/41)$ or $(180 -) \cos^{-1}(41/76)$ or $(180 -) \sin^{-1}(64/76)$ or equivalent (x =) 122.6(…) (º) (Unusable area =) $\frac{122.6(\ldots)}{360} \times \pi \times 76^2 + \frac{41 \times 64}{2}$ (6176.5 to 6201) (1312) = 7488.5 to 7513 (cm^2)	M2 A1 M2 A1	Note: angle in triangle = 57.3(…) or 57.4 (º) An equivalent method could include Pythagoras followed by trigonometry Allow an angle of 57(º) from correct working M1 for • tan(angle) = 64/41 or • cos(angle) = 41/76 or • sin(angle) = 64/76 or M1 for unrearranged (or better) correct substitutions into the sine or cosine rules Allow an answer of 122.7 (º) or 123(º) FT 'their derived 122.6(…)', but if < 90 then only M2A0 or M1A0 are available M1 for $\frac{122.6(\ldots)}{360} \times \pi \times 76^2$ FT for similar range provided their x > 90 and allowing π = 3.14 to 3.142

6(a) $335\left(\frac{\left(\left(1+\frac{5.4/100}{12}\right)^{n}-1\right)\left(1+\frac{5.4/100}{12}\right)}{\frac{5.4/100}{12}}\right)$ or $335\left(\frac{((1+0.0045)^{n}-1)(1+0.0045)}{0.0045}\right)$ $335\left(\frac{\left(\left(1+\frac{5.4/100}{12}\right)^{28}-1\right)\left(1+\frac{5.4/100}{12}\right)}{\frac{5.4}{12\times 100}}\right)$ or $335\left(\frac{((1+0.0045)^{28}-1)(1+0.0045)}{0.0045}\right)$ = (£) 10 017(.57…) or (£) 10 018 (Date when Rebecca has £10 000) November 2024	 B1 M1 A1 A1	For all the amounts of money shown below, accept other reasonable approximations e.g. nearest 10p, rounded or truncated Only allow a misread of the amount deposited, not of the nominal annual rate For any value of n OR $335\left(\frac{\left(\left(1+\frac{5.4/100}{12}\right)^{n}-1\right)\left(1+\frac{5.4/100}{12}\right)}{\frac{5.4/100}{12}}\right)=10000$ (or $\geq$ 10000) May be implied by amounts of (£)9259.52(1991) for n=26 AND (£)9637.69(734) for n=27 Or evidence that n = 28 An answer of 28 months with no incorrect work seen can be awarded B1M1A1 and possible final A1 CAO If first B1 only awarded, SC1 for a correct evaluation of the formula for any value of n from 20 to 30 • n=20 leads to (£)7025(.78…) or (£)7026 • n=21 leads to (£)7393(.906…) or (£)7394 • n=22 leads to (£)7763(.686..) or (£)7764 • n=23 leads to (£)8135(.13…) • n=24 leads to (£)8508(.246…) • n=25 leads to (£)8883(.04…) • n=26 leads to (£)9259(.52…) or (£)9260 • n=27 leads to (£)9637(.697…) or (£)9638 • n=29 leads to (£)10399(.16…) • n=30 leads to (£)10782(.46…) If no marks awarded and from using a rate of $^{5.4}/_{12}$ = 0.45, SC2 for (£)13467(.65…) or (£)13468 AND Feb 2023 from $335\left(\frac{((1+0.45)^{7}-1)(1+0.45)}{0.45}\right)$, or SC1 for (£)13467(.65) or (£)13468 If no marks awarded and from using a rate of 0.045, SC2 for (£)10174(.426…) AND February 2024 from $335\left(\frac{((1+0.045)^{19}-1)(1+0.045)}{0.045}\right)$, or SC1 for (£)10174(.426...) If no marks awarded and from using a rate of 0.054, SC2 for (£)10312(.178…) AND January 2024 from $335\left(\frac{((1+0.054)^{18}-1)(1+0.054)}{0.054}\right)$, or SC1 for (£)10312(.178…)
6(b) (AER =) $\left(1+\frac{5.4/100}{12}\right)^{12}-1$ or equivalent = 5.54(%)	M1 A1	Sight of an answer of 5.53(5675…%) is awarded M1A0

6(c) £ 236.84	B1	
7(a) Strategy of using Pythagoras in 2 different planes to calculate the vertical height	S1	
$115^2 + 115^2$ OR $\frac{230^2 + 230^2}{4}$ OR $217^2 - 115^2$	M1	Or their square roots Note: $115^2 + 115^2$ and $\frac{230^2 + 230^2}{4}$ = 26 450, and $\sqrt{115^2 + 115^2}$ and $\frac{\sqrt{230^2 + 230^2}}{2}$ = 162.6(3…)
(Vertical height =) $\sqrt{217^2 - (115^2 + 115^2)}$ OR $\sqrt{217^2 - \frac{230^2 + 230^2}{4}}$ (=$\sqrt{20639}$)	M2	Awarding of M2 or M1 here implies previous S1M1 M1 for $217^2 - (115^2 + 115^2)$ or M1 for $217^2 - \frac{230^2 + 230^2}{4}$ or equivalent, or M1 for $217^2 = h^2 + (115^2 + 115^2)$ or M1 for $217^2 = h^2 + \frac{230^2 + 230^2}{4}$ or equivalent
= 143.6(627…) to 143.7 (m)	A1	Allow 144 (m) provided no incorrect work seen
(Volume of pyramid =) $\frac{1}{3} \times 230 \times 230 \times 143.6(627…)$	M1	FT 'their derived 143.6(627…)'
= 2 533 254(.034) (m^3)	A1	Allow answers of 2530000 to 2534000 A height of: • 143.6 leads to 2532146(.667) (m^3) • 143.66 leads to 2533204(.667) (m^3) • 143.7 leads to 2533910 (m^3) • 144 leads to 2539200 (m^3), allowing answers of 2539000 to 2540000
7(b)(i) $\frac{A}{1+tan58} = b^2$ OR $\frac{A}{1+tan58} = 12^2$ OR $\frac{A}{1+tan58} = 144$	B1	Note: 1 + tan58(°) = 2.6(00334…)
$(A =)\ b^2(1 + tan58)$ OR $(A =)\ 12^2(1 + tan58)$ OR $(A =)\ 144(1 + tan58)$	B1	Implies previous B1
(A =) 374.4(481…) (cm^2)	B1	Implies previous B1B1
7(b)(ii) (Area factor =) $\left(\frac{31.5}{15}\right)^2$ OR $\left(\frac{15}{31.5}\right)^2$ or 2.1^2 OR $0.476…^2$ (= 4.41) (= 0.2267…)	B1	May be implied in further working
(Area of large souvenir to be painted =) $400 \times \left(\frac{31.5}{15}\right)^2$ OR $400 \div \left(\frac{15}{31.5}\right)^2$	M1	
= 1764 (cm^2)	A1	

8(a) (Distances travelled up to 11:00 =) 135 (km) AND 157.5 (km)	B1	Check diagram
(Distance =) $\sqrt{135^2 + 157.5^2 - 2 \times 135 \times 157.5 \times cos49(°)}$ (=$\sqrt{15132.33\ldots}$)	M2	FT their distances for M2 or M1 Allow use of 30 and 35 M1 for $135^2 + 157.5^2 - 2\times135\times157.5\times\cos49(°)$
= 123(.01…) (km)	A1	Must come from M2 and provided 30 and 35 not used in the cosine rule
(Time taken for Explorer to reach Magellan =) 123(.01…) ÷ 30	M1	Can only be awarded provided at least M1 previously awarded FT 'their derived 123(.01…)'
= 4.1(…) (hours) or 4 hrs 6 mins = 15:06 or 3:06 p.m.	A1 A1	FT from M1A0 for 'their 4.1(…) (hours)' provided of equivalent difficulty (not quarter or half hours involved) On FT, needs to be correct to the nearest minute, rounded or truncated If final M0A0A0 awarded, SC2 for an answer of 14:31 or 2:31 p.m. from the division by 35 OR SC1 for 3.5(1…) hours from the division by 35
8(b) (Angle at top of triangle =) $\sin^{-1}\left(\frac{sin49(°)}{123(.01\ldots)} \times 157.5\right)$ OR $\cos^{-1}\left(\frac{135^2+123(.01\ldots)^2-157.5^2}{2\times135\times123(.01\ldots)}\right)$	M2	FT their values consistently used from (a) M1 for $\frac{\text{sin angle}}{157.5} = \frac{\text{sin49(°)}}{123(.01\ldots)}$ or equivalent OR M1 for $157.5^2 = 135^2+123(.01)^2 - 2\times135\times123(.01)\times\cos$ angle
75(.08…) to 75.105 (°)	A1	Must come from M2
(Bearing =) 360 – (180 – 51) – 75(.08…) or 180 – (75(.08…) – 51) or 231 – 75(.08…)	M1	FT 'their derived 75(.08…)'
= 156 (°)	A1	Allow an answer of 155.9(19…)(°)
8(b) Alternative method: *(Angle at right of triangle =)* *$\sin^{-1}\left(\frac{sin49(°)}{123(.01\ldots)} \times 135\right)$ OR* *$\cos^{-1}\left(\frac{157.5^2+123(.01\ldots)^2-135^2}{2\times157.5\times123(.01\ldots)}\right)$*	*M2*	*FT their values consistently used from (a)* *M1 for $\frac{\text{sin angle}}{135} = \frac{\text{sin49(°)}}{123(.01\ldots)}$ or equivalent OR* *M1 for* *$135^2=157.5^2+123(.01)^2 - 2\times157.5\times123(.01)\times\cos$ angle*
= 55.9(19…) to 56 (°)	*A1*	*Must come from M2*
(Bearing =) *360 – (180 – 51) – (180 – 49 – 55.9(19…)) or* *51 + 49 + 55.9(19…) or* *100 + 55.9(19…)*	*M1*	*FT 'their derived 55.9(19…)'*
= 156 (°)	*A1*	*Allow an answer of 155.9(19…)(°)*