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## GCSE MARKING SCHEME

## SUMMER 2016

## GCSE MATHEMATICS LINKED PAIR METHODS UNIT 2 HIGHER <br> 4364-02

## INTRODUCTION

This marking scheme was used by WJEC for the 2016 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.

## METHODS IN MATHEMATICS UNIT 2 (HIGHER TIER) - SUMMER 2016

| Methods in Mathematics Unit 2 Higher Tier |  | Comments |
| :---: | :---: | :---: |
| 1. Shape completed accurately with correct rotation seen | B3 | With no other $90^{\circ}$ rotations shown B2 for at least two lines correct in attempting to complete the shape with correct rotation of their shape with no other $90^{\circ}$ rotations shown, OR <br> B1 for the shape completed correctly, or a correct rotation of the part of the shape given, ignore other $90^{\circ}$ rotations shown |
| 2(a) $3 \mathrm{x}+\mathrm{x}$ OR $4 \mathrm{x}(\mathrm{cm})$ <br> (b) $(\mathrm{x}=) 40$ | $\begin{gathered} \text { B1 } \\ \text { B2 } \\ \\ 3 \end{gathered}$ | Mark final answer <br> FT for $8 \mathrm{x}+$ 'their FE ' $=480$ <br> B1 for sight of $12 x=480$ or equivalent informal notation |
| 3(a) $100 \times 45 / 9000$ or $100 \times 45 \div 9000$ $0.5(\%) \text { or } 1 / 2(\%)$ <br> (b) $1.015 \times 4000$ or $4000+4000 \times 1.5 / 100$ or $101.5 \times 4000 / 100$ <br> 4060 | $\begin{gathered} \hline \text { M1 } \\ \text { A1 } \\ \text { M1 } \\ \text { A1 } \end{gathered}$ | CAO <br> Accept 0.5 written as $1 / 2$ CAO |
| (c) $0.28 \times 1350$ or $5 / 8 \times 580$ or $0.084 \times 4450$ or equivalent 378 (m) $\begin{gathered} 362.5(\mathrm{~m}) \\ \\ 373.8(\mathrm{~m}) \\ 360370380 \end{gathered}$ | M1 <br> A1 <br> A1 <br> A1 <br> B1 | Any one correct calculation shown <br> Accept to 2 sig. figs. 380 <br> Accept $362(.5)$ or 363 or to 2 sig. figs. 360 <br> Accept $373(.8)$ or 374 or to 2 sig. figs. 370 <br> Ignore any further working for M and A marks <br> Must all be 2 significant figures, do not accept 360.0 etc. <br> FT provided at least 2 of the A marks awarded |
| (d) $10-9$ $=1$ | M1 <br> A1 <br> 11 | If no marks, award SC1 for sight of $9.999-9=0.999$ or 0.9 recurring |
| 4. <br> (a) $(x=) 12 \times 8 / 3$ $x=32$ <br> (b) $(x=) 8$ $\begin{array}{rl} \text { (c) } 35 \mathrm{x}-65=40 & \text { OR } \\ 35 \mathrm{x}=105 \text { or } \mathrm{x}=105 / 35 & 7 \mathrm{x}-13=40 / 5 \\ & 7 \mathrm{x}=21 \text { or } \mathrm{x}=21 / 7 \end{array}$ <br> (d) $6 x<100-4$ or $6 x<96$ or $3 x<50-2$ or $3 x<48$ $\mathrm{x}<16$ <br> (e) $x<81 / 3$ or $x<27$ or $78<81$ $(\mathrm{x}=) \quad 26$ | M1 <br> A1 <br> B1 <br> B1 <br> B1 <br> B1 <br> M1 <br> A1 <br> M1 <br> A1 <br> 10 | Accept embedded answers in parts (a), (b) \& (c) <br> Mark final answer. Do not accept 72/9 <br> FT until $2^{\text {nd }}$ error <br> Accept an embedded answer for B3 <br> No marks for use of "=", unless finally replaced to give $\mathrm{x}<16$ then award M1 A1. <br> SC1 for $\mathrm{x}<104 / 6$ ISW <br> Or sight of $3 \times 26=78$ with $3 \times 27=81$ or equivalent divisions <br> Accept unsupported 26, or a unique answer of 26 from a trial and improvement method, or $3 \times 26<81$ <br> Do not accept $\mathrm{x}<26$. <br> Allow sight of $3 x=81, x=27$ followed by selecting $x=26$ |
| 5. $24 \pi=2 \pi \mathrm{r}$ or $24 \pi=\pi \mathrm{d}$ or $\mathrm{d}=24(\mathrm{~cm})$ $\mathrm{r}=12(\mathrm{~cm})$ | $\begin{gathered} \mathrm{M} 1 \\ \mathrm{~A} 1 \\ 2 \\ \hline \end{gathered}$ | Do not accept 11.9(9...) |
| $\begin{aligned} & \text { 6. }\left(x^{2}=\right) 6.8^{2}+8.4^{2} \\ & x^{2}=116.8 \text { or }(x=) \sqrt{ } 116.8 \text { OR } y^{2}=40.25 \text { or }(y=) \sqrt{ } 40.25 \\ & x=10.8(07 \ldots) \quad y=6.3(44 \ldots) \end{aligned}$ | $\begin{gathered} \text { M1 } \\ \text { M1 } \\ \text { A1 } \\ \text { A1 } \\ \text { A1 } \\ 5 \end{gathered}$ | Accept 11 from correct working Accept 6 from correct working |


| Methods in Mathematics Unit 2 Higher Tier |  | Comments |
| :---: | :---: | :---: |
| 7.(a) Correct rotation | B2 | B1 near miss of grid lines, or for anticlockwise $90^{\circ}$ about (2, 0), or for clockwise $90^{\circ}$ about $(0,2)$ |
| (b) Correct reflection in $y=x$ | B2 | B1 for sight of the line $y=x$ or correct reflection in $y=-x$ |
| (c) Enlargement scale factor $1 / 2$ with correct orientation | B2 | B1 for any 1 line correct, or consistent incorrect fractional scale $<1$, or enlargement scale factor $1 / 2$ with incorrect orientation |
| Correct position | $\begin{gathered} \text { B1 } \\ 7 \end{gathered}$ | Not FT. Use bottom right hand vertex as a guide |
| 8. (base edge ${ }^{2}$ ) $576.6 \div 15 \quad(=38.44)$ | M1 |  |
| (base edge) $\sqrt{ }(576.6 \div 15) \quad(=6.2 \mathrm{~cm})$ | m1 |  |
| (new base edge) $\sqrt{ }(576.6 \div 15) \times 6 / 5$ or equivalent | m1 | FT 'their 6.2' that is 'their base edge' |
| $7.44(\mathrm{~cm})$ | A1 | CAO |
| (New volume) $7.44 \times 7.44 \times 15\left(=830.304 \mathrm{~cm}^{3}\right)$ | B1 | FT their 7.44 provided M1, m2 previously awarded |
| (Difference volume) $830.304-576.6$ ( $=253.704 \mathrm{~cm}^{3}$ ) | B1 | FT their new volume provided M1 previously awarded and attempt 'their 7.44 ' $\times$ 'their 7.44 ' $\times$ 'their 15 ' May be implied in further working |
| (Percentage increase is) | M1 | FT provided their difference in volumes correctly |
| $\frac{253.704}{576.6}(\times 100) \text { or } 1(\times 100)-\frac{830.304}{576.6}(\times 100)$ |  | evaluated or implied in an equivalent method |
| 44(\%) | A1 | ('their 15 ' as 18 gives an answer of $72.8(\%)$ or $73(\%)$ ) Alternative: |
|  |  | Linear scale factor 1.2 or equivalent M2 |
|  |  | Volume scale factor $1.2^{2}$ m3 |
|  |  | $=1.44$ $A 2$ <br> Percentage increase $44(\%)$ $A 1$ |
|  |  | Other alternatives are accepted, such as new volume as $\%$ original subtract 100 , or comparison of base areas |
| QWC2: Candidates will be expected to <br> - present work clearly, with words explaining start, process or steps <br> AND <br> - make few if any mistakes in mathematical form, spelling, punctuation and grammar in their answer | Q | QWC2 Presents relevant material in a coherent and |
|  | $\begin{aligned} & \text { W } \\ & \text { C } \\ & 2 \end{aligned}$ | logical manner, using acceptable mathematical form, and with few if any errors in spelling, punctuation and grammar. |
|  |  | QWC1 Presents relevant material in a coherent and logical manner but with some errors in use of mathematical form, spelling, punctuation or grammar OR |
| QWC1: Candidates will be expected to <br> - present work clearly, with words explaining start, process or steps <br> OR <br> - make few if any mistakes in mathematical form, spelling, punctuation and grammar in their answer |  | evident weaknesses in organisation of material but using acceptable mathematical form, with few if any errors in spelling, punctuation and grammar. |
|  | 10 | QWC0 Evident weaknesses in organisation of material, and errors in use of mathematical form, spelling, punctuation or grammar. |
| $9(\mathrm{a}) \mathrm{x}=14.3 \times \sin 35^{\circ} \quad \mathrm{x}=8.2(02 \ldots \mathrm{~cm})$ | M2 | M1 for $\sin 35^{\circ}=\mathrm{x} / 14.3$ |
|  | A1 | Accept 8(cm) from correct working |
| (b) $\tan y=14.6 / 8.7$$y=\tan ^{-1} 14.6 / 8.7$ or $\tan y$ | M1 |  |
|  | A1 | Allow for sight of $\tan y=1.67$ or 1.68 |
| $y=59\left(.2^{\circ}\right)$ | A1 6 |  |

\begin{tabular}{|c|c|c|}
\hline Methods in Mathematics Unit 2 Higher Tier \& \& Comments \\
\hline \begin{tabular}{l}
10. (+£) 32 AND (+) 4.3(\%) \\
(£) 900 \\
(+£) 100 AND (+) 12.5(\%) \\
(£) 81
\end{tabular} \& \[
\begin{gathered}
\hline \text { B2 } \\
\text { B2 } \\
\text { B1 } \\
\text { B1 } \\
6
\end{gathered}
\] \& \begin{tabular}{l}
B1 for (32 and) 32/750 or sight of 4.2(666...\%) \\
B1 for interpretation ' \(1()\).09 is 981 ', e.g. \(981 \div 1()\). \\
CAO \\
CAO
\end{tabular} \\
\hline 11. \(1.23 \times 10^{2}\) \& \[
\begin{gathered}
\text { B3 } \\
3 \\
\hline
\end{gathered}
\] \& B2 for \(1.2(29 \ldots) \times 10^{2}\) or 123 B1 for \(122.903 \ldots\) \\
\hline 12. \(\mathrm{x}=2.6 \times 4.6 \div 3.2\) \& \begin{tabular}{l}
M2 \\
A1 \\
3
\end{tabular} \& \begin{tabular}{l}
M1 for 3.2/4.6 \(=2.6 / \mathrm{x}\) or equivalent Award M2, A0 for an answer of 3.8(3...cm) from \(4.6 \div 1.2\) \\
Accept 4(cm) from appropriate working. \\
No marks for unsupported 4(cm)
\end{tabular} \\
\hline \begin{tabular}{l}
13(a) \(3 \times 13.6 \div 8.5\) or \(3 \times 1.6\) or equivalent
\[
4.8 \text { (cm) }
\] \\
(b) Volume scale factor \(1.6^{3}\) or \(0.625^{3}\) or unsimplified equivalents \\
Volume smaller box \(102.4 \times 0.625^{3}\) or \(102.4 \div 1.6^{3}\) \(25\left(\mathrm{~cm}^{3}\right)\)
\end{tabular} \& \[
\begin{gathered}
\text { M1 } \\
\text { A1 } \\
\text { B1 } \\
\text { M1 } \\
\text { A1 } \\
\hline
\end{gathered}
\] \& FT 'their derived \(1.6{ }^{3}\), \\
\hline  \& \begin{tabular}{l}
M1 \\
M1 \\
A1 \\
M1 \\
A1 \\
A1 \\
6
\end{tabular} \& \begin{tabular}{l}
OR For sight of \(x^{2}+x y=7 x \quad\left(2^{\text {nd }}\right.\) eqn multiplied by \(\left.x\right)\) OR Subtraction from \(1^{\text {st }}\) equation \\
OR \(\quad x^{2}+7 x=-6\) or equivalent \\
FT provided quadratic from an appropriate substitution method or subtraction method \\
OR alternative method to solve, e.g. formula with correct substitution and \(b^{2}-4 a c\) correctly simplified \\
If AO, A0 then SC1 for \(x=-1, y=8\) OR \(x=-6, y=13\) \\
provided algebraic method shown with appropriate M1, M1, M1 marks \\
No marks for trial \& improvement methods
\end{tabular} \\
\hline \[
\begin{aligned}
\& \text { 15. } y \propto 1 / x^{2} \text { OR } y=k / x^{2} \\
\& 10=k / 6^{2} \\
\& y=360 / x^{2} \quad \text { or } k=360 \\
\& x^{2}=360 / 4 \text { or } x=( \pm) \sqrt{ } 90 \text { or } x=9.4868 \ldots \\
\& \quad x= \pm 9.4868 \ldots \text { or } \pm 3 \sqrt{ } 10
\end{aligned}
\] \& \begin{tabular}{l}
B1 \\
M1 \\
A1 \\
M1 \\
A1 \\
5
\end{tabular} \& \begin{tabular}{l}
Ignore use of incorrect symbol ' \(\alpha\) ' later \\
FT y \(\alpha 1 / \mathrm{x}\) or \(\mathrm{y} \alpha \mathrm{x}^{2}\) \\
FT 'their k' provided at least 1 mark previously awarded Accept rounded or truncated, but MUST be \(\pm\). \\
No FT from 1/x as both solutions required
\end{tabular} \\
\hline \begin{tabular}{l}
16. Sight of \(\mathrm{BA}=2.8(\mathrm{~cm})\) and \(\mathrm{AO}=5.6(\mathrm{~cm})\) \\
Outer arc \(2 \times \pi \times 8.4 \times 131 / 360\) \\
Inner arc \(2 \times \pi \times 5.6 \times 131 / 360\) \\
Outer arc 19.2( \(\ldots \mathrm{cm})\) AND Inner arc 12.8( \(\ldots \mathrm{cm}\) )
\end{tabular} \& \[
\begin{aligned}
\& \hline \text { B1 } \\
\& \text { M1 } \\
\& \text { M1 } \\
\& \text { A1 }
\end{aligned}
\] \& \begin{tabular}{l}
FT 'their 5.6' provided \(<8.4, \neq 4.2\) and \(>2.8\) \\
CAO \\
If MO, MO, AO allow: \\
SC2 for 9.6(cm) with 6.4(cm), or \\
SC1 for sight of \(v \times \pi \times 131 / 360\), where \(v\) is a value \(>0\)
\end{tabular} \\
\hline Perimeter \(\quad 2.8+2.8+\) outer arc + inner arc
\[
37.6 \text { (cm) }
\] \& M1
A1

6 \& | FT 'their 2.8 ' provided $<4.2$. FT their outer and inner arcs provided derived from dimensionally correct formulae |
| :--- |
| CAO |
| Alternative: |
| use of mean arc, using mean radius 7 cm twice - must be convincing, then B1 mean radius, M2, A1 for mean arc used twice, then M1, A1 for perimeter | <br>

\hline
\end{tabular}

| Methods in Mathematics Unit 2 Higher Tier |  | Comments |
| :---: | :---: | :---: |
| 17. $\mathrm{EG}^{2}=7.8^{2}+5.5^{2}-2 \times 7.8 \times 5.5 \times \cos 136^{\circ}$ | M1 | or $\mathrm{EG}^{2}=152.809 \ldots$ or $\mathrm{EG}=\sqrt{152.809 \ldots}$ |
| $\mathrm{EG}=12.36 \ldots(\mathrm{~cm})$ | A1 |  |
| $\sin F=\frac{\sin 51^{\circ} \times 12.36 \ldots}{11.4}$ | M2 | FT 'their derived EG' provided M1 awarded <br> M 1 for $\sin \mathrm{F}=\sin 51^{\circ}$ or $12.36 \ldots=11.4$ |
|  |  |  |
| $\mathrm{F}=57.4 \ldots{ }^{\circ} \mathrm{AND}$ | A1 | $E G=12 \mathrm{~cm}$ gives 54.88.. ${ }^{\circ}$ |
| sight or use of $\mathrm{E}=180^{\circ}-51^{\circ}-\mathrm{F}\left(=71.57 \ldots{ }^{\circ}\right)$ |  | $\begin{aligned} & E G=12.3 \mathrm{~cm} \text { gives } 56.98 \ldots{ }^{\circ} \\ & E G=12.4 \mathrm{~cm} \text { gives } 57.7 . .^{\circ} \end{aligned}$ |
| Area EFG OR Area EHG | M1 | FT 'their EG' provided at least M2 previously awarded |
| $=1 / 2 \times 11.4 \times 12.36 \times \sin 71.6^{\circ} \quad=1 / 2 \times 7.8 \times 5.5 \times \sin 136^{\circ}$ |  | FT their correct evaluation of angle E from their angle F provided $<90^{\circ}$ and at least M2 previously awarded ( $\mathrm{E}=71.6^{\circ}$ ) |
| $=66.85\left(\ldots \mathrm{~cm}^{2}\right)$ | A1 | $\left(E=72^{\circ}, E G=12.4 \mathrm{~cm}\right.$ gives $\left.67\left(.22 . . \mathrm{cm}^{2}\right)\right)$ |
| $=14.9\left(. . \mathrm{cm}^{2}\right)$ | A1 | Accept 15( $\mathrm{cm}^{2}$ ) |
| Area EFGH 81.7(49... cm ${ }^{2}$ ) or $82\left(\mathrm{~cm}^{2}\right)$ | A1 | Accept other rounding, unrounded or truncated answers. FT provided at least one of the areas EFG or EHG is correct AND all M marks awarded |
|  | 9 |  |

GCSE Methods in Mathematics
Unit 2 Higher Tier MS Summer 2016

