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# **GCSE MARKING SCHEME**

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**SUMMER 2018**

**GCSE (NEW)  
MATHEMATICS – UNIT 2 (HIGHER TIER)  
3300U60-1**

## **INTRODUCTION**

This marking scheme was used by WJEC for the 2018 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 (NEW)**

**SUMMER 2018 MARK SCHEME**

<b>GCSE MATHEMATICS Unit 2 : Higher Tier Summer 2018</b>		<b>Mark</b>	<b>Comments</b>																																																	
1.(a)	8.27	B2	Mark final answer. B1 for sight of 8.26(.....) or for sight of 8.270 or for sight of 8.30 or for sight of 8.3																																																	
1.(b)	0.0213	B2	Mark final answer. B1 for sight of 0.0212(.....) Ignore 'recurring dot'.																																																	
2.(a)	48°	B1																																																		
2.(b)	East	B1																																																		
2.(c)	280°	B1																																																		
3.	<p>One correct evaluation <math>4 \leq x \leq 5</math>                  2 correct evaluations <math>4.25 \leq x \leq 4.45</math>,                  one <math>&lt; 0</math>, one <math>&gt; 0</math>.                  2 correct evaluations <math>4.25 \leq x \leq 4.35</math>,                  one <math>&lt; 0</math>, one <math>&gt; 0</math>.</p> <p align="center">( x = ) 4.3</p>	<p>B1</p> <p>B1</p> <p>M1</p> <p>A1</p>	<p><i>Correct evaluation regarded as enough to identify if negative or positive. If evaluations not seen accept 'too high' or 'too low'.</i>  <i>Look out for equating <math>x^3 - 7x = 51</math></i></p> <table border="0"> <tr> <td align="center"><math>x</math></td> <td align="center"><math>x^3 - 7x - 51</math></td> <td></td> <td></td> </tr> <tr> <td align="center">4</td> <td align="center">-15</td> <td></td> <td></td> </tr> <tr> <td align="center">4.1</td> <td align="center">-10.779</td> <td></td> <td></td> </tr> <tr> <td align="center">4.2</td> <td align="center">-6.312</td> <td align="center">4.25</td> <td align="center">-3.984...</td> </tr> <tr> <td align="center">4.3</td> <td align="center">-1.593</td> <td align="center">4.34</td> <td align="center">0.366...</td> </tr> <tr> <td align="center">4.4</td> <td align="center">3.384</td> <td align="center">4.35</td> <td align="center">0.862...</td> </tr> <tr> <td align="center">4.5</td> <td align="center">8.625</td> <td align="center">4.45</td> <td align="center">5.971...</td> </tr> <tr> <td align="center">4.6</td> <td align="center">14.136</td> <td></td> <td></td> </tr> <tr> <td align="center">4.7</td> <td align="center">19.923</td> <td></td> <td></td> </tr> <tr> <td align="center">4.8</td> <td align="center">25.992</td> <td></td> <td></td> </tr> <tr> <td align="center">4.9</td> <td align="center">32.349</td> <td></td> <td></td> </tr> <tr> <td align="center">5</td> <td align="center">39</td> <td></td> <td></td> </tr> </table> <p><i>For this question A1 can only be awarded if M1 given.</i></p>		$x$	$x^3 - 7x - 51$			4	-15			4.1	-10.779			4.2	-6.312	4.25	-3.984...	4.3	-1.593	4.34	0.366...	4.4	3.384	4.35	0.862...	4.5	8.625	4.45	5.971...	4.6	14.136			4.7	19.923			4.8	25.992			4.9	32.349			5	39		
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Organisation and Communication		OC1	For OC1, candidates will be expected to: <ul style="list-style-type: none"> <li>• present their response in a structured way</li> <li>• explain to the reader what they are doing at each step of their response</li> <li>• lay out their explanation and working in a way that is clear and logical</li> </ul>																																																	
Accuracy of writing		W1	For W1, candidates will be expected to: <ul style="list-style-type: none"> <li>• show all their working</li> <li>• make few, if any, errors in spelling, punctuation and grammar</li> <li>• use correct mathematical form in their working</li> <li>• use appropriate terminology, units, etc.</li> </ul>																																																	
4.(a)	225	B2	Mark final answer. Allow $\sqrt{225}$ (= 15) as an indication of correct answer and award B2. B1 for unambiguous indication that HCF is 15. B1 only for $15^2$ if not shown to be 225.																																																	
4.(b)	9.6	B2	Mark final answer. B1 for sight of 3.2.																																																	

<p>5. <math>(QR^2 =) 1.41^2 + 0.89^2</math>  <math>(QR^2) = 2.78(02)</math> or <math>(QR) = \sqrt{2.78(02)}</math>  <math>(QR =) 1.66(\dots)(m)</math> or <math>1.67 (m)</math> or <math>1.7(m)</math>  OR <math>166.7(\dots) cm</math> or <math>167cm</math></p>	<p>M1 A1 A1</p>	<p>Allow 2.8 for 2.78.  FT from M1 for the correctly evaluated square root of 'their 2.78(02)' provided their answer &gt; 1.41  Allow working in centimetres but penalise -1 from any A marks gained if units not shown for final answer  e.g. <math>QR^2 = 27802 (A1)</math> , <math>QR = 166.74 (A1)</math> then -1  BUT <math>QR = 166.74 cm</math> OR <math>167 cm</math> is M1A1A1.</p>
<p><u>Alternative method.</u>  <b>Correct use of 'two-step' trigonometric relationship.</b>    <math>(QR =) 1.66(\dots)(m)</math> or <math>1.67 (m)</math> or <math>1.7(m)</math>  OR <math>166.7(\dots) cm</math> or <math>167cm</math></p>	<p>M2  A1</p>	<p>A partial trigonometric method is M0.  C.A.O.</p>
<p>6.(a) 0.58 on 'Male' branch.   0.65 and 0.35 correctly shown on both pairs of branches.</p>	<p>B1  B2</p>	<p>B1 if correctly shown on one pair only.  SC1 if 0.65 and 0.35 consistently reversed on all branches.</p>
<p>6.(b) <math>0.42 \times 0.35</math>   = 0.147 or equivalent. ISW</p>	<p>M1  A1</p>	<p>FT 'their 0.35' (on 'uppermost train branch') provided less than 1</p>
<p>7.(a) <math>x = 3.2 \times \frac{8.4}{5.6}</math> OR <math>\frac{x}{3.2} = \frac{8.4}{5.6}</math> or equivalent.   <math>x = 4.8</math></p>	<p>M1  A1</p>	<p>M1 for correct <u>use</u> of linear ratio.</p>
<p>7.(b) <math>y = 6.3 \times \frac{5.6}{8.4}</math> OR <math>\frac{y}{6.3} = \frac{5.6}{8.4}</math> or equivalent.   <math>y = 4.2</math></p>	<p>M1  A1</p>	<p>M1 for correct <u>use</u> of linear ratio.   FT a slip in the calculation (<u>not a misuse</u>) of the scale factor in part (a) if used again in (b).</p>
<p>7.(c) Correct strategy of comparing corresponding ratio of lengths.   Indicates that <math>\frac{3.9}{6.5} (= 0.6)</math>  is not equal to <math>\frac{5.6}{8.4} (= 0.666\dots)</math> or equivalent.</p>	<p>S1  B1</p>	<p>Sight of 3.9 / 6.5 (or 6.5 / 3.9) along with any pair of corresponding lengths or scale factor used (or corresponding FT lengths from their answers in 7(a) or 7(b)).   Allow using FT values from 7(a) or 7(b).</p>
<p><u>Alternative method 1</u>  (If <math>CD = 3.9</math> then) <math>RS = 3.9 \times 1.5</math>  = '5.85 (cm)' or/and 'which is not 6.5'</p>	<p>S1 B1</p>	
<p><u>Alternative method 2</u>  (If <math>RS = 6.5</math> then) <math>CD = 6.5 \times \frac{2}{3}</math>  = '4.3... (cm)' or/and 'which is not 3.9'</p>	<p>S1 B1</p>	

<p>8. <math>2x - y = 6</math> or equivalent e.g. <math>12(2x - y) = 72</math> <math>3x + y = 16.5</math> or equivalent e.g. <math>3x + y + 3x + y = 33</math></p> <p>Correct method to solve simultaneous equations.</p> $x = 4.5$ $y = 3$	<p>B1 B1 M1 A1 A1</p>	<p>B1 for sight of correct equation. B1 for sight of correct equation. FT 'their two simultaneous equations'. Equating a variable (if necessary) AND adding or subtracting as appropriate. Allow one slip. C.A.O. from 'their equations' for 1<sup>st</sup> variable. F.T. from substituting 'their 1<sup>st</sup> variable' if M1 gained. SC1 if <math>x = 4.5</math> AND <math>y = 3</math> given without using simultaneous equations method. This could happen after a B1 (or B1B1) gained or just appear with no equations shown.</p>
<p>9.(a) <math>\tan \text{ACB} = \frac{6.5}{10.4}</math> (ACB =) <math>\tan^{-1} 0.625</math> or <math>\tan^{-1} (6.5 / 10.4)</math> (x) = <math>32^\circ</math></p>	<p>M1 A1 A1</p>	<p>M1 for equivalent complete method. C.A.O. (Implies previous A1.) Accept an answer that rounds to <math>32^\circ</math></p>
<p><u>Alternative method.</u> <b>Correct use of 'two-step' method.</b> (x) = <math>32^\circ</math></p>	<p>M2 A1</p>	<p>A partial trigonometric method is M0. Accept an answer that rounds to <math>32^\circ</math></p>
<p>9.(b) (DE =) <math>9.4 \times \sin[22 + 32]^\circ</math>  <math>= 7.6(\dots)(\text{cm})</math> ISW</p>	<p>M2 A1</p>	<p>FT <math>22^\circ +</math> 'their <math>32^\circ</math>'. M0 for using <math>\sin 22^\circ</math> or <math>\sin</math> 'their <math>32^\circ</math>' alone. M1 for <math>\frac{DE}{9.4} = \sin 54^\circ</math> <u>If no marks awarded</u> SC1 for a <u>correct</u> answer (1dp) using their clearly <u>stated</u> or <u>shown</u> angle (D)C(E), but not <math>22^\circ</math> or 'their <math>32^\circ</math>'.</p>
<p><u>Alternative method.</u> <b>Correct use of 'two-step' method.</b> (DE) = <math>7.6(\dots)(\text{cm})</math> ISW</p>	<p>M2 A1</p>	<p>A partial trigonometric method is M0.</p>
<p>10. <math>(2m + 17)(2m - 17)</math></p>	<p>B2</p>	<p>B1 for <math>(2m \dots 17)(2m \dots 17)</math> OR B1 for <math>(2m + \sqrt{289})(2m - \sqrt{289})</math> OR <math>4(m + 8.5)(m - 8.5)</math> OR <math>(4m + 34)(m - 8.5)</math> OR <math>(4m - 34)(m + 8.5)</math>. Mark final answer. Penalise -1 further work, e.g. solving an equation.</p>
<p>11. <math>13200 \times 460 \div 3</math> <math>= 2024000 (\text{cm}^3)</math> <math>= 2.024(\text{m}^3)</math></p>	<p>M1 A1 B1</p>	<p>Or equivalent. Strict FT of a correct conversion of their volume to <math>\text{m}^3</math>.</p>
<p><u>Alternative method</u> <u>Sight of 1.32 AND 4.6</u> <math>1.32 \times 4.6 \div 3</math> <math>= 2.024(\text{m}^3)</math></p>	<p>B1 M1 A1</p>	<p>FT 'their 1.32' and 'their 4.6' from place value errors for M1A1.</p>

<p>12.</p> <div style="display: flex; flex-direction: column; align-items: flex-start;"> <div style="margin-bottom: 10px;"> <math>x^2 - 4 = 0</math> </div> <div style="margin-bottom: 10px;"> <math>x(2x + 3) = 0</math> </div> <div style="margin-bottom: 10px;"> <math>(x - 1)(2x - 3) = 0</math> </div> <div style="margin-bottom: 10px;"> <math>(2x - 3)(2x + 3) = 0</math> </div> <div> <math>(4x + 9)^2 = 0</math> </div> </div> <div style="display: flex; flex-direction: column; align-items: flex-start; margin-top: 10px;"> <div style="margin-bottom: 5px;"><math>x = 1, x = -\frac{3}{2}</math></div> <div style="margin-bottom: 5px;"><math>x = 2, x = -2</math></div> <div style="margin-bottom: 5px;"><math>x = 1, x = \frac{3}{2}</math></div> <div style="margin-bottom: 5px;"><math>x = \frac{4}{9}</math></div> <div style="margin-bottom: 5px;"><math>x = -1, x = -\frac{12}{9}</math></div> <div style="margin-bottom: 5px;"><math>x = -\frac{2}{9}, x = \frac{12}{9}</math></div> <div style="margin-bottom: 5px;"><math>x = \frac{3}{2}, x = -\frac{3}{2}</math></div> <div style="margin-bottom: 5px;"><math>x = 1, x = -\frac{12}{9}</math></div> <div style="margin-bottom: 5px;"><math>x = -\frac{9}{4}</math></div> <div style="margin-bottom: 5px;"><math>x = 0, x = \frac{12}{9}</math></div> <div style="margin-bottom: 5px;"><math>x = \frac{81}{16}</math></div> <div style="margin-bottom: 5px;"><math>x = 0, x = -\frac{3}{2}</math></div> <div style="margin-bottom: 5px;"><math>x = \frac{3}{2}</math></div> <div> <math>x = -\frac{9}{4}, x = 0</math> </div> </div>	<p>B1</p> <p>B1</p> <p>B1</p> <p>B1</p>	<p>3<sup>rd</sup> box</p> <p>7<sup>th</sup> box</p> <p>9<sup>th</sup> box</p> <p>12<sup>th</sup> box</p>
<p>13.</p> $\frac{26.5 - 1.95}{0.815} \text{ or } \frac{24.55}{0.815}$ <p style="text-align: center;">= 30(.12...)</p>	<p>M2</p> <p>A1</p>	<p>If many attempts are offered without a method/answer being identified then mark final attempt. Award M1 for correct use of values <math>26.5 \leq a &lt; 27</math>, <math>1.9 &lt; b \leq 1.95</math> and <math>0.81 &lt; c \leq 0.815</math>. OR award M1 for use of 2 of the 3 correct limits.</p> <p>Mark final answer. Only award A1 if M2 gained. If no marks gained award SC1 for an unsupported answer of 30.12(...). Unsupported 30 or 30.1 gains no marks.</p>
<p>14. <math>AB = (191/360) \times 2 \times \pi \times 3.1</math> = 10.3(...cm)</p>	<p>M1</p> <p>A1</p>	<p>Sight of correct work to calculate major arc AB. Accept an answer in the range 10.2(cm) to 10.4(cm). Allow in terms of <math>\pi</math>, e.g. <math>\frac{5921}{1800}\pi</math>. Mark final answer. SC1 for 9.1(cm) to 9.2(cm), the minor arc AB. Must be convincing from <math>169/360 \times 2 \times \pi \times 3.1</math>.</p>
<p>15. Sight of <math>22x - 26 - 21x + 35</math> or equivalent.</p> <p>Denominator of <math>(3x - 5)(11x - 13)</math></p> $\frac{x+9}{(3x-5)(11x-13)} \text{ or } \frac{x+9}{33x^2-94x+65}$	<p>B2</p> <p>B1</p> <p>B1</p>	<p>Award B1 for sight of <math>2(11x - 13) - 7(3x - 5)</math> OR three of the four terms correct. Must be seen or stated as the denominator.</p> <p>CAO. Mark final answer.</p>
<p>16. <math>\frac{n}{200} \times \frac{n}{200} = 0.1369</math></p> <p><math>(n^2 =) 200 \times 200 \times 0.1369</math> OR <math>(n =) \sqrt{200 \times 200 \times 0.1369}</math> (Number of red beads =) 74</p>	<p>M2</p> <p>m1</p> <p>A1</p>	<p>Award M1 for <math>P(\text{Red}) \times P(\text{Red}) = 0.1369</math> or equivalent, e.g. <math>R(\text{ed}) \times R(\text{ed}) = 0.1369</math>; <math>P^2 = 0.1369</math>, etc. Where <math>n</math> is the number of red beads.</p>

<p><i>Alternative method</i>  <math>P(\text{Red}) \times P(\text{Red}) = 0.1369</math> or equivalent,  <math>(P(\text{Red})) = \sqrt{0.1369} (= 0.37)</math>  <math>(\text{Number of red beads}) = \sqrt{0.1369} \times 200</math>  <math>= 74</math></p>	<p>M1 m1 m1 A1</p>	<p>e.g. <math>R(\text{ed}) \times R(\text{ed}) = 0.1369</math>; <math>P^2 = 0.1369</math>, etc.   If an answer 74/200 is offered award M3A0, but '74 out of 200' gains full marks.</p>
<p>17. <math>6x^2 - 22x + 15x - 55 (= 7)</math>  <math>6x^2 - 7x - 62 = 0</math></p> $(x =) \frac{-(-7) \pm \sqrt{(-7)^2 - 4 \times 6 \times (-62)}}{2 \times 6}$ $= \frac{7 \pm \sqrt{1537}}{12}$ <p><math>x = 3.85</math> AND <math>x = -2.68</math> (answers to 2dp)</p>	<p>B1 B1  M1  A1  A1</p>	<p>CAO. '= 0' may be implied in further working.   FT 'their derived quadratic equation' set to zero and of equivalent level of difficulty (<math>a</math>, <math>b</math> and <math>c</math> are non-zero).  Allow one slip in substitution, but must be correct formula.  If one slip seen award A0.   CAO for 'their equation'.  Note: no marks to be awarded for 1 correct solution from trial and improvement.</p>
<p>18.  For sight of <math>gc^2 - v = c^2</math></p> $c^2(g - 1) = v \text{ OR } gc^2 - c^2 = v \text{ OR } -v = c^2 - gc^2$ $c^2 = \frac{v}{g-1} \text{ OR } \frac{-v}{1-g} = c^2$ $c = (\pm) \sqrt{\frac{v}{g-1}} \text{ OR } (\pm) \sqrt{\frac{-v}{1-g}}$	<p>B1  B1  B1  B1</p>	<p>FT a formula with three or more terms AND with at least two terms in <math>c^2</math>.  FT until 2<sup>nd</sup> error for equivalent level of difficulty.</p>

19.(a) $(AE^2 =) 8^2 + 11^2 - 2 \times 8 \times 11 \times \cos 31^\circ$ (AE =) 5.8(...cm)	M1 A2	Award A2 for an answer of 6(cm) from correct working. A1 for $(AE^2 =) 34.1(\dots)$
19.(b) $\sin CAE = \frac{8 \times \sin 31^\circ}{5.8(\dots)}$  (CAE=) 44.8(...°)  (CED=) 44.8(...°)	M2  A1  B1	FT 'their AE' from 19(a). Check the diagram. M1 for $\frac{\sin CAE}{8} = \frac{\sin 31^\circ}{5.8(\dots)}$ or equivalent Accept answers in the range 44.7° to 45.3°.  Strict FT of 'their CAE', provided not 31°. Must be convincing (check the diagram). Accept answers in the range 44.7° to 45.3°.
<u>Alternative method 1</u>  $\cos(CAE) = \frac{11^2 + 5.8(\dots)^2 - 8^2}{2 \times 11 \times 5.8(\dots)}$  (CAE=) 44.8(...°)  (CED=) 44.8(...°)	M2  A1  B1	FT 'their AE' from 19(a). Check the diagram. M1 for $8^2 = 11^2 + 5.8(\dots)^2 - 2 \times 11 \times 5.8(\dots) \times \cos(CAE)$ Accept answers in the range 44.7° to 45.3°.  Strict FT of 'their CAE', provided not 31°. Must be convincing (check the diagram). Accept answers in the range 44.7° to 45.3°.
<u>Alternative method 2 (Initially evaluating CEA)</u>  $\sin CEA = \frac{11 \times \sin 31^\circ}{5.8(\dots)}$ OR  $\cos CEA = \frac{5.8(\dots)^2 + 8^2 - 11^2}{2 \times 5.8(\dots) \times 8}$  (CEA=) 104.1(...) [or 75.8(...) from sine rule]  (CAE=) $180 - 31 - 75.8(\dots) = 73.2(\dots)$ or $180 - 31 - 104.1(\dots) = 44.8(\dots)$  (CED=) 44.8(...) or 73.2(...)	M2  A1  B1	FT 'their AE' from 19(a). Check the diagram. M1 for $\frac{\sin CEA}{11} = \frac{\sin 31^\circ}{5.8(\dots)}$ or equivalent OR  M1 for $11^2 = 5.8(\dots)^2 + 8^2 - 2 \times 5.8(\dots) \times 8 \times \cos CEA$ Accept answers in the range 103.7 to 104.3 or 75.7 to 77.7 OR 78.  Strict FT of 'their CAE', provided not 31°. Must be convincing (check the diagram). Accept answers in the range 44.7° to 45.3°.