GCSE Mathematics (1MA1) - Higher Tier Paper 3H
October 2016 mock paper mark scheme

## NOTES ON MARKING PRINCIPLES

## Guidance on the use of codes within this mark scheme

M1 - method mark. This mark is generally given for an appropriate method in the context of the question. This mark is given for showing your working and may be awarded even if working is incorrect.

P1 - process mark. This mark is generally given for setting up an appropriate process to find a solution in the context of the question.

A1 - accuracy mark. This mark is generally given for a correct answer following correct working.

B1 - working mark. This mark is usually given when working and the answer cannot easily be separated.

C1 - communication mark. This mark is given for explaining your answer or giving a conclusion in context supported by your working.

In some cases full marks can be given for a question or part of questions where no working is seen. However, it is wise to show working for one small slip could lead to all marks being lost if no working is shown.

Some questions (such as QWC) require all working to be shown; in such questions, no marks will be given for an answer with no working (even if it is a correct answer).

Note that in some cases a correct answer alone will not score marks unless supported by working; these situations are made clear in the mark scheme. Examiners are prepared to award zero marks if the student's response is not worthy of credit according to the mark scheme.

Question 1 (Total 3 marks)

| Part | Working or answer an examiner might <br> expect to see | Mark | Notes |
| :--- | :--- | :---: | :--- |
| $24,48,72,96,120, \ldots$ <br> $20,40,60,80,100,120, \ldots$ | P1 | This mark is given for a process to list <br> multiples of 24 and 20 with at least 3 <br> numbers in each list, or an expansion of <br> 24 and 20 into factors |  |
|  | 120 minutes (or 2 hours) | A1 | This mark is given for a correct answer <br> identifying the lowest common multiple <br> (LCM) |
|  | 9.30 a.m. | A1 | This mark is given for a correct answer <br> only |

## Question 2 (Total 2 marks)

| Part | Working or answer an examiner might <br> expect to see | Mark | Notes |
| :--- | :--- | :---: | :--- |
|  | $(x+5)^{2}(x+5)^{2}=$ | C1 | This mark is given for a correct for <br> expansion of $(x+5)^{2}$ with at least 3 terms <br> correct <br> or for a substitution of the same number <br> into both expressions (counterexample) |
|  | $(x+5)^{2}=x^{2}+10 x+25$ <br> Azmol is wrong; $x^{2}+10 x+25 \neq x^{2}+25$ for <br> all values of $x$ | C1 | This mark is given for a correct <br> evaluation of both expressions |

Question 3 (Total 4 marks)

| Part | Working or answer an examiner might <br> expect to see | Mark | Notes |
| :--- | :--- | :---: | :--- |
|  | $105 \div(5-2)(=35)$ <br> Kim gets $£ 70$, Molly gets $£ 175$ | P1 | This mark is given for a strategy to start <br> to solve the problem |
| $385-(2 \times 35)-(5 \times 35)(=140)$ <br> or <br> $(385 \div 35)-2-5(=4)$ | P1 | This mark is given for a process to find <br> Laura’s share |  |
| $\frac{140}{385} \times 100$ <br> or $\frac{4}{11} \times 100$ | P1 | This mark is given for a process to find <br> the percentage Laura gets |  |
| $36.4 \%$ | A1 | This mark is given for an answer in range <br> 36.3 to 36.4 |  |

## Question 4 (Total 2 marks)

| Part | Working an or answer examiner might <br> expect to see | Mark | Notes |
| :--- | :--- | :---: | :--- |
|  | Points are joined with a curve, not with <br> line segments | C 1 | This mark is given for a correct statement |
|  | Points should be plotted at mid-points of <br> the intervals, not end points | C 1 | This mark is given for a correct statement |

## Question 5 (Total 2 marks)

| Part | Working or answer an examiner might <br> expect to see | Mark | Notes |
| :--- | :--- | :---: | :--- |
|  | $5 \%=2.30 ; 100 \%=20 \times 2.30$ | M1 | This mark is given for a method to link $5 \%$ <br> with 2.30 or $100 \div 5(=20)$ |
|  | 46 | A1 | This mark is given for a correct answer <br> only |

Question 6 (Total 3 marks)

| Part | Working or answer an examiner might <br> expect to see | Mark | Notes |
| :--- | :--- | :---: | :--- |
|  | $(180 \times 3) \div 5(=108)$ <br> or <br> $360 \div 5(=72)$ | P1 | This mark is given for a process to find <br> either an interior or an exterior angle of <br> the pentagon $A B C D E$ |
|  | $F C D=C D F=72$ <br> $C F D=180-72-72$ | P1 | This mark is given for a complete process <br> to find angle $C F D$ |
| 36 | A1 | This mark is given for a correct answer <br> only |  |

Question 7 (Total 6 marks)

| Part | Working or answer an examiner might <br> expect to see | Mark | Notes |
| :---: | :--- | :---: | :--- |
| (a) | $\pi \times 4.2^{2}(\div 2)$ | P1 | This mark is given for a process to find <br> the area of circle or semicircle |
|  | $(8.4 \times 5.6)+\frac{\pi \times 4.2^{2}}{2}$ | P1 | This mark is given for a process to find <br> the area of the garden $(=74.7 \ldots)$ |
|  | $74.7 \div 12(=6.22$, so 7 boxes required $)$ | P1 | This mark is given for a process to find <br> number of boxes required |
|  | $7 \times 4.99$ | P1 | This mark is given for a process to find <br> the cost of 7 boxes |
|  | 34.93 | A1 | This mark is given for a correct answer <br> only |
| (b) | Carol might need to buy fewer boxes | C1 | This mark is given for a correct statement |

Question 8 (Total 4 marks)

| Part | Working or answer an examiner might expect to see | Mark | Notes |
| :---: | :---: | :---: | :---: |
|  | $\frac{4}{7}, \frac{3}{7}$ | B1 | This mark is given for two correct answers only |
|  | $\frac{3}{8}, \frac{5}{8}, \frac{3}{8}, \frac{5}{8}$ | B1 | This mark is given for four correct answers only |
|  | $\frac{3}{7} \times \frac{5}{8}$ | M1 | This mark is given for a method to find the probability of two red pens |
|  | $\frac{15}{56}$ | A1 | This mark is given for a correct answer only |

## Question 9 (Total 2 marks)

| Part | Working or answer an examiner might <br> expect to see | Mark | Notes |
| :---: | :--- | :---: | :--- |
| (i) | D | B1 | This mark is given for a correct answer <br> only |
| (ii) | A | B1 | This mark is given for a correct answer <br> only |

## Question 10 (Total 2 marks)

| Part | Working or answer an examiner might <br> expect to see | Mark | Notes |
| :--- | :--- | :---: | :--- |
|  | $12, m^{5}, r^{7}$ | M1 | This mark is given for 2 of 3 parts correct <br> in a product |
|  | $12 m^{5} r^{7}$ | A1 | This mark is given for a correct answer <br> only |

Question 11 (Total 6 marks) ************

| Part | Working or answer an examiner might <br> expect to see | Mark | Notes |
| :---: | :--- | :--- | :--- | :--- |
| (a) | $166-158=8$ | B1 | This mark is given for a correct answer <br> only |
| (b) |  | C1 | This mark is given for at least 2 correctly <br> plotted values, including box or whiskers / <br> tails, or 5 correct values and no whiskers / <br> tails |

## Question 12 (Total 4 marks)

| Part | $\begin{array}{l}\text { Working or answer an examiner might } \\ \text { expect to see }\end{array}$ | Mark | Notes |
| :--- | :--- | :---: | :--- |
| $\begin{array}{ll}3 \times 20 \times 120(=7200) & \text { P1 } \\ \begin{array}{ll}8000 \div 7200 \\ \text { or } \\ 1030 \div 1000\end{array} & \begin{array}{l}\text { This mark is given for a process to find } \\ \text { volume of the piece of wood }\end{array} \\ \hline & 1.11 \ldots \text { and } 1.03 \ldots\end{array} \begin{array}{l}\text { This mark is given for a process to find a } \\ \text { density of the piece of wood or the density } \\ \text { of the sea water }\end{array}$ |  |  |  |
|  | $\begin{array}{l}\text { The piece of wood will not float since it } \\ \text { has a greater density than the sea water } \\ (1.11>1.03)\end{array}$ | P1 | $\begin{array}{l}\text { This mark is given for a complete process } \\ \text { to find two densities to be compared }\end{array}$ |
|  |  |  |  |
|  |  |  |  |$]$.

## Question 13 (Total 7 marks)

| Part | Working an or answer examiner might <br> expect to see | Mark | Notes |
| :---: | :--- | :---: | :--- |
| (a) | $x^{2}+5 x-4=-4$ when $x=0$, <br> $x^{2}+5 x-4=2$ when $x=1$ | M1 | This mark is given for a method to <br> establish at least one root in the interval <br> $0<x<1$ |
|  | Since there is a sign change, there must be <br> at least one root in $0<x<1$ | C 1 | This mark is given for a correct statement |
| (b) | $x^{3}+5 x=4$ <br> $x^{2}+5=\frac{4}{x}$ | C1 | This mark is given for at least one correct <br> step in rearrangement |
| $x=\frac{4}{x^{2}+5}$ | C1 | This mark is given for a fully correct <br> chain of reasoning |  |
| (c) | $x_{1}=0.8$ or $x_{1}=\frac{4}{5}$ | B1 | This mark is given for a correct answer <br> only |
|  | $x_{2}=\frac{4}{(0.8)^{2}+5}$ | M1 | This mark is given for a method to <br> substitute $x_{1}$ into the iteration formula to |
| find $x_{2}$ |  |  |  |$|$| This mark is given for a correct answer |
| :--- |
| only |

Question 14 (Total 3 marks)

| Part | Working or answer an examiner might <br> expect to see | Mark | Notes |
| :--- | :--- | :--- | :--- |
| $0.5=\left(1-\frac{x}{100}\right)^{8}$ or $0.5=r^{8}$ M1This mark is given for a method to <br> determine an equation to solve the <br> problem |  |  |  |
|  | $r=\sqrt[8]{0.5}=0.917(\ldots)$ | M1 | This mark is given for a method to solve <br> the equation found |
|  | A1 | This mark is given for an answer in the <br> range $8.29-8.3$ |  |

## Question 15 (Total 2 marks)

| Part | Working or answer an examiner might <br> expect to see | Mark | Notes |
| :--- | :--- | :---: | :--- |
|  | $160 \div(10 \div 8)^{2}$ <br> or <br> $160 \times(8 \div 10)^{2}$ | M1 | This mark is given for a method to <br> determine the ratio of the areas and so <br> find the area of the base of pot A |
|  | 102.4 | A1 | This mark is given for a correct answer <br> only |

Question 16 (Total 5 marks)

| Part | Working or answer an examiner might expect to see | Mark | Notes |
| :---: | :---: | :---: | :---: |
|  | $\begin{aligned} & a: 6.425 \text { or } 6.435(\text { or } 6.434999 \ldots) \\ & b: 5.5135 \text { or } 5.5145(\text { or } 5.5144999 \ldots) \end{aligned}$ | B1 | This mark is given for finding a bound of $a$ or a bound of $b$ |
|  |  | P1 | This mark is given for a process to use the upper bounds and lower bounds in an expression |
|  | $\begin{aligned} & \text { Lower bound for } v=\sqrt{\frac{6.425}{5.5145}} \\ & \text { Upper bound for } v=\sqrt{\frac{6.435}{5.5135}} \end{aligned}$ | P1 | This mark is given for choosing the correct upper and lower bounds |
|  | $\begin{aligned} & \sqrt{\frac{6.425}{5.5145}}=1.079(4027 \ldots) \\ & \sqrt{\frac{6.435}{5.5135}}=1.080(3403 \ldots) \end{aligned}$ | A1 | This mark is given for finding 1.079... and $1.080 \ldots$ (both values must clearly come from correct working) |
|  | 1.08; both the upper bound and the lower bound round to this value | C1 | This mark is given for a correct answer and explanation |

## Question 17 (Total 3 marks)

| Part | Working or answer an examiner might <br> expect to see | Mark | Notes |
| :--- | :--- | :---: | :--- |
|  | Volume of cylinder $=\pi \times(3 x)^{2} \times h$ <br> Volume of one sphere $=\frac{4}{3} \pi \times\left(\frac{1}{2} x\right)^{3}$ | P1 | This mark is given for a process of <br> substituting to find volume of cylinder <br> and volume of sphere |
|  |  | P1 | This mark is given for a process to for <br> forming a correct equation |
|  | Cancelling, $x^{2} h=5 x^{3}$ <br> $(h=) 5 x$ | A1 | This mark is given for a correct answer <br> only |

Question 18 (Total 4 marks)

| Part | Working or answer an examiner might <br> expect to see | Mark | Notes |
| :--- | :--- | :---: | :--- |
|  | $(5+m) f=4-3 m$ | M1 | This mark is given for a method to for <br> multiplying both sides by $5+m$ as a first <br> step |
|  | $f m+3 m=4-5 f$ | M1 | This mark is given for a method to for <br> correctly moving their $m$ terms to one <br> side and their other terms to the other side |
|  | $(f+3) m=4-5 f$ | M1 | This mark is given for a method to for <br> factorising |
|  | $m=\frac{4-5 f}{f+3}$ | A1 | This mark is given for a correct answer <br> only |

## Question 19 (Total 5 marks)

| Part | Working or answer an examiner might expect to see | Mark | Notes |
| :---: | :---: | :---: | :---: |
|  | $\tan 34^{\circ}=\frac{C D}{20}, C D=20 \tan 34^{\circ}=13.49$ | P1 | This mark is given for a process to process to find the length of $C D$ |
|  | $\cos 34^{\circ}=\frac{20}{B D}, \quad B D=\frac{20}{\cos 34^{\circ}}=24.12$ <br> or $\begin{aligned} & B D^{2}=20^{2}+C D^{2}=400+181.98=581.98 \\ & B D=\sqrt{ } 581.98=24.12 \end{aligned}$ | P1 | This mark is given for a process to process to find the length of $B D$ |
|  | $\begin{aligned} & \frac{A D}{\sin 60^{\circ}}=\frac{B D}{\sin (180-60-45)^{\circ}} \\ & A D=\frac{B D}{\sin 75^{\circ}} \times \sin 60^{\circ}=21.63 \end{aligned}$ | P1 | This mark is given for using the sine rule to find the length of $A D$ |
|  | $\sin D A C=\frac{D C}{A D}=0.624$ | P1 | This mark is given for a process to process to find $\sin D A C$ |
|  | $\angle D A C=38.6$ | A1 | This mark is given for a correct answer only answer in range 38.5-38.6 |

Question 20 (Total 7 marks)

| Part | Working an or answer examiner might expect to see | Mark | Notes |
| :---: | :---: | :---: | :---: |
|  | $(-4)^{2}+2=18$ | B1 | This mark is given for a correct answer only |
|  | $(2 x-3)^{2}+2$ | C1 | This mark is given for a correct first step |
|  | $\begin{aligned} & =4 x^{2}-6 x-6 x+9+2 \\ & =4 x^{2}-12 x+11 \end{aligned}$ | C1 | This mark is given for a correct fully correct chain of reasoning that the includes correct expansion of $(2 x-3)^{2}$ |
|  | $2\left(x^{2}+2\right)-3=4 x^{2}-12 x+11$ | P1 | This mark is given for a process to process to find $\operatorname{fg}(x)$ and form an equation |
|  | $\begin{aligned} & 2 x^{2}+1=4 x^{2}-12 x+11 \\ & 2 x^{2}-12 x+10=0 \end{aligned}$ | P1 | This mark is given for a process to reduce the equation to the form $a x^{2}+b x+c=0$ |
|  | $(2 x-2)(x-5)=0$ | P1 | This mark is given for a process to solve the quadratic equation |
|  | $x=1, x=5$ | A1 | This mark is given for a correct answer only |

## Question 21 (Total 4 marks)

| Part | Working or answer an examiner might expect to see | Mark | Notes |
| :---: | :---: | :---: | :---: |
|  | angles at a point add up to $360^{\circ}$ $x+y=360^{\circ}$ | C1 | This mark is given for drawing $A O$ and $O C$ and considering angles around the point $O$ |
|  | The angle at the centre of a circle is twice the angle at the circumference $\angle A B C=\frac{1}{2} x \quad \text { or } \quad \angle A D C=\frac{1}{2} y$ | C1 | This mark is given for a correct use of "angle at centre..." to find angle $A B C$ or angle $A D C$ |
|  | $\begin{aligned} & \angle A B C+\angle A D C=\frac{1}{2} x+\frac{1}{2} y \\ & =\frac{1}{2}(x+y)=\frac{1}{2}\left(360^{\circ}\right)=180^{\circ} \end{aligned}$ | C1 | This mark is given for a conclusion |
|  |  | C1 | This mark is given for a correct complete proof with all reasons given <br> NB: "opposite angles of a cyclic quadrilateral add up to $180^{\circ} "$ is not acceptable |

