

Mark Scheme Mock Paper

GCSE

GCSE Applications of Mathematics (Pilot)
Paper: 5AM2H / 01

NOTES ON MARKING PRINCIPLES

- 1 All candidates must receive the same treatment. Examiners must mark the first candidate in exactly the same way as they mark the last.
- 2 Mark schemes should be applied positively. Candidates must be rewarded for what they have shown they can do rather than penalised for omissions.
- 3 All the marks on the mark scheme are designed to be awarded. Examiners should always award full marks if deserved, i.e if the answer matches the mark scheme. Examiners should also be prepared to award zero marks if the candidate's response is not worthy of credit according to the mark scheme.
- 4 Where some judgement is required, mark schemes will provide the principles by which marks will be awarded and exemplification may be limited.
- 5 Crossed out work should be marked UNLESS the candidate has replaced it with an alternative response.
- 6 Mark schemes will indicate within the table where, and which strands of QWC, are being assessed. The strands are as follows:
 - i) *ensure that text is legible and that spelling, punctuation and grammar are accurate so that meaning is clear*
Comprehension and meaning is clear by using correct notation and labeling conventions.
 - ii) *select and use a form and style of writing appropriate to purpose and to complex subject matter*
Reasoning, explanation or argument is correct and appropriately structured to convey mathematical reasoning.
 - iii) *organise information clearly and coherently, using specialist vocabulary when appropriate.*
The mathematical methods and processes used are coherently and clearly organised and the appropriate mathematical vocabulary used.

7 With working

If there is a wrong answer indicated on the answer line always check the working in the body of the script (and on any diagrams), and award any marks appropriate from the mark scheme.

If working is crossed out and still legible, then it should be given any appropriate marks, as long as it has not been replaced by alternative work.

If it is clear from the working that the “correct” answer has been obtained from incorrect working, award 0 marks. Send the response to review, and discuss each of these situations with your Team Leader.

If there is no answer on the answer line then check the working for an obvious answer.

Any case of suspected misread loses A (and B) marks on that part, but can gain the M marks. Discuss each of these situations with your Team Leader.

If there is a choice of methods shown, then no marks should be awarded, unless the answer on the answer line makes clear the method that has been used.

8 Follow through marks

Follow through marks which involve a single stage calculation can be awarded without working since you can check the answer yourself, but if ambiguous do not award.

Follow through marks which involve more than one stage of calculation can only be awarded on sight of the relevant working, even if it appears obvious that there is only one way you could get the answer given.

9 Ignoring subsequent work

It is appropriate to ignore subsequent work when the additional work does not change the answer in a way that is inappropriate for the question: e.g. incorrect canceling of a fraction that would otherwise be correct

It is not appropriate to ignore subsequent work when the additional work essentially makes the answer incorrect e.g. algebra.

Transcription errors occur when candidates present a correct answer in working, and write it incorrectly on the answer line; mark the correct answer.

10 Probability

Probability answers must be given a fractions, percentages or decimals. If a candidate gives a decimal equivalent to a probability, this should be written to at least 2 decimal places (unless tenths).

Incorrect notation should lose the accuracy marks, but be awarded any implied method marks.

If a probability answer is given on the answer line using both incorrect and correct notation, award the marks.

If a probability fraction is given then cancelled incorrectly, ignore the incorrectly cancelled answer.

11 Linear equations

Full marks can be gained if the solution alone is given on the answer line, or otherwise unambiguously indicated in working (without contradiction elsewhere). Where the correct solution only is shown substituted, but not identified as the solution, the accuracy mark is lost but any method marks can be awarded.

12 Parts of questions

Unless allowed by the mark scheme, the marks allocated to one part of the question CANNOT be awarded in another.

13 Range of answers

Unless otherwise stated, when an answer is given as a range (e.g 3.5 - 4.2) then this is inclusive of the end points (e.g 3.5, 4.2) and includes all numbers within the range (e.g 4, 4.1)

Guidance on the use of codes within this mark scheme

M1 - method mark
A1 - accuracy mark
B1 - Working mark
C1 - communication mark
QWC - quality of written communication
oe - or equivalent
cao - correct answer only
ft - follow through
sc - special case
dep - dependent (on a previous mark or conclusion)
indep - independent
isw - ignore subsequent working

5AM2H_01				
Question	Working	Answer	Mark	Notes
1 (a)	$1-(0.2+0.4+0.1)$	0.3	2	M1 for $1-(0.2+0.4+0.1)$ A1 for 0.3
(b)	200×0.2	40	2	M1 for 200×0.2 A1 for 40 NB: B1 for 40 out of 200, B0 for 40/200 oe
(c)	$1000 \left(\frac{\pi \times 2.69^2 \times 4.49}{6} + 3 \right)$ $=1000(17.011\dots+3) =$	20 000	2	M1 substitution of figures into the formula A1 answer in the range 20 000 - 20 100
2 (a)		Diagram	2	B2 for trapezium (base 5cm, ht 2cm, top 3cm) (B1 for a trapezium with exactly two right angles)
(b)		Diagram	2	B2 for a rectangle with length 5 cm and width 2cm and a line at 3cm from one edge (B1 for rectangle length 5 cm or width 2 cm or for rectangle with an interior line parallel to the shorter sides, do not accept a square; B0 for nets) Note: orientation must be correct in (a), ignore in (b) Do not accept extra lines in (a) or (b).
(c)	area of front face: $\frac{1}{2} \times 2 \times (3+5)$ (=8) $8 \times 2 =$	16	3	M1 for substitution of figures into trapezium formula: $\frac{1}{2} \times 2 \times (3+5)$ oe eg division in to triangle & rectangle M1 for "area" $\times 2$ A1 cao

5AM2H_01				
Question	Working	Answer	Mark	Notes
3	eg $2n, 3n, 4n$ (any integer n) $4n - 2n = 12$ $n = 6$	12 18 24	3	M1 for writing multiples of 2:3:4 or for two figures for Amy & Colin with a difference of 12, or 12:24 seen, or introduces an algebraic equivalent M1 for $2:3:4 \times 12$, or a factor of 12 used with algebra A1 for all of 12, 18, 24 SC B2 for 12, 18, 24 given but on the wrong answer lines
4	18 30 to 22 15 is 3 h 45 min 23 15 to 00 30 is 1 h 15 min $3 \text{ h } 45 \text{ min} + 1 \text{ h } 15 \text{ min} = 5 \text{ h}$ $600 \div 5 =$	120	5	M1 attempt at a single time duration eg 3 h 45 min, 1 h 15 min or in minutes M1 “3 h 45 min” + “1 h 15 min” A1 for 5 h oe M1 distance \div time A1 cao
5 (a)	$\frac{135}{18} \times 12 = 7.5 \times 12 =$	90	2	M1 for $135/18$ or sight of 7.5 or $18:12=135:x$ A1 cao
(b)	$5 + 1 = 6$ $54 \div 6 = 9$ 5×9	45	2	M1 for $5 \div (5+1) \times 54$ or $1 \div (5+1) \times 54$ or $54 \div "5+1"$ or 54×5 or 270 or 9:45 A1 for 45 cao

5AM2H_01				
Question	Working	Answer	Mark	Notes
6 (a)		Line	2	B2 line drawn $\pm 2\text{mm}$ from accurate line, crossing AB and CD (B1 a straight line which crosses AB within a line drawn $\pm 2\text{mm}$ from accurate line, and also crossed CD) NB: accept dotted or dashed lines, but not curves; accept freehand if considered to be straight
(b)		Region	2	B2 correct arc $\pm 2\text{mm}$ and shaded within. Allow dotty or continuous arc. (B1 inaccurate arc and shaded or accurate arc unshaded).
7	$5 \times 5 \times 6$ Alternative: $40 \times 40 \times 60 \div 8 \times 8 \times 10$	150	4	M1 for attempt at 1 division (eg $40 \div 8$), may be implied by marks or number on one edge of diagram or by 5 or 6 seen M1 for attempt at 3 divisions ($40 \div 8$, $40 \div 8$, $60 \div 10$), may be implied by marks or numbers on diagram or by 5, 5 and 6 seen. M1 (dep on 1 st M1) for “5” \times “5” \times “6” A1 cao Alternative M1 for $40 \times 40 \times 60$ or $8 \times 8 \times 10$ or 96000 or 640 seen M1 for $40 \times 40 \times 60$ and $8 \times 8 \times 10$ or 96000 and 640 seen M1 (dep on 1 st M1) for “(40 \times 40 \times 60)” \div “(8 \times 8 \times 10)” A1 cao

APPLICATIONS OF MATHEMATICS

5AM2H_01				
Question	Working	Answer	Mark	Notes
8		$N=4p+20b$	3	B3 for $N=4p+20b$ (B2 $4p+20b$ as an expression not in a formula or $N=k+20b$ oe or $N=4p+k$ oe $k \neq 0$) (B1 for $N=cp+db$, c and d numerical and not both zero or $k+20b$ oe or $4p+k$ oe any $k \neq 0$) SC B2 for $N=4p+20b$ subsequently incorrectly simplified or for $kN=4p+20b$ ($k \neq 1$) SC B1 for $4p+20b$ subsequently incorrectly simplified or for $N=4p$ (space) $20b$ or $N=4p \times 20b$
9 (a)	$50 \times \frac{2000}{500}$	200	2	M1 for $\frac{2000}{500}$ or 4 seen A1 cao
(b)	$400 \times \frac{750}{500}$	600	2	M1 for $\frac{750}{500}$ or 1.5 seen or $400 + 200$ A1 cao

5AM2H_01				
Question	Working	Answer	Mark	Notes
10	Per hour: $150 \times 3 = 450$ per h $13500 \div 450 = 30$ hours 8am Mon to 1pm Thu: 28h $30 - 28 =$ or Monday, Tuesday, Wed 8h Thurs 4 h totalling 28 h No of pieces: $28 \times 3 \times 150 = 12600$ Extra needed = 900 ie 300 each machine $300 \div 150 = 2$ h overtime	2	5	M1 Per hour: $150 \times 3 (= 450)$ M1 $13500 \div 450 (= 30)$ M1 8am Mon to 1pm Thu: 28h M1 "30" - "28" = A1 cao OR M1 $13500 \div 150 (=90)$ M1 $90 \div 3 (=30)$ M2 8am Mon +30h = 3pm Thu (M1 for arriving at 3pm Thu) A1 cao OR M1 Mon+Tue+Wed+Thu= $8+8+8+4 (=28$ h) M1 Pieces: $28 \times 3 \times 150 (=12600)$ M2 $900 \div 3 \div 150$ (M1 $900 \div 3$ or 3×150 or $900 \div 150$ etc) A1 cao
11	$\pi \times 32 \times 20 \times 0.6 =$	339 - 340	3	M1 for $\pi \times 32 \times 20$ or "vol" $\times 0.6$ M1 for $\pi \times 32 \times 20 \times 0.6$ A1 339-340
12	$\tan x = \frac{1.9}{3.2}$ $x = \tan^{-1} \left(\frac{1.9}{3.2} \right) (=30.7)$ 90 + "30.7"	121	4	$M1 \text{ for } \tan x = \frac{1.9}{3.2} \text{ or } \tan \frac{1.9}{3.2}$ $M1 \text{ for } x = \tan^{-1} \left(\frac{1.9}{3.2} \right)$ A1 for 30.6-30.7 B1 (indep) ft for 90 + "30.7" rounded to 3 or 4 sf

5AM2H_01																
Question	Working	Answer	Mark	Notes												
13	Monday x Tuesday $2x$ Wednesday $2x+20$ Thursday x Friday 200 Total: $6x+220$ $6x+220 > 1000$ $6x > 780, x > 130$	130, 131	5	M1 for an attempt to express algebraically (at least 3 correct, could be ft) or as ratios M1 expressions stated for all 5 days (could be ft from Monday) M1 totaled and inequality stated or deduced from ratios M1 attempt to simplify inequality A1 for 130 or 131												
14 (a)		0.85 0.95, 0.15, 0.85	2	B1 0.85 B1 0.95, 0.15, 0.85												
(b)	$0.15 \times 0.05 =$	0.0075	2	M1 0.15×0.05 A1 0.0075 oe												
(c)(i)	NOT sampled is $1-(p-0.1)$ $p \times (1-(p-0.1)) = 1.1p-p^2$ $1.1p-p^2 = 0.01$	0.009	7	M1 NOT sampled is $1-(p-0.1)$ M1 $p \times (1-(p-0.1))$ A1 $1.1p-p^2$ M1 $1.1p-p^2 = 0.01$												
(ii)	<table border="1" style="width: 100%; text-align: center;"> <tr> <td>0</td> <td>0 less</td> </tr> <tr> <td>1</td> <td>0.1 more</td> </tr> <tr> <td>0.1</td> <td>0.1 more</td> </tr> <tr> <td>0.01</td> <td>0.0109 more</td> </tr> <tr> <td>0.009</td> <td>0.009819 less</td> </tr> <tr> <td>0.0095</td> <td>0.01036 more</td> </tr> </table>	0	0 less	1	0.1 more	0.1	0.1 more	0.01	0.0109 more	0.009	0.009819 less	0.0095	0.01036 more			B1 for a trial $0.009 \leq p \leq 0.01$ B1 for a different trial $0.009 \leq p < 0.01$ B1 (dep on at least one previous B1) for 0.009 NB: no working scores no marks in (ii) even if the answer is correct. Trials must be evaluated for the award of B marks.
0	0 less															
1	0.1 more															
0.1	0.1 more															
0.01	0.0109 more															
0.009	0.009819 less															
0.0095	0.01036 more															

5AM2H_01				
Question	Working	Answer	Mark	Notes
15	Height: $h = \sqrt{3^2 - 2^2} = \sqrt{5} = 2.236$ Vol of one pyramid: $\frac{1}{3} \times (10.4 \div 6) \times 2.236 = 1.29..$ Vol of tent = $6 \times 1.29..$	7.75	4	M1 to find the height $h = \sqrt{3^2 - 2^2}$ A1 for 2.236... M1 for method to find the volume of the tent or 1/6 of the tent as a pyramid A1 for 7.7-7.8
16 (a)	T=km $k=600/250$ $T=600/250 \times 400$	960	3	M1 for T=km or $600/250 = T/400$ oe M1 for (k=) $600/250 (=2.4)$ or (T=) $400 \times 600/250$ A1 cao
(b)	$T=K/P$ $T=(1400 \times 360)/900$	560	3	M1 for $T=K/P$ or $T/1400 = 360/900$ oe M1 for (K=) 1400×360 or $360=K/1400$ or (K=) 504000 or (T=) $(360 \times 1400)/900$ oe A1 cao
17 (a)		9.5577746	3	B1 upper bound =100.5 M1 for greatest distance divided by least time where $99.5 < \text{greatest distance} \leq 100.5$, $10.51 \leq \text{least time} < 10.52$ A1 for 9.555 - 9.56
(b)		9.45368..	3	B1 lower bound = 10.515 M1 for least distance divided by greatest time where $99.5 \leq \text{least distance} < 100$, $10.52 < \text{greatest time} \leq 10.53$ A1 for 9.45-9.455

5AM2H_01				
Question	Working	Answer	Mark	Notes
18	$\left(\frac{3}{9} \times \frac{2}{8}\right) + \left(\frac{3}{9} \times \frac{4}{8}\right) + \left(\frac{2}{9} \times \frac{3}{8}\right) + \left(\frac{2}{9} \times \frac{4}{8}\right)$ $+ \left(\frac{4}{9} \times \frac{3}{8}\right) + \left(\frac{4}{9} \times \frac{2}{8}\right)$ $= \frac{6+12+6+8+12+8}{72} =$ <p>OR</p> $1 - \left(\frac{3}{9} \times \frac{2}{8}\right) - \left(\frac{2}{9} \times \frac{1}{8}\right) - \left(\frac{4}{9} \times \frac{3}{8}\right)$ $= 1 - \frac{6+2+12}{72} = \frac{72-20}{72} =$	$\frac{52}{72}$	5	<p>M1 for use of 8 as denominator for 2nd probability</p> <p>M2 for $\left(\frac{3}{9} \times \frac{2}{8}\right)$</p> <p>or $\left(\frac{3}{9} \times \frac{4}{8}\right)$ or $\left(\frac{2}{9} \times \frac{3}{8}\right)$ or $\left(\frac{2}{9} \times \frac{4}{8}\right)$ or $\left(\frac{4}{9} \times \frac{3}{8}\right)$ or $\left(\frac{4}{9} \times \frac{2}{8}\right)$</p> <p>or $\left(\frac{3}{9} \times \frac{2}{8}\right)$ or $\left(\frac{2}{9} \times \frac{1}{8}\right)$ or $\left(\frac{4}{9} \times \frac{3}{8}\right)$</p> <p>(M1 for at least 3 of these)</p> <p>M1</p> <p>for $\left(\frac{3}{9} \times \frac{2}{8}\right) + \left(\frac{3}{9} \times \frac{4}{8}\right) + \left(\frac{2}{9} \times \frac{3}{8}\right) + \left(\frac{2}{9} \times \frac{4}{8}\right) + \left(\frac{4}{9} \times \frac{3}{8}\right) + \left(\frac{4}{9} \times \frac{2}{8}\right)$</p> <p>OR $1 - \left(\frac{3}{9} \times \frac{2}{8}\right) - \left(\frac{2}{9} \times \frac{1}{8}\right) - \left(\frac{4}{9} \times \frac{3}{8}\right)$</p> <p>(M0 without the "1-")</p> <p>A1 for $\frac{52}{72}$</p>

APPLICATIONS OF MATHEMATICS

5AM2H_01				
Question	Working	Answer	Mark	Notes
19 (a)		1 - 1.5	3	M1 for tangent drawn at T=20 M1 attempt to find gradient of line eg $70 \div 58$ A1 gradient in the range 1 to 1.5
(b)	Example: $10(80+45)=10 \times 125=1250$ $10(45+30)=10 \times 75=750$ $10(30+35)=10 \times 65=650$ $10(35+60)=10 \times 95=950$ Total = $10 \times 360=$	3600	3	M1 division of area into trapezia M1 use of trapezia (oe) to calculate area A1 for 3600

5AM2H_01				
Question	Working	Answer	Mark	Notes
20	<p>Growth factor = $\frac{100+x}{100}$</p> $546 \times \left(\frac{100+x}{100}\right)^2 = 813$ $\left(\frac{100+x}{100}\right)^2 = \frac{813}{546} = 1.489$ $(100-x)/100 = \sqrt{1.489} = 1.22$ <p>$x = 22$ or 22% per annum $546 \times (1.22)^5 = 1475$ but $546 \times (1.22)^6 = 1800$</p> <p>OR</p> <p>Growth modelled by $p=ka^t$ $t=0$ in January 2008 $546 = ka^0$, so $k=546$ $p=546a^t$ When $t=2$, $813=546a^2$; $a=1.22..$ $p=546 \times 1.22^t$ $1500/546 = 1.22^t = 2.747..$ when $t=5$ $1.22^5 = 2.702$ when $t=6$ $1.22^6 = 3.29$ so will exceed before Jan 2014</p>	2013	5	<p>M1 for introducing a fully defined growth factor eg Growth factor = $\frac{100+x}{100}$</p> <p>M1 $546 \times \left(\frac{100+x}{100}\right)^2 = 813$ or</p> $\left(\frac{100+x}{100}\right)^2 = \frac{813}{546} = 1.489$ <p>M1 $(100-x)/100 = \sqrt{1.489} (= 1.22)$ leading to $x = -22$ or 22% per annum M1 $546 \times (1.22)^5 = 1475$ or $546 \times (1.22)^6 = 1800$ A1 cao</p> <p>OR</p> <p>M1 for introducing a fully defined growth factor eg $p=ka^t$ M1 $546 = ka^0$ at $t=0$, or $k=546$ or $p=546a^t$ M1 for use when $t=2$ eg when $t=2$, $813=546a^2$; $a=1.22..$ $p=546 \times 1.22^t$ M1 when $t=5$ $1.22^5 = 2.702$ or when $t=6$ $1.22^6 = 3.29$ A1 cao</p>