Version : 1.0.0610

General Certificate of Education
June 2010

Applying Mathematics UOM4/2

Advanced Subsidiary Level

Final

Mark Scheme

Mark schemes are prepared by the Principal Examiner and considered, together with the relevant questions, by a panel of subject teachers. This mark scheme includes any amendments made at the standardisation meeting attended by all examiners and is the scheme which was used by them in this examination. The standardisation meeting ensures that the mark scheme covers the candidates' responses to questions and that every examiner understands and applies it in the same correct way. As preparation for the standardisation meeting each examiner analyses a number of candidates' scripts: alternative answers not already covered by the mark scheme are discussed at the meeting and legislated for. If, after this meeting, examiners encounter unusual answers which have not been discussed at the meeting they are required to refer these to the Principal Examiner.

It must be stressed that a mark scheme is a working document, in many cases further developed and expanded on the basis of candidates' reactions to a particular paper. Assumptions about future mark schemes on the basis of one year's document should be avoided; whilst the guiding principles of assessment remain constant, details will change, depending on the content of a particular examination paper.

Set and published by the Assessment and Qualifications Alliance.

The Assessment and Qualifications Alliance (AQA) is a company limited by guarantee registered in England and Wales (company number 3644723) and a registered charity (registered charity number 1073334).
Registered address: AQA, Devas Street, Manchester M15 6EX

Key to mark scheme and abbreviations used in marking

M	mark is for method
m or dM	mark is dependent on one or more M marks and is for method
A	mark is dependent on M or m marks and is for accuracy
B	mark is independent of M or m marks and is for method and accuracy
E	mark is for explanation

√or ft or F	follow through from previous incorrect result	MC	mis-copy
CAO	correct answer only	MR	mis-read
CSO	correct solution only	RA	required accuracy
AWFW	anything which falls within	FW	further work
AWRT	anything which rounds to	ISW	ignore subsequent work
ACF	any correct form	FIW	from incorrect work
AG	answer given	BOD	given benefit of doubt
SC	special case	WR	work replaced by candidate
OE	or equivalent	FB	formulae book
A2,1	2 or 1 (or 0) accuracy marks	NOS	not on scheme
–*x* EE	deduct *x* marks for each error	G	graph
NMS	no method shown	c	candidate
PI	possibly implied	sf	significant figure(s)
SCA	substantially correct approach	dp	decimal place(s)

No Method Shown

Where the question specifically requires a particular method to be used, we must usually see evidence of use of this method for any marks to be awarded. However, there are situations in some units where part marks would be appropriate, particularly when similar techniques are involved. Your Principal Examiner will alert you to these and details will be provided on the mark scheme.

Where the answer can be reasonably obtained without showing working and it is very unlikely that the correct answer can be obtained by using an incorrect method, we must award **full marks**. However, the obvious penalty to candidates showing no working is that incorrect answers, however close, earn **no marks**.

Where a question asks the candidate to state or write down a result, no method need be shown for full marks.

Where the permitted calculator has functions which reasonably allow the solution of the question directly, the correct answer without working earns **full marks**, unless it is given to less than the degree of accuracy accepted in the mark scheme, when it gains **no marks**.

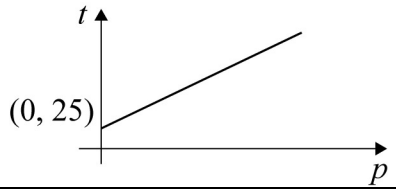
Otherwise we require evidence of a correct method for any marks to be awarded.

General Certificate of Education

A/S Level – Applying Mathematics UOM 4/2

Answers and Marking Scheme – June 2010

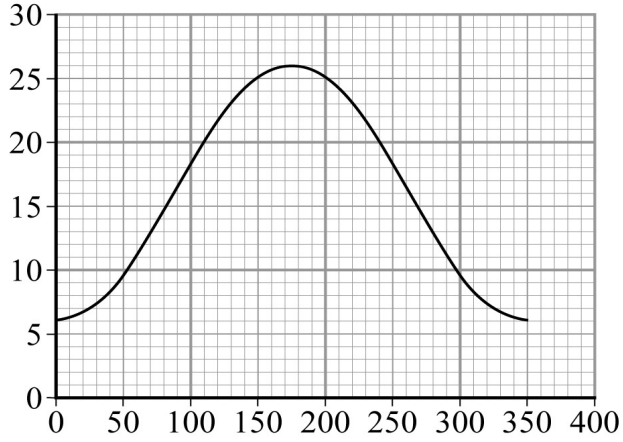
Question 1

(a)(i)	$7 \times 2.205 = 15.435$ pounds 0.435 pounds = 0.435 x 16 = 6.96 ounces 7 kilograms = 15 pounds 7 ounces	**M1** **M1** **A1**	multiplying candidate's decimal by 16
(a)(ii)	$\frac{5}{2.205} = 2.27$ kilograms	**M1** **A1**	allow greater degree of accuracy
(a)(iii)	$k = \frac{p}{2.205}$	**B2**	accept equivalent $k = 0.454p$ allow B1 for expression
(b)(i)	$t = 25p + 25$	**M1** **A1**	for $25p$ (implied)
(b)(ii)	$t = 25 \times 5 + 25 = 150$	**M1** **A1ft**	accept 2 hours 30 minutes if suitable linear equation
(b)(iii)		**B1** **B1**	straight line with positive gradient – no negative p – no negative t correct intercept on t axis
(c)(i)	$t = 55k + 25$	**M1** **A1**	for $55k$
(c)(ii)	$212 = 55k + 25$ $55k = 187$ $k = 3.4$ 3.4 (kilograms)	 **M1** **A1ft**	rearrangement of linear equation to remove 'tc' from linear equation
	TOTAL	**17**	

Question 2

<table>
<tr><td>(a)(i)</td><td>75%</td><td>B2</td><td>allow SC1 for 0.75</td></tr>
<tr><td>(a)(ii)</td><td>40%</td><td>B2</td><td>allow SC1 for 0.4</td></tr>
<tr><td>(b)</td><td>$A_1 = 0.75 \times 100 + 0.4 \times 50$
$A_1 = (75 + 20) = 95$
There are 150 calculators altogether so
$B_1 = 150 - A_1 = 55$
Alternatively:
$B_1 = 0.25 \times 100 + 0.6 \times 50 = 55$</td><td>M1
A1
B1 ft</td><td>alternatively finding B_1 first</td></tr>
<tr><td>(c)(i)</td><td><table><tr><th>Week n</th><th>A_n</th><th>B_n</th></tr><tr><td>0</td><td>100</td><td>50</td></tr><tr><td>1</td><td>95</td><td>55</td></tr><tr><td>2</td><td>93</td><td>57</td></tr><tr><td>3</td><td>93</td><td>57</td></tr><tr><td>4</td><td>92</td><td>58</td></tr><tr><td>5</td><td>92</td><td>58</td></tr></table></td><td>B1+B1
B1
B1
B1</td><td>SC4 for values in table that round to correct values.
SC2 if all rows add up to 150 but incorrect values.
$n = 2$
$n = 3$
$n = 4$
$n = 5$</td></tr>
<tr><td>(c)(ii)</td><td>92 in town A and 58 in town B</td><td>B1</td><td></td></tr>
<tr><td>(d)</td><td>any two appropriate factors, for example:
not the same percentage of calculators returned each week
not all calculators borrowed
not all calculators returned
calculators borrowed for different lengths of time</td><td>
B1
B1
B1
B1</td><td>Maximum B2</td></tr>
<tr><td></td><td>TOTAL</td><td>15</td><td></td></tr>
</table>

Question 3

(a)(i)	22(°C)	**B1**	cao
(a)(ii)	$n - 30 = 180$ $n = 210$	 **B1**	 cao
(a)(iii)	6°C	**B1**	cao
(b)	$14 - 8\cos(n - 30)° = 15$ $8\cos(n - 30)° = -1$ $\cos(n - 30)° = -\frac{1}{8} = -0.125$ $n - 30 = 97.18$ $n = 127\ (.18)$	**M1** **M1** **M1** **A1**	 isolating $\cos(n - 30)°$ evidence of use of $\cos^{-1}$ (1.696 in radians)
(c)	Stretch in the y – direction scale factor 8 or correct reference to amplitude Translation parallel to the x axis (30 units in the positive direction) Reflect in x axis Translation parallel to the y axis 14 units in the positive direction	**B1** **B1** **B1** **B1** **B1**	may refer to n axis (for x) and axis (for y) stretch in y-direction scale factor -8 scores B2 -1 if y translation not last.
(d)		**B1** **B1** **B1**	general (– cos) shape with one max approx half way through year - not quadratic indication of maximum at 26 indication of minima at 6
	TOTAL	**15**	

Question 4

(a)(i)	$\frac{4}{10} = \frac{2}{5}$	**B1**	allow 0.4, 40%
(a)(ii)	there are 4 randomly assigned integers out of 10	**B1**	
(b)	see tables below		

Time since start of simulation, *t*	Customer	Time arrives	Random integer	Time taken to buy a ticket at window
0	A	0	2	1
1	B	1	1	1
2	C	2	5	2
3	D	3	4	2
4	E	4	0	1
5	F	5	7	3
6	G	6	3	1
7	H	7	2	1
8	I	8	7	3
9	J	9	9	4
10	K	10	2	1

B1 for rows t = 4, 5, 6 correct
B1 for remaining rows correct

Time since start of simulation, *t*	Customer being Served	Customer(s) in queue
0	A	-
1	B	-
2	C	-
3	C	D
4	D	E
5	D	E, F
6	E	F, G
7	F	G, H
8	F	G, H, I
9	F	G, H, I, J
10	G	H, I, J, K

B1 for 'Customer being served' column correct

B1ft for first 3 values below shading in 'Customers in queue' Column

B1ft for remaining values

Question 4 …. Cont/d

(c)	See tables below		

Time since start of simulation, *t*	Customer	Time arrives	Random integer	Time taken to buy a ticket at window
0	M	0	2	2
1	N	1	3	3
2	P	2	0	1
3	Q	3	9	4
4	R	4	1	2
5	S	5	0	1
6	T	6	5	3
7	U	7	8	4
8	V	8	9	4
9	W	9	2	2
10	X	10	2	2

B1 for rows $t = 4, 5, 6$ correct
B1 for remaining rows correct

Time since start of simulation, *t*	Customer being Served	Customer(s) in queue
0	M	-
1	M	N
2	N	P
3	N	P, Q
4	N	P, Q, R
5	P	Q, R, S
6	Q	R. S, T
7	Q	R, S, T, U
8	Q	R, S, T, U, V
9	Q	R, S, T, U, V, W
10	R	S, T, U. V. W, X

B1 for 'Customer being served' column Correct

B1ft for first 3 values in 'Customer(s) in queue' column

B1ft for remaining values.

Question 4 …. Cont/d

(d)	correct reasoning *with* appropriate justification eg use the Travel Today window because after 10 minutes there are 4 customers waiting whereas at that time the All Travel window has 6 customers waiting or use the Travel Today window because of the probability model which suggests customers will be dealt with more quickly.	**B1** **B1**	follow through from their tables if complete. has to be quantified using numbers from their table or from probability model. Maximum B2
(e)	altering an assumption to make simulation more realistic such as: allow customers to change queues have more than one customer arriving at once allow times other than whole numbers of minutes	 **B1** **B1** **B1**	
	TOTAL	**17**	
	TOTAL MARK FOR PAPER	**64**	

+ up to 3 marks for ability to present information accurately using correct notation.
+ up to 3 marks for mathematical arguments presented clearly and logically.

	TOTAL MARK	**70**	