Version : 08/06

ASSESSMENT and QUALIFICATIONS ALLIANCE

General Certificate of Education

AS Use of Mathematics
Applying Mathematics paper 2
UOM4/2

Mark Scheme

2006 examination - June series

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.

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	OE	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)

Application of Mark Scheme

No method shown:

Correct answer without working	mark as in scheme
Incorrect answer without working	zero marks unless specified otherwise

More than one method / choice of solution:

2 or more complete attempts, neither/none crossed out	mark both/all fully and award the mean mark rounded down
1 complete and 1 partial attempt, neither crossed out	award credit for the complete solution only

Crossed out work — do not mark unless it has not been replaced

Alternative solution using a correct or partially correct method — award method and accuracy marks as appropriate

AS Use of Mathematics

Applying Mathematics (UOM4/2)

Answers and Marking Scheme

Question 1

(a)	*A*: When the price of a pack is £5 none will be sold	**B2**	B1 £5; B1 None (sold or brought)
	B: When nothing is charged for a pack 400000 will be sold	**B2**	B1 nothing charged; B1 400000 (sold or brought)
(b)	$P = 5 - \frac{5}{4}Q$	**M1**	for correct numerical value of gradient $\left(\text{i.e. } \frac{5}{4}\right)$
		A1	for equation SC1 $y = 5 - \frac{5}{4}x$
(c)	*C*: When the price of a pack is 50p fruit farmers won't supply any packs of strawberries	**B2**	allow B1 for identification of 50p B1 no strawberries (or packs)
(d)	$P = Q + 0.5$	**M1** **A1**	for gradient, numerical value SC1 $y = x + 0.5$ (penalise again)
(e)(i)	$Q + 0.5 = 5 - \frac{5}{4}Q$	**M1**	equating their expressions for *P or* Q
	$Q + \frac{5}{4}Q = 4.5$	**M1**	attempt to isolate Q
	$\frac{9}{4}Q = \frac{9}{2}$		
	$Q = 2$	**A1**	
	$P = 2.5$	**A1**	ft from (b) and (d)
	ALTERNATIVE METHOD		
	Elimination method		
	Same coefficient of P or Q Adding/subtracting eg^{-1}	**(M1 M1) (A1 A1)**	
(ii)	When a pack of strawberries costs £2.50 200000 packs will be sold	**B1 ft**	
	The number of packs that fruit farmers will supply exactly matches the number of packs that customers will buy.	**B2**	Everything sold **or** no waste B1
	TOTAL	**17**	

Question 2

<table>
<tr><td>(a)</td><td>$B_1 = 1.0125 \times 200 - 25$
$= 202.50 - 25.00$
$= 177.50$</td><td>M1

A1</td><td>Either of first 2 lines give M1

Need to see 202.50-25
Condone 177.5</td></tr>
<tr><td>(b)</td><td>1.0125: 1 gives the original amount +
0.0125 gives the amount of interest charged</td><td>B1
B1</td><td>
SC1 ‘interest’</td></tr>
<tr><td>(c)</td><td><table><tr><th>n</th><th>Bn</th></tr><tr><td>0</td><td>£200.00</td></tr><tr><td>1</td><td>£177.50</td></tr><tr><td>2</td><td>£154.72</td></tr><tr><td>3</td><td>£131.65</td></tr><tr><td>4</td><td>£108.30</td></tr><tr><td>5</td><td>£84.65</td></tr><tr><td>6</td><td>£60.71</td></tr><tr><td>7</td><td>£36.47</td></tr><tr><td>8</td><td>£11.93</td></tr><tr><td>9</td><td>£0.00</td></tr><tr><td>10</td><td>£0.00</td></tr></table></td><td>
B1
B1 ft
B1 ft
B1 ft</td><td>Allow ±1p in any amount (and then ft)

for $n = 2$ & 3
for $n = 4$ & 5
for $n = 6$ & 7
for $n = 8$, 9 10
SC2 for rounding to nearest £ or 10p OR use of 3 or more dp.
Penalise – values.</td></tr>
<tr><td>(d)</td><td>$8 \times £25 + £11.93$
$= £211.93$</td><td>M1
A1 ft</td><td>
ft from table</td></tr>
<tr><td>(e)</td><td>$\frac{£11.93}{£200} \times £100 = 5.97\%$</td><td>M1
A1 ft</td><td>M1 for (d) − 200 i.e. interest</td></tr>
<tr><td>(f)</td><td>$B_{n+1} = 1.0125B_n - 50$
<table><tr><th>n</th><th>Bn</th></tr><tr><td>0</td><td>£200.00</td></tr><tr><td>1</td><td>£152.50</td></tr><tr><td>2</td><td>£104.41</td></tr><tr><td>3</td><td>£55.71</td></tr><tr><td>4</td><td>£6.41</td></tr><tr><td>5</td><td>£0.00</td></tr></table>interest = £6.41
half of original interest = £5.97, so the statement is not true</td><td>M1

B1
B1

B1
E1</td><td>indication of use of revised recurrence relation (can be seen from 152.50).
for $n = 1, 2$ (allow ±1p)
for $n = 3, 4, 5$ (allow ±1p)
[6.41 ± 1 p gives M1 B3)</td></tr>
<tr><td></td><td>TOTAL</td><td>17</td><td></td></tr>
</table>

Question 3

(a)	The probability that a call will receive no reply is $\frac{2}{5}$ Therefore 4 out of 10 integers (0 to 9 inclusive) are assigned to this type of response	**B1** **B1**	

(b)

Call number	Randomly generated integer	Code of response type	Length of call (minutes)	Cumulative time (minutes)
1	2	A	½	½
2	5	C	2	2½
3	9	D	5	7½
4	7	D	5	12½
5	0	A	½	13
6	5	C	2	15
7	7	D	5	20
8	1	A	½	20½
9	6	C	2	22½
10	1	A	½	23
11	9	D	5	28
12	8	D	5	33
13	3	A	½	33½
14	7	D	5	38½
15	0	A	½	39

B1 for first two rows correct
B1 for next two rows correct ft (cumulative times)
B1 for next two rows correct ft
B1 for final two rows correct ft

(c)

Type of response	Code	Random integer
No reply	A	0, 1
Reply but customer unavailable	B	2, 3, 4
Customer replies but unwilling to complete survey	C	5
Customer replies and completes survey	D	6, 7, 8, 9

B1 for any two responses assigned correctly
B1 for final two responses assigned correctly

(d)

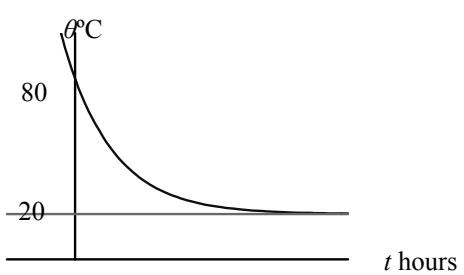
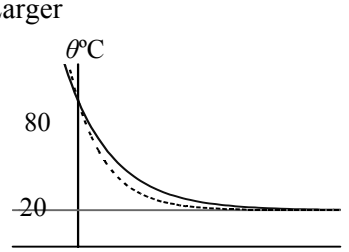
Call number	Randomly generated integer	Code of response type	Length of call (minutes)	Cumulative time (minutes)
1	7	D	5	5
2	8	D	5	10
3	8	D	5	15
4	2	B	1	16
5	3	B	1	17
6	9	D	5	22
7	6	D	5	27
8	5	C	2	29
9	6	D	5	34
10	9	D	5	39
11	4	B	1	40
12	4	B	1	41
13	1	A	½	41½
14	7	D	5	46½
15	0	A	½	47

Using their assignment of integers (most likely assignment shown here)

B1 for first two rows correct
B1 for next two rows correct ft (codes and cumulative times)
B1 for next two rows correct ft (codes and cumulative times)
B1 for final two rows correct ft (codes and cumulative times)

(e)	More completed surveys included in evening	**B2**	
(f)	Anything reasonable, eg ▪ include more categories of response ▪ include a simulation of different call lengths for each category	**B2**	
	TOTAL	**16**	

Question 4

(a)	$\theta = 20 + \frac{60}{e^{\circ}} (= 20 + 60) = 80$	**M1** **A1**	M1 substitution $t = 0$ i.e. e°
(b)	$\theta = 20 + \frac{60}{e^{kt}}$ so $\theta - 20 = \frac{60}{e^{kt}}$ $e^{kt} = \frac{60}{\theta - 20}$ $\therefore kt = \ln\left(\frac{60}{\theta - 20}\right)$ $\Rightarrow t = \frac{1}{k}\ln\left(\frac{60}{\theta - 20}\right)$	 **M1** **M1** **M1** **A1**	 need equation correct [isolating e^{kt} gains both method marks]. Condone $\frac{1}{e^{kt}} = \frac{\theta - 20}{60}$ Correct use of logs [A1 awarded for fully correct solution]
(c)	$0.5 = \frac{1}{k}\ln\left(\frac{60}{30}\right)$ $\therefore k = 2\ln 2 = 1.39$	**M1** **M1** **A1**	Correct substitutions M1 for 0.5; M1 for 50-20 or 30 [$50 = 20 + 60e^{-0.5k}$ M1 M1] **OR** [$\theta = 20 + 60e^{-1.39\times 0.5}$ M1 M1] = 50 A1
(d)	$t = \frac{1}{1.39}\ln\left(\frac{60}{96 - 20}\right) = -0.1705$ or -0.17006 no. of minutes = $0.1705 \times 60 = 10.2$ (or 10.3)	**M1A1** **M1** **A1 ft**	
(e)		**B1** **B1** **B1**	approx shape (may show values for negative t). Must not have y-axis as asymptote intercept indicated (80) asymptote indicated (and 20 shown)
(f)(i) **(ii)**	Larger 	**B1** **B1** **B1** **B1**	 same intercept for curve lower than original for $t>0$, and stated which is which same asymptote
	TOTAL	**20**	
	GRAND TOTAL	**70**	