AQA

ASSESSMENT and
QUALIFICATIONS
ALLIANCE

Mark scheme
January 2004

GCE

Mathematics A

Unit MAD1

Key to mark scheme

M	mark is for	method
m	mark is dependent on one or more M marks and is for	method
A	mark is dependent on M or m mark 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
CAO		correct answer only
AWFW		anything which falls within
AWRT		anything which rounds to
AG		answer given
SC		special case
OE		or equivalent
A2,1		2 or 1 (or 0) accuracy marks
– x EE		Deduct x marks for each error
NMS		No method shown
PI		Perhaps implied
c		Candidate

Abbreviations used in marking

MC – x	deducted x marks for miscopy
MR – x	deducted x marks for misread
ISW	ignored subsequent working
BOD	gave benefit of doubt
WR	work replaced by candidate

Application of mark scheme

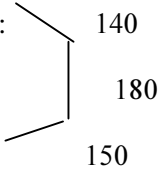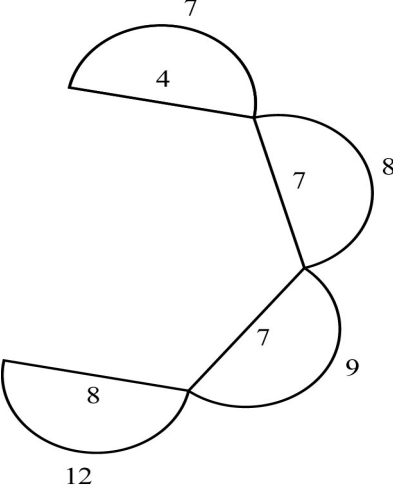|	
Correct answer without working	mark as in scheme
Incorrect answer without working	zero marks unless specified otherwise

Award method and accuracy marks as appropriate to an alternative solution using a correct method or partially correct method.

Q	Solution	Marks	Total	Comments
1 (a)		M1 A1	 2	Bipartite graph
(b)	(Initial $A \rightarrow 2, B \rightarrow 1, C \rightarrow 3, D \rightarrow 4$) $\left\{\begin{array}{l} \therefore \ E \rightarrow 3 \rightarrow C \rightarrow 2 \rightarrow A \rightarrow 1 \rightarrow B \rightarrow 5 \\ \quad\quad \text{then} \ \ F \rightarrow 2 \rightarrow C \rightarrow 4 \end{array}\right.$	M1A1 M1A1		1st path 2nd path or $\left\{\begin{array}{ll} E \rightarrow 3 \rightarrow C \rightarrow 4 \rightarrow D \rightarrow 6 & \text{M1A1} \\ \text{then} \ F \rightarrow 2 \rightarrow A \rightarrow 1 \rightarrow B \rightarrow 5 & \text{M 1A1} \end{array}\right.$ or $\left\{\begin{array}{ll} F \rightarrow 2 \rightarrow A \rightarrow 3 \rightarrow C \rightarrow 4 \rightarrow D \rightarrow 6 & \text{M1A1} \\ \text{then} \ E \rightarrow 3 \rightarrow A \rightarrow 1 \rightarrow B \rightarrow 5 & \text{M1A1} \end{array}\right.$
	Match: A1, B5, C4, D6, E3, F2	B1	5	
		Total	**7**	
2	Odd vertices D and F	E1		$\left.\begin{array}{l} \\ \\ \end{array}\right\}$ May be implied
	Repeat x or 13 (or DF)	B1		
	$\therefore 2x + 82 = 100$	M1		
	$x = 9$	A1	4	
		Total	**4**	

Q	Solution	Marks	Total	Comments

3 (a)(i)	$\begin{pmatrix} X & Y \\ 5 & 20 \end{pmatrix} \begin{array}{cc} A & B \end{array}$
	
	    20
	        0
	   15 1
	   10 2
	    5 3
	    0 4
		M1
		
		A1
			
			2
				
				All correct

(ii)	$\begin{pmatrix} X & Y \\ 7 & 29 \end{pmatrix} \begin{array}{cc} A & B \end{array}$
	
	   29
	       0
	   22 1
	   15 2
	    8 3
	    1 4
		M1
		
		A2, 1,0
			
			3	

(b)	Divides Y by X to give quotient and remainder	E2,1, 0	2	$y = Bx + A$
		Total	**7**	

Q	Solution	Marks	Total	Comments
4 (a)	L A $\rightarrow$ S B $\rightarrow$ L V $\rightarrow$ P S $\rightarrow$ S D $\rightarrow$ L A 90 140 180 150 185	M1 M1 A1 		Tour $\left.\begin{array}{c} \\ \\ \end{array}\right\}$ Independent All visited Correct order (must have both method marks)
	Total 745	B1	4	

(b)	Delete LA
	
	MST: $\searrow$ 140
	
	        180
	
	        150
	
	      = 470
	LB = (their 470) + 90 +185
	
	    = 745
		
		M1
		
		A1
		
		A1
		M1
		
		A1
			
			5
				
				SCA
				
				3 edges
				
				or (their 470) + (2×90)
				
				= 650

(c)	Tour = 745	B1F	1	(b)$\leq$T$\leq$ (a) or 650 $\leq$ Tour $\leq$ 745
		Total	**10**	

Q	Solution	Marks	Total	Comments
5 **(a)**	Min = $4 + 7 + 7 + 7$ $= 25$	B1	1	
(b)	Min (H) = $4 + 7 + 7 + 7 + 8$ $= 33$	B1	1	
(c)	Min (E) = $\Sigma = 62$	B1	1	
(d)		M1 m1 A1	 3	5 vertices 8 edges All correct
		Total	**6**	

Q	Solution	Marks	Total	Comments
6 **(a)**	75 + 55 = 130	B1	1	
(b)(i)				

		Marks	Total	Comments
		M1		SCA
		A1		2 values at *L*
		M1		3 or more values of *A*
		A1		All correct at *A*
	Min = 133	B1	5	

Q	Solution	Marks	Total	Comments
6 b)(i)	**Alternative to part (b)(i)** Working backwards: $(M1)$ SCA $(A1)$ 2 values at C_0 $(M1)$ 2 values at C $(A1)$ Correct at P $(B1)$ 133			
(ii)	$P \; C_0 \; L \; A$	B1	1	
(c)	$C \; E \; A$	M1		For either
	$\rightarrow \left(\frac{55}{60} \times 100\right) + \left(\frac{75}{60} \times 50\right)$			Allow $55 \times 100 + 75 \times 50$ M1
	$= 154\frac{1}{6}$	A1		$\left(154.1 \rightarrow 154.2\right)$
	$P \; C_0 \; L \; A$			
	$\rightarrow \frac{133}{60} \times 50 = 110\frac{5}{6}$	A1		$\left(110.8 \rightarrow 110.9\right)$
	Saved $43\frac{1}{3}$	B1	4	(In range $43.3 \rightarrow 43.4$)
		Total	**11**	

Q	Solution	Marks	Total	Comments
7 (a)	$x \geq 2,\ y \geq 5,\ z \geq 2$	B1		All
	$x + y + z \leq 28$	B1		
	$40 \leq 3x + 2y + 2z \leq 60$	B1+1	4	
(b)(i)	$x = z$			
	$\therefore x \geq 2,\ y \geq 5$			
	$2x + y \leq 28$	B1		Must have shown $x + z = 2x$ etc
	$40 \leq 5x + 2y \leq 60$	B1	2	
(ii)		B1		$x \geq 2,\ y \geq 5$
		B1×3		other lines
		B1F		region (pentagon)
		M1		objective line
		A1	7	Correct
(iii)	Iron 28			
	$\therefore x = 2,\ y = 24$	M1		Attempt at a max extreme point on their graph
	or $x = 3,\ y = 22$	A1	2	any pair
	or $x = 4,\ y = 20$			or 2, 2, 24 3, 3, 22 4, 4, 20
	Total		**15**	
	Total		**60**	