Version 1.0 0608

ASSESSMENT and QUALIFICATIONS ALLIANCE

General Certificate of Education

Mathematics 6360

MD01 Decision 1

Mark Scheme

2008 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.

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
Dr Michael Cresswell Director General

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.

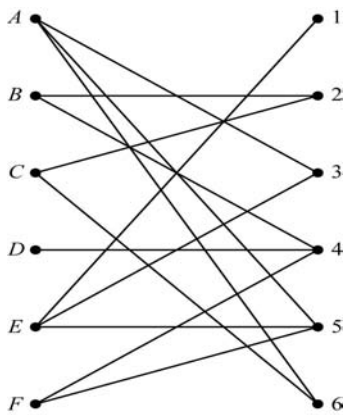
Where the answer can be reasonably obtained without showing working and it is very unlikely that the correct answer can be obtained by using an incorrect method, we must award **full marks**. However, the obvious penalty to candidates showing no working is that incorrect answers, however close, earn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

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

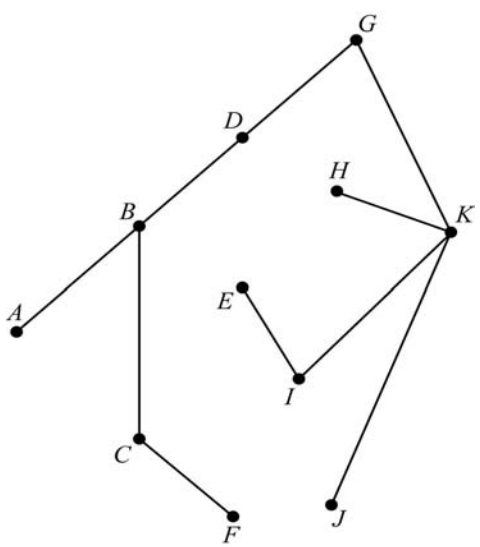
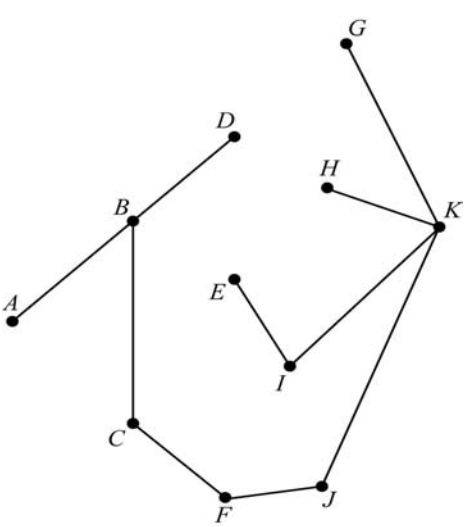
Where the permitted calculator has functions which reasonably allow the solution of the question directly, the correct answer without working earns **full marks**, unless it is given to less than the degree of accuracy accepted in the mark scheme, when it gains **no marks**.

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

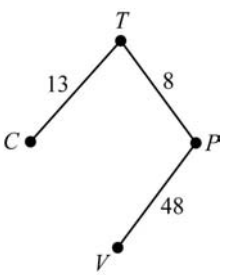
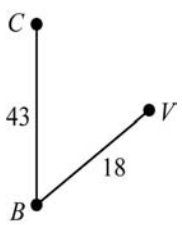
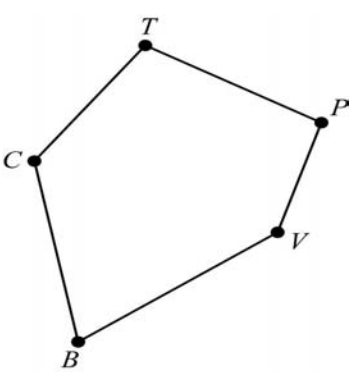
MD01

Q	Solution	Marks	Total	Comments
1(a)		M1		Bipartite graph: 2 sets of vertices with at least one edge
		A1	2	All correct
(b)	*A*3, *B*4, *C*2, *E*5			Initial match
	Start from *D*, *F* or 1, 6	M1 M1		1st path } must go beyond 2nd 2nd path } letter/number eg $D-4\,(+)\,B/F$ If working is **only** on diagram, **the path(s) must be clear**, and only 1 path per diagram can be credited. If 2 paths shown on one diagram, max mark M1A1
	Accept paths in reverse order $D-4\,(+)B-2\,(+)\,C-6$ $F-5\,(+)E-1$ or $F-4(+)B-2(+)C-6$ $D-4(+)F-5(+)E-1$	A1 A1		1st correct path 2nd correct path or $F-5(+)E-3(+)A-6$ $D-4(+)B-2(+)C-6(+)A-3(+)E-1$
	Match: *A*3, *B*2, *C*6, *D*4, *E*1, *F*5	B1	5	Must be clearly stated or indicated
	Total		**7**	
2(a)	P B M N J K R D	M1		Using quick sort
	B M N J K D P R	A1		First pass (based on their pivot)
	B M N J K D P R			
	B J K D M N P R	A1		A correct third pass
	B D J K M N P R	A1		All passes correct
		B1	5	Consistent pivots clearly labelled (at least three passes)
(b)(i)	28	B1	1	
(ii)	In reverse order	B1	1	Allow descending
	Total		**7**	

MD01 (cont)

Q	Solution	Marks	Total	Comments
3(a)(i)	10	B1	1	
(ii)	$n - 1$	B1	1	
(b)	Condone candidates attempting all of part (b) together / in different order			
(i)	*AB* *BC* *BD* *CF* *DG* or *FJ* *GK* *JK* *KJ* *GK* *KH* or *KI* *KI* *IE* *EI* *KH*	M1 A1 A1 A1 B1	 5	Using Prim's *BD* 3rd *CF* 4th All correct 10 edges
(ii)	(Length =) 155	B1	1	
(iii)		M1 A1	 2	Spanning tree with at least 8 edges Any cycle scores M0 Correct and labelled Alternative: *FJ* instead of *DG*: 
	Total		**10**	

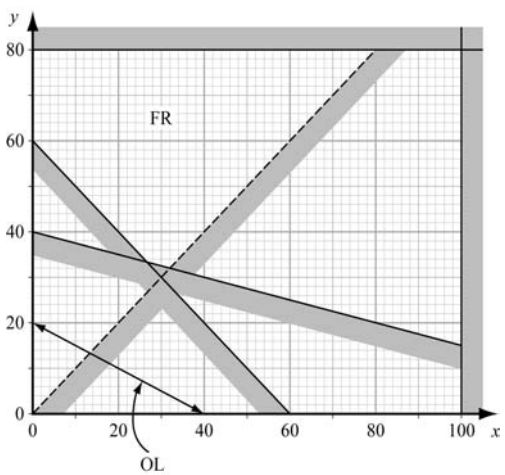
MD01 (cont)

Q	Solution	Marks	Total	Comments
4(a)(i)	130	B1	1	*T* *P* *V* *B* *C* *T* 8 48 18 43 13
(ii)	*T* *P* *C* *B* *V* *T* 8 18 43 18 51	M1		Tour (vertices or edges) starting from *T* (Letters not numbers)
		M1		Visits all vertices starting from *T*
		A1		Correct order
	= 138	B1	4	
(iii)	A possible solution, eg tour	E1		OE
	May be improved on	E1	2	Allow '**can**' in this case as (i) < (ii) OE
(b)(i)		M1		Spanning tree with 3 edges
	PT, *CT*, *PV*	A1		Correct
		m1		2 edges from *B*
	+ 2 shortest from *B*	A1		Correct
	(Lower bound =) 130	A1	5	CSO
(ii)	May not exist	E1		OE
	Cannot be lowered	E1	2	OE
(c)		B1		
	Tour *or* optimum *or* same as (a)(i)	E1	2	Lower bound = Upper bound
	Total		**16**	

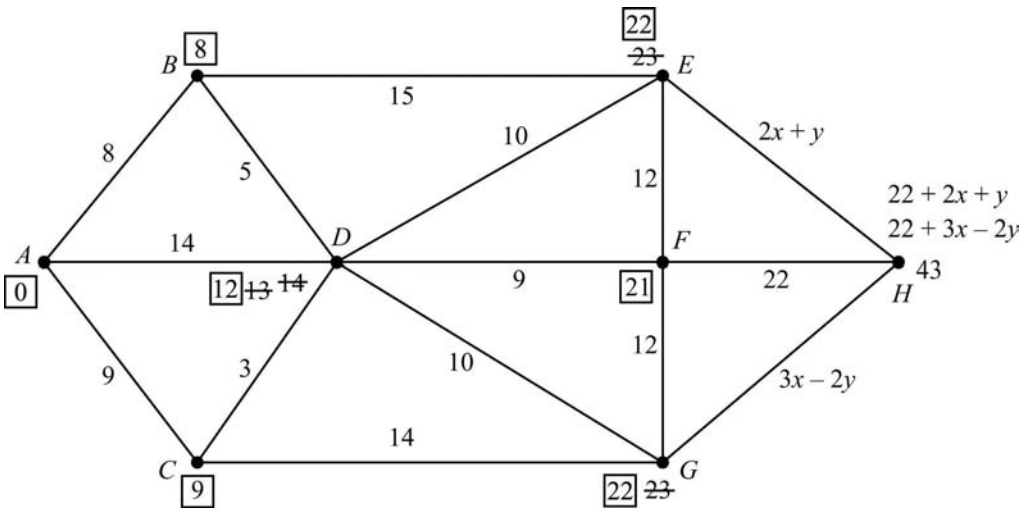
MD01 (cont)

Q	Solution	Marks	Total	Comments
5(a)	Odds *A*, *B*, *C*, *D*	M1		PI (but *A*, *B*, *C*, *D* must be mentioned)
		m1		Considering 3 sets of pairings of odd vertices, eg *AB* with *CD* etc
	$AB + CD = 270 + 270 = 540$ $AC + BD = 290 + 290 = 580$ $AD + BC = 260 + 270 = 530$	A2,1,0		A1 for 2 correct, A2 for all correct
	Repeat *AD*, *BC*	A1F		Follow through their shortest pairing PI by adding 530 to 1920 Or *AEHD* or *DHEA* **and** *BFGC* or *CGFB* listed in any route
	(Length = 1920 + 530 =) 2450 (metres)	B1	6	
(b)	Repeats *BC*	E1		PI by *BFGC* or *CGFB* listed in a complete route or adding 270 / subtracting 260
	(Length = 1920 + 270 =) 2190 (metres)	B1	2	2450 – 260 = 2190 (2190 with no evidence scores E0B1)
(c)(i)	Min. repeat *AD*	E1		PI by *AEHD* or *DHEA* listed in a complete route or adding 260 / subtracting 270
	(Length = 1920 + 260 =) 2180 (metres)	B1	2	2450 – 270 = 2180 (2180 with no evidence scores E0B1)
(ii)	*B*, *C*	B1	1	Condone start at *B*, finish at *C* (or reverse)
	Total		**11**	

MD01 (cont)

Q	Solution	Marks	Total	Comments
6(a)	**All inequalities must be as below**			
	$x \leqslant 100,\ y \leqslant 80$	B1		Both
	$x + y \geqslant 60$	B1		
	$x < y$	B1		
	$2x + 8y \geqslant 320$	B1		OE
	(minimise C =) $1.5x + 3y$	B1	5	
(b)				
		B1		$x = 100, y = 80$ } within $\frac{1}{2}$ square
		B1 × 3		Other lines } from $(0,0)$ to $(80,80)$
		B1		Feasible Region CAO (must have scored B4 for drawing lines) (condone $x = y$ as solid line)
		B1	6	An Objective Line with gradient –0.5
(c)	Considering an extreme point in their region	M1		
	Min at intersect of $x + y = 60$ $x + 4y = 160$	A1		PI by indication on diagram or $x = 26\frac{2}{3}$ $y = 33\frac{1}{3}$
	Considering a pair of integer values where $26 \leqslant x \leqslant 28,\ 32 \leqslant y \leqslant 34$	M1		
	(C =) £141 at (26, 34) *or* £141 at (28, 33)	A1	4	
	Total		**15**	

MD01 (cont)

Q	Solution	Marks	Total	Comments
7(a)				
		M1		SCA; cancelling at 2 (or more) vertices
		A1		Correct at *D*
		M1		2 values at *E*
		M1		2 values at *G*
		A1		All correct (condone 0 missing at *A* and missing expressions in *x* and *y* at *H*)
	(Min =) 43	B1	6	Accept 43 at *H*
(b)	$2x + y = p$ $3x - 2y = q$	M1		Obtaining a pair of equations in this form *or* (22) + 2*x* + *y* = (43) and (22) + 3*x* – 2*y* = (43) $2x + y = 21$ and $3x - 2y = 21$
	$x = 9$	A1		CAO
	$y = 3$	A1	3	CAO NMS: both correct M1A2 one/none correct M0A0
	Total		**9**	
	TOTAL		**75**	