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General Certificate of Education

Mathematics 6360

MD01 Decision 1

Mark Scheme

2010 examination - January 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.

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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.

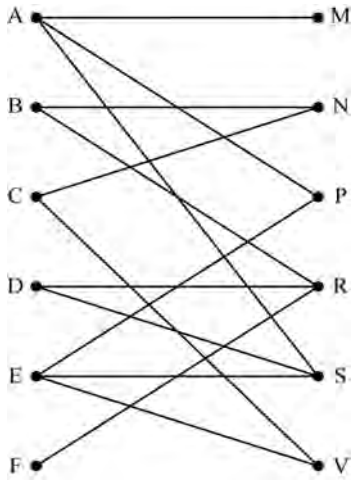
Where the answer can be reasonably obtained without showing working and it is very unlikely that the correct answer can be obtained by using an incorrect method, we must award **full marks**. However, the obvious penalty to candidates showing no working is that incorrect answers, however close, earn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

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

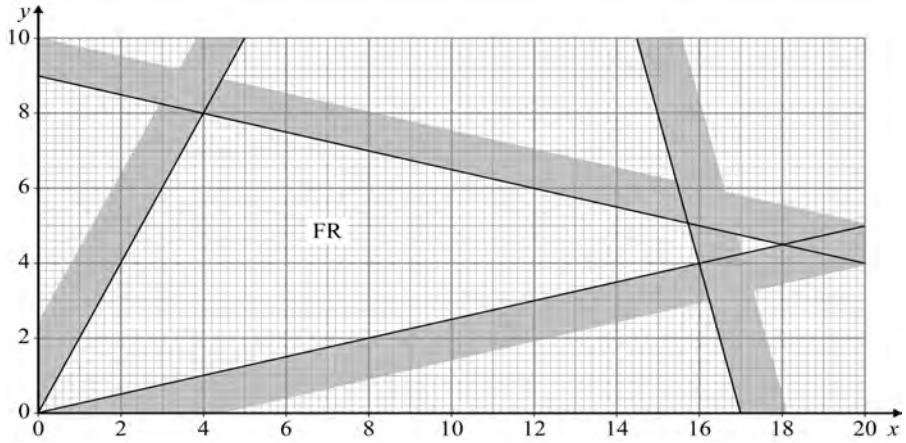
Where the permitted calculator has functions which reasonably allow the solution of the question directly, the correct answer without working earns **full marks**, unless it is given to less than the degree of accuracy accepted in the mark scheme, when it gains **no marks**.

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

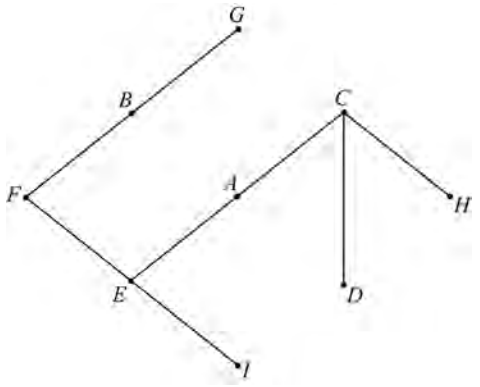
MD01

Q	Solution	Marks	Total	Comments
1(a)		M1 A1	2	Bipartite graph, 2 sets of (some) vertices, labelled, 6+ edges
(b)	AP, BR, CN, ES			
	D – R + B V – C + N M – A + P F – R + B D – S + E V – E + S	M1		1 correct
		M1		2nd path started correctly, must be different start point from 1st path (allow F – R + D for 2nd M1 if D – R + B first)
	D – R + B – N + C – V	A1		or reverse
	F – R + D – S + E – P + A – M	A1		or reverse, but two paths must be in this order
	OR			
	D – S + E – V	(A1)		or reverse
	F – R + B – N + C – V + E – P + A – M	(A1)		or reverse, but two paths must be in this order
	OR			
	F – R + B – N + C – V	(A1)		or reverse
	D – S + E – P + A – M	(A1)		or reverse, the two paths can be in either order
	AM, BN, CV, DS, EP, FR	B1	5	Must be written as a list
	Total		**7**	

MD01 (cont)

Q	Solution	Marks	Total	Comments
2(a)	13 16 10 11 4 12 6 7 13 10 11 4 12 6 7 16 10 11 4 12 6 7 13 16 10 4 11 6 7 12 13 16 4 10 6 7 11 12 13 16 4 6 7 10 11 12 13 16 4 6 7 10 11 12 13 16	M1 A1 A1 A1 A1	 5	SCA, must have 16 at end of first pass 1st pass 2nd pass 3rd pass All correct, must have only 2 identical lines at end. Ignore any intermediate lines and labelling on lines.
(b)	C S 1st 7 6 2nd 6 6 3rd 5 3	B3;2;1	3	6 correct; 5 correct; 3 correct – with number of comparisons and swaps being clearly identified for each of the three passes (may be earned in part (a))
	Total		**8**	
3(a)				
		M1		line $y = mx$, must be correct to 1 square horizontally or vertically at origin
		A1		through (0, 0) and (4, 8)
		A1		through (0, 0) and (16, 4)
		B1		line through (15, 8) and (17, 0)
		B1		line through (4, 8) and (12, 6)
		B1	6	FR must have scored previous 5 marks and labelled region (condone no shading)
(b)(i)	Max (4, 8)	B1		Coordinates must be stated explicitly
	= 44	B1	2	
(ii)	Max (16, 4)	B1		Coordinates must be stated explicitly
	= 84	B1	2	
	Total		**10**	

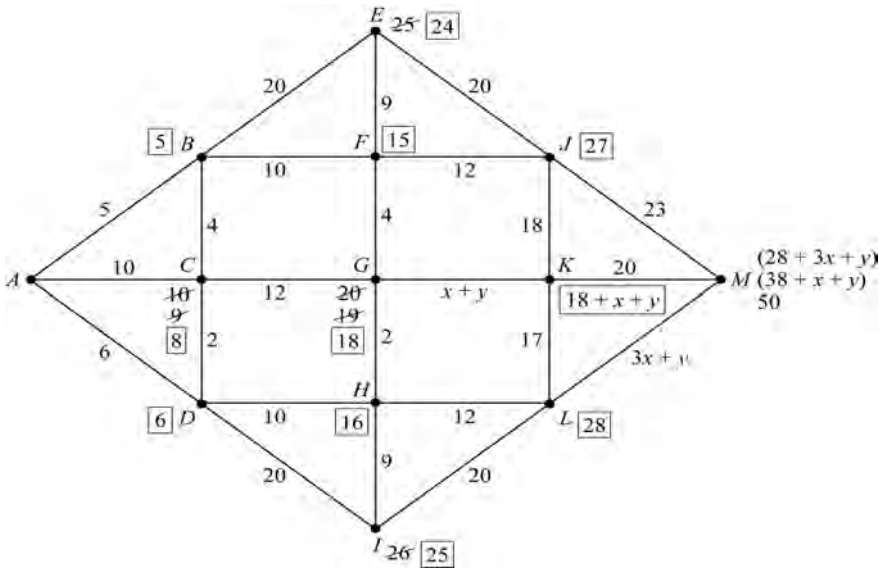
MD01 (cont)

Q	Solution	Marks	Total	Comments
4(a)(i)	*AC* 13 *AE* 14 *EI* 15 *CD* 16	M1		Use of Prim's (not Kruskal's and not path); 6+ edges (no cycles); edges, not lengths or vertices, with first 2 edges correct
	CH 20	B1		8 edges
	EF 21	A1		*CH* 5th
	FB 19	A1		*EF* 6th
	BG 19	A1	5	All correct
(ii)	137	B1	1	
(iii)		M1		6+ edges, no cycles
		A1	2	Correct, including labelling
(b)	(Odds) *B, C, D, E*	E1		PI CAO
	$BC + DE = 22 + 18 (\text{or } 40)$ $BD + CE = 38 + 27 (\text{or } 65)$	M1		3 correct sets of pairs (lettered)
	$BE + CD = 22 + 16 (\text{or } 38)$	A2;1		3 correct sets of numbers; 2 correct sets of numbers
	$\text{min} = 307 + 38$	A1F		PI 307 plus their shortest
	$= 345$	B1	6	SC: 345 with no M mark scored scores 2/last 5 Route without 345 scores 0/last 5
	Total		**14**	

MD01 (cont)

Q	Solution	Marks	Total	Comments
5(a)	(*B* *E* *C* *D* *A* *B*) 12(.0)	B1	1	
(b)	*B* *D* *A* *C* *E* *B*	M1		Tour starts/finishes at *B*
		m1		Visits *B* twice and all other vertices once
		A1		Correct order
	= 13.5	B1	4	If solution only on a matrix, then order of selection of vertices must be clearly shown
(c)	12(.0)	B1F	1	Their min, condone writing 'part (a)' ft
(d)	*B* *A* *D* *E* *C* *B*	M1		Tour starts/finishes at *B*
		m1		Visits *B* twice and all other vertices once
		A1		Correct order
	= 12.1	B1	4	If solution only on a matrix, then order of selection of vertices must be clearly shown
	Total		**10**	
6(a)	(*A*) (*B*) (*N*) *T* *D* *H* *E* (1) (5) (2) 0 1 2 1 126 3 180 5	M1		SCA trace as far as a second value for *T* with at least 1 value for all other variables
		A1		*T* = 126
		m1		*T* = (180) trace as far as a third value for *T* and 2 values for *D*
	("Area =") 180	A1	4	All correct values including final value of 180 and no extra values, but including *A*, *B*, *N* and their values 1, 5, 2
(b)	(*A*) (*B*) (*N*) *T* *D* *H* *E* (1) (5) (4) 0 1 1 0.5 126 2 142 3 196 4 324 5	M1		SCA as above
		A1		*T* = 142
		m1		*T* = (324) 5 values for *T*
	("Area =") 162	A1	4	All correct values including final value of 162 and no extra values, but including *A*, *B*, *N* and their values 1, 5, 4
	Total		**8**	

MD01 (cont)

Q	Solution	Marks	Total	Comments
7(a)				
		M1		SCA cancelling at C (PI)
		A1		Correct values at C
		m1		3 values at G
		A1		Correct values at G
		m1		2 values at both E and I
		A1		All correct, with no extra values, and including $18 + x + y$ boxed at K
		B1	7	50 at M (diagram takes precedence over answer book)
(b)	$3x + y$ (=22) OE	M1		setting up simultaneous equations
	$x + y$ (=12) OE			
	$\therefore x=5,\ y=7$	A1+1	3	CSO SC $x=5,\ y=7$ with no working 3/3
	Total		**10**	
8	$2x+3y+4z\le 360$ $3x+y+5z\le 300$ $4x+3y+2z\le 400$	B2,1,0		
	$2x+3y+4z\ (>)\ 3x+y+5z$	M1		Their A (>) their B
	$2y>x+z$	A1		OE
	$5x+4y+9z\ (\ge)\ 4x+3y+2z$	M1		Their A + B (≥) their C
	$x+y+7z\ge 0$	A1		OE
	$4x+3y+2z\ (\ge)\ \frac{40}{100}(9x+7y+11z)$	M1		Their C (≥) 40% of their total OE
	$2x+y\ge 12z$	A1	8	OE
	Total		**8**	
	TOTAL		**75**	