

General Certificate of Education

Mathematics 6360

MD01 Decision 1

Mark Scheme

2007 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.

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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						
В	mark is independent of M or m marks an	d is for method	I and accuracy				
Е	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.

June 07

MD01

Q Q	Solution	Marks	Total	Comments
1(a)	B 2 2 3 3 4 4 5 5 5 6 6	M1 A1	2	
(b)	D can only do 4	E1	1	Cannot be matched to task
(c)	A-2+E-6+C-5 D-4+F-5+C-3+B-1	M1A1 M1A1 A1		Starting with A , D , 5 , 1 First pass Second pass All Correct Alt:1 $A-4+F-5$ D-4+A-2+E-6+C-3+B-1
	Match A2, B1, C3, D4, E6, F5	B1	6	Alt: 2 $D-4+F-5$ A-2+E-6+C-3+B-1
	Total		9	77 2 1 2 1 0 1 0 3 1 2 1
2(a)	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	M1		SCA
	6 20 5 17 14 11 6 5 28 22 20 17 6 14 20 28	M1 A1		4 sublists correct 1 st pass
	5 11 17 22 6 5 14 11 20 17 28 22	M1		2 sublists
	5 6 11 14 17 20 22 28	A1	5	All correct
(b)(i)	4	B1		
(ii)	4	В1	2	
(c)	28 T. 4-1	B1	1	
	Total		8	

01 (cont) Q		lution		Marks	Total		Comments
3(a)(i)							
	A+	15	B 15	10	25 C	15	40 D
			12		12		12
	12		12		12		12
	12 E	20	32 F	9	.37	G 20	H 52
			[27]		36		.56
	20		20		20		20
	32	14	.47	20		15	<i>72</i>
	Ĩ		46J	1	K	56	L 71
				M1 A1		SCA Correct at F	
				M1		2 values at G	
				M1		2 values at J	
				M1		2 values at <i>H</i>	
	71			A1 B1	7	All correct	
(a)(i)	OR	_					
(a)(i)	Working back from 35 at G	L					
	47 at <i>C</i>						
	44 at <i>F</i>						
	49 at <i>I</i>						
	$\begin{array}{c} \begin{array}{c} 49 \text{ at } 1 \\ 56 \text{ at } B \end{array} \end{array} \begin{array}{c} \text{B1} \times 7 \end{array}$						
	64 at <i>E</i>						
	71 at <i>A</i>						
	, 1 41.21						
(ii)	ABFGKL			B1	1		
(b)	ADL gives 62			M1		OE	
	AIL gives 69			A1			dering routes ADL or A
	$\therefore A \text{ to } D$			A1	3	CSO	
			Total		11		

D01 (cont) Q	Solution	Marks	Total	Comments
4(a)(i)	SD 12	M1		Prim's (first 4 edges, allow 1 slip)
	SC 13			
	<i>SA</i> 14	B1		12 edges
	<i>SB</i> 16			
	DH 75			th
	HG 23	A1		HG 6 th
	<i>GF</i> 22			
	FE 24	A 1		EI 9 th
	EI 81 IJ 12	A1		EI 9
	IJ 12 GK 83			
	KL 16	B1	5	All correct
	KL 10	Di	3	All collect
(ii)	391	B1	1	
(-2)	371	21	-	
(iii)	S	M1		MST (10 + edges)
(111)		1,11		(10 · cages)
	4. D	A1		12 edges
	R. C			
	<i>b</i> - C - \	A1	3	All correct
	1			
	E F G			
	• • • H			
	<i>1</i> ← • • • • •			
(*)	J K L	D1		
(iv)	GF 7 th (22)	B1	2	
	HG 8 th (23)	B1	2	
(b)	Odd vertices (E, H, J, K)	E1		PI
	EH + JK = 69 + 131 = (200)	M1		2 correct sets of pairings
	EJ + HK = 93 + 106 = (199)	A3,2,		2 control of panings
	EK + JH = 129 + 142 = (271)	1,0		
	Repeat $EJ + HK$	1,0		
	Total $1135 + 199 = 1334$	B1	6	
	Total		17	

Q Solution Marks Total Comments 5(a) $5x+10y \le 1500$ (balloons) E1 Solution Solution E1 Solution E1 Solution Solution Solution E1 Solution Solution Solution E1 Solution Solution Solution E1 Solution Solution <th>MD01 (cont)</th> <th></th> <th></th> <th></th> <th></th>	MD01 (cont)				
$\Rightarrow x + 2y \le 300$ $32x + 8y \le 4000 \text{ (sweets)}$ $\Rightarrow 4x + y \le 500$ $x \ge 50, y \ge 50, \text{ at least } 140 \text{ in total}$ 200 140 140 140			Marks	Total	Comments
$32x + 8y \le 4000 \text{ (sweets)}$ $\Rightarrow 4x + y \le 500$ $x \ge 50, y \ge 50, \text{ at least } 50 \text{ of each}$ $x + y \ge 140, \text{ at least } 140 \text{ in total}$ E1 40 100 100 100	5(a)	$5x + 10y \le 1500 \text{ (balloons)}$			
$\Rightarrow 4x + y \le 500$ $x \ge 50, y \ge 50, \text{ at least } 50 \text{ of each } x + y \ge 140, \text{ at least } 140 \text{ in total}$ E1		$\Rightarrow x + 2y \le 300$	E1		
$x \geq 50, y \geq 50, \text{ at least } 50 \text{ of each } x + y \geq 140, \text{ at least } 140 \text{ in total}$ 100 140 100 140 100 140 $200 x$ 100 140 $200 x$ 100 140 $200 x$ 100 140 100 140 100 140 100 140 100 140 100 140 100 140 100 14		$32x + 8y \le 4000 \text{ (sweets)}$	E1		
(b)(i) $x+y \ge 140, \text{ at least } 140 \text{ in total} \qquad \qquad \text{E1} \qquad 4$ 100 100 100 140 $200 x$ 100 140 $200 x$ 100 140 $200 x$ 100 140 100 140 100 140 100 140 100 140 100 140 100 140 100 140 100 140		$\Rightarrow 4x + y \le 500$			
(b)(i) $x+y \ge 140, \text{ at least } 140 \text{ in total} \qquad \qquad \text{E1} \qquad 4$ 100 100 100 140 $200 x$ 100 140 $200 x$ 100 140 $200 x$ 100 140 100 140 100 140 100 140 100 140 100 140		$x \ge 50, y \ge 50$, at least 50 of each	E1		
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$			E1	4	
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$					
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	(b)(i)		•	•	
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$		200			
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$		200] \			
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$		1			
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$\begin{array}{c ccccccccccccccccccccccccccccccccccc$		1	/		
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$		140	1		
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$			/		
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$			1		
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$		100-	1		
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$		FI	R	\	
B1 $x = 50, y = 50$ B1 $x = 50, y = 50$ x + y = 140 Negative gradient (either) A1 $x = 50, y = 50$ x + y = 140 Negative gradient (either) x = 50, y = 50 x + y = 300 Feasible region M1 Objective line drawn M1 8 Considering extreme point on their region		1	- //		
B1 $x = 50, y = 50$ B1 $x = 50, y = 50$ x + y = 140 Negative gradient (either) A1 $x = 50, y = 50$ x + y = 140 Negative gradient (either) x = 50, y = 50 x + y = 300 Feasible region M1 Objective line drawn M1 8 Considering extreme point on their region			//		
B1 $x = 50, y = 50$ B1 $x = 50, y = 50$ x + y = 140 M1 Negative gradient (either) A1 $x = 50, y = 50$ x + y = 140 Negative gradient (either) x = 50, y = 50 x + y = 300 Feasible region M1 Objective line drawn M1 8 Considering extreme point on their region			1		
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$			11		
$ \begin{array}{ c c c c c c }\hline & B1 & & x=50, y=50 \\ B1 & & x+y=140 \\ M1 & & Negative gradient (either) \\ A1 & & 4x+y=500 \\ & & & x+2y=300 \\ B1 & & Feasible region \\ M1 & & Objective line drawn \\ \hline & & & & & \\ \hline & & & & & & \\ \hline & & & &$		OL	1	1	
$ \begin{array}{ c c c c c c }\hline & B1 & & x=50, y=50 \\ B1 & & x+y=140 \\ M1 & & Negative gradient (either) \\ A1 & & 4x+y=500 \\ & & & x+2y=300 \\ B1 & & Feasible region \\ M1 & & Objective line drawn \\ \hline & & & & & \\ \hline & & & & & & \\ \hline & & & &$				V	
$\begin{array}{ c c c c c c }\hline & B1 & x = 50, y = 50 \\ B1 & x + y = 140 \\ M1 & Negative gradient (either) \\ A1 & 4x + y = 500 \\ A1 & x + 2y = 300 \\ B1 & Feasible region \\ M1 & Objective line drawn \\ \hline & M1 & Considering extreme point on their region} \\ M1 & Considering extreme point on their region} \\ M2 & Considering extreme point on their region} \\ M3 & Considering extreme point on their region} \\ M4 & Considering extreme point on their region} \\ M5 & Considering extreme point on their region} \\ M6 & Considering extreme point on their region} \\ M8 & Considering extreme point on their region} \\ M9 & Considering extreme point on their region} \\ M1 & Considering extreme point on their region} \\ M2 & Considering extreme point on their region} \\ M3 & Considering extreme point on their region} \\ M4 & Considering extreme point on their region} \\ M1 & Considering extreme point on their region} \\ M2 & Considering extreme point on their region} \\ M3 & Considering extreme point on their region} \\ M3 & Considering extreme point on their region} \\ M4 & Considering extreme point on their region} \\ M5 & Considering extreme point on their region} \\ M1 & Considering extreme point on their region} \\ M2 & Considering extreme point on their region} \\ M3 & Considering extreme point on their region} \\ M4 & Considering extreme point on their region} \\ M4 & Considering extreme point on their region} \\ M3 & Considering extreme point on their region} \\ M4 & Considering extreme point on their region} \\ M4 & Considering extreme point on their region} \\ M4 & Considering extreme point on their region} \\ M5 & Considering extreme point on their region} \\ M5 & Considering extreme point on their region} \\ M4 & Considering extreme point on their region} \\ M5 & Considering extreme point on their region} \\ M5 & Considering extreme point on their region} \\ M5 & Considering extreme point on the c$		0	100	1	200
B1 M1 Negative gradient (either) A1 $4x + y = 500$ A1 $x + 2y = 300$ B1 Feasible region Objective line drawn (ii) Maximum (100,100) M1 Considering extreme point on their region		0 40	100	140	200 x
B1 M1 Negative gradient (either) A1 $4x + y = 500$ A1 $x + 2y = 300$ B1 Feasible region Objective line drawn (ii) Maximum (100,100) M1 Considering extreme point on their region					
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$					
(ii) Maximum (100,100) A1 A1 A1 A1 B1 A2 A2 A3 A4					
(ii) Maximum (100,100) A1 B1 Feasible region Objective line drawn M1 Considering extreme point on their region					
B1 M1 Objective line drawn (ii) Maximum(100,100) M1 Considering extreme point on their region Considering extreme point on their region Objective line drawn					
(ii) Maximum (100,100) M1 B Objective line drawn Considering extreme point on their regions.					
(ii) Maximum (100,100) A1 8 M1 Considering extreme point on their regions.					
(ii) Maximum (100,100) M1 Considering extreme point on their regions.				0	Objective line drawn
			Al	8	
	(ii)	Maximum(100 100)	M1		Considering extreme point on their region
$ = \pm 200$	(11)	=£200	A1	2	Considering extreme point on their region
		~_00	AI	_	
(iii) Minimum (90,50) M1 Considering extreme minimum point of	(iii)	Minimum (90,50)	M1		Considering extreme minimum point on
their region		(')			
= £132 A1 2			A1		
Total 16		Total		16	

Q	Solution	Marks	Total	Comments
6(a)(i)	$G \to P \to A \to N \to R \to G$	M1		Tour
	65 115 155 125 160	M1 A1		Visits all places Correct order
	Total = 620	B1	4	Correct order
	10tai - 020	Di		
(ii)				
	P 115 A	M1		SCA $(MST + extra edge(s))$
	- A			N COT
	155	m1		MST
		A1		
	• •			
	R 125 N			
	P			
	↑			
	\ /	m1		2 edges from <i>G</i>
	65 160			
	\ /			
	¥			
	G			
	LB = 395 + 225 = 620	A 1	5	
	EB 333 \ 223 \ 023	111	S	
(iii)	T = 620	E1F		Their (a)(ii) $\leq T \leq$ their (a)(i)
				where $(a)(i) \ge (a)(ii)$
(b)(i)	92	B1	1	
(ii)	87	B1	1	
(:::)		D1	1	
(iii)	6	B1	1	
(iv)	n!	B1	1	
(11)	Total	21	14	
	TOTAL		75	