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General Certificate of Education (A-level) January 2012

Mathematics

MD01

(Specification 6360)

Decision 1

Final





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Key to mark scheme abbreviations

М	mark is for method
m or dM	mark is dependent on one or more M marks and is for method
А	mark is dependent on M or m marks and is for accuracy
В	mark is independent of M or m marks and is for method and accuracy
E	mark is for explanation
\sqrt{or} ft or F	follow through from previous incorrect result
CAO	correct answer only
CSO	correct solution only
AWFW	anything which falls within
AWRT	anything which rounds to
ACF	any correct form
AG	answer given
SC	special case
OE	or equivalent
A2,1	2 or 1 (or 0) accuracy marks
-x EE	deduct <i>x</i> marks for each error
NMS	no method shown
PI	possibly implied
SCA	substantially correct approach
С	candidate
sf	significant figure(s)
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.

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.

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D01				~ -							Sloud
Q 1				Solı	ıtion				Marks	Total	Comments
1	37	25 ~	16 ×	12 •	36 -	24 ~	13 ×	11 •			
	36	24	13	11	37	25	16	12	M1		Using 4 sets of 2
	36 _	24 ×	13	11 ×	37 _	25 ×	16 _	12 ×	A1		Must see this line
	13	11	16	12	36	24	37	25	m1		Using 2 sets of 4
	13	11	16	12	36	24	37	25	A1		Must see this line
	11	12	13	16	24	25	36	37	A1	5	All correct
								Total		5	
2(a)						<u> </u>		\sim 1 > 2	M1		Bipartite graph, 2 sets of 6 vertices, at least 10 edges
	$C \leqslant$ $D \leqslant$ $E \leftarrow$ $F \leftarrow$							$3 \\ 4 \\ 5 \\ 6 \\ 6$	A1	2	Correct, including labels
(b)	$\begin{array}{c} F\\ \therefore E\\ \therefore B\end{array}$	must		ith 5	}				E1 E1		
	∴ A & Impo alloca	&Cb ssible	ooth w e as ty	vith 1 wo pe	ople	canno	ot be		E1	3	Include conclusion
											Or E1 3 must be with <i>D</i> (generous) E1 4 " " <i>D</i> (generous) E1 Impossible as <i>D</i> cannot do both 3 and 4 (strict)

MD01	(cont)
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Q	Solution	Marks	Total	Comments Kruskal must have first 2 edges correct &
3 (a)	$ED = \begin{pmatrix} 6 \end{pmatrix}$	M1		Riuskai, must nave mist 2 euges conteet &
	AC = 8			no cycles (edges not lengths must be seen)
	$AD = \begin{bmatrix} 10 \end{bmatrix}$			
	or	A1		AD or CD third edge
	$DC = \begin{bmatrix} 10 \end{bmatrix}$			
	FG = 11			
	$BE = \begin{bmatrix} 12 \end{bmatrix}$	A1		<i>BE</i> 5th edge
	$CF = \begin{pmatrix} 16 \end{pmatrix}$	B1		6 edges
		A1	5	All correct
(b)	63	B1	1	
(c)	B••E			
(C)				
		M1		Spanning tree with 5+ edges
	A			
		A1		Correct including labelling
	C F			
	B •──── ≠ E			
	A D G			
		A1	3	Correct including labelling on a separate
				diagram
	C			
1 (-)	Total		9	
4 (a)	CE + KH = (35 + 24) = 59	M1		These 3 correct sets of pairs
	CK + EH = (25 + 40) = 65	A2,1		3 correct totals, 2 correct totals
	CH + EK = (25 + 30) = 55			
	Total $= 224 + 55$ PI by their '279'	M1		224 + their smallest of three pair totals
	= 279	A1	5	CSO including totals seen
				, č
(b)	3	B1	1	
	Total		6	

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Q	Solution	Marks	Total	Comments
5(a)		B1 B1 M1 A1 B1	6	Each line must be straight to have the B mark available. For all lines, must be correct to $\frac{1}{2}$ square horizontal and vertical at the indicated vertices. y = 20 line through (4,40) and (16,10) line through (0,25) and (10,15) any line through origin (or if extended, through the origin) with positive gradient (generous ± 1 square at the origin) lines through (10,20) and (10,40) as well as origin (normal accuracy rules) FR, all lines correct and region labelled (condone no shading, ignore 'poor' shading)
(b)(i)	(Min at) x = 5, y = 20	B1	1	Accept (5, 20)
	(P =) 45	B1 B1	1	1000pt (0, 20)
	(r –) 43		1	
(ii)	(Min at) x = 10, y = 20	B1		Accept (10, 20)
	$(\mathbf{P}=)10$	B1	4	
	Total		10	

<u>l (cont</u> Q	Solution	Marks	Total	WWW.TNymathsold
6(a)	A ()			
	28 48	M1		SCA, 2 values at <i>C</i> or <i>D</i>
	28 B 39 10 C ₄₈ 47	A1		Correct values at D
	D 39 37	1		
		m1		4 values at F
	55 66 45	m1		2 values at <i>G</i> or <i>H</i> 2 values at <i>I</i>
	56	m1		2 values at T
				Each m1 depends only on the M1
	83 E 8 F 94 93 92 91	A 1		
	54 23 10 31	A1		All correct, condone 0 missing at <i>A</i> , with rejected values crossed and final values
	G = 20			boxed and no extra values at other
	137 ¹ 14 H 122 [2]			vertices.
	135 10 28			
	J 149 145	B1	7	145 at J
(b)	Route: A B E F G H I J	B1	1	Or reverse
(c)	'their 135' – (28 + GJ)	M1		or replace their <i>BG</i> in terms of letters or
(0)	GJ may be in terms of letters or numbers	1011		numbers eg $55 + 8 + 10 = 73$,
				then 'their $73' - 10 =$
				DC 10 20
				or $BG = AG - 10 - 28$ eg BG = 'their 101' - 10 - 28
	= 63	A1		Note: 63 with no working seen scores 2/2
	Route: A B G H I J	B1	3	Or reverse

MD01 (cont)

(ii) $B A D E F G E C A B$ (iii) $B A D E F G E C A B$ (iii) $B A D E F G E C A B$ (iii) 76 (c)(i) $1 \bigcirc 2 \bigcirc 4 \bigcirc 3 \bigcirc 5 \bigcirc 6$ $A = 10 \bigcirc 23 \odot 32 \bigcirc 6$ (ii) $4 \Im = 10 \bigcirc 23 \odot 32 \bigcirc 6$ (iii) $4 \Im = 10 \bigcirc 23 \odot 32 \bigcirc 6$ (iii) $4 \Im = 10 \bigcirc 23 \odot 32 \bigcirc 6$ (iii) $4 \Im = 10 \bigcirc 23 \odot 32 \bigcirc 6$ (iii) $4 \Im = 10 \bigcirc 23 \odot 32 \bigcirc 6$ (ii) $4 \Im = 10 \bigcirc 23 \odot 32 \bigcirc 6$ (ii) $4 \Im = 10 \bigcirc 23 \odot 32 \bigcirc 6$ (ii) $4 \Im = 10 \bigcirc 23 \odot 32 \bigcirc 6$ (ii) $4 \Im = 10 \bigcirc 23 \odot 32 \bigcirc 6$ (ii) $4 \Im = 10 \bigcirc 23 \odot 32 \bigcirc 6$ (ii) $4 \Im = 10 \bigcirc 23 \odot 32 \bigcirc 6$ (ii) $4 \Im = 10 \bigcirc 23 \odot 32 \bigcirc 6$ (ii) $4 \Im = 10 \bigcirc 23 \odot 32 \odot 6$ (ii) $4 \Im = 10 \bigcirc 23 \odot 32 \odot 6$ (ii) $4 \Im = 10 \bigcirc 23 \odot 32 \odot 6$ (ii) $4 \Im = 10 \bigcirc 23 \odot 32 \odot 6$ (ii) $4 \Im = 10 \bigcirc 23 \odot 32 \odot 6$ (ii) $4 \Im = 10 \bigcirc 23 \odot 32 \odot 6 \odot \odot 6$ (ii) $4 \Im = 10 \odot 23 \odot 32 \odot 6 \odot \odot 6$ (ii) $4 \Im = 10 \odot 23 \odot 32 \odot 6 \odot 6$ (ii) $4 \Im = 10 \odot 23 \odot 32 \odot 6 \odot 6$ (ii) $4 \Im = 10 \odot 23 \odot 32 \odot 6 \odot 6$ (ii) $4 \Im = 10 \odot 23 \odot 32 \odot 6 \odot 6$ (ii) $4 \Im = 10 \odot 23 \odot 32 \odot 6 \odot 6$ (ii) $4 \Im = 10 \odot 23 \odot 32 \odot 6 \odot 6$ (ii) $4 \Im = 10 \odot 23 \odot 32 \odot 6 \odot 6$ (ii) $4 \Im = 10 \odot 23 \odot 32 \odot 6 \odot 6$ (ii) $4 \Im = 10 \odot 23 \odot 32 \odot 6 \odot 6$ (ii) $4 \Im = 10 \odot 23 \odot 32 \odot 6 \odot 6$ (ii) $4 \Im = 10 \odot 23 \odot 32 \odot 6 \odot 6$ (ii) $4 \Im = 10 \odot 23 \odot 32 \odot 6 \odot 6$ (ii) $4 \Im = 10 \odot 23 \odot 32 \odot 6 \odot 6$ (ii) $4 \Im = 10 \odot 23 \odot 32 \odot 6 \odot 6$ (iii) $4 \Im = 10 \odot 23 \odot 32 \odot 6 \odot 6$ (ii) $4 \Im = 10 \odot 7 \odot 10 \odot 7 \odot $	<u>1 (cont</u>)				a contraction of the second seco
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$		Solution	Marks	Total	Comments
A1 A1 A1 B1A1 A1 B1Visits all 7 vertices Correct order from B(ii) $B A D E F G \underline{E} C \underline{A} B$ M1 A1Expansion of GC or CB Both correct(iii)76B1F1Minimum of 76 and their (b)(i)(c)(i) (1) (2) (4) (3) (5) (6) $A B C D F G$ $A A B C D F G$ M1 $A - 2 6 4 16 27 6 6 8 - 110 23 32 2 - 20 G 27 26 32 23 (2) - 20 G 32 23 (2) - 20 G 32 32 (2) - 20 G 32 (2) - 20 G 32 (2) - 20 (3)$	7(a)	$ \begin{array}{cccccccccccccccccccccccccccccccccccc$		2	5 correct values in an <i>E</i> 'line'
(iii) 76 A1 2 Both correct B1F 1 Minimum of 76 and their (b)(i) Use of matrix form, 4+ numbers circled and 4+ parallel 'lines' crossed out C added 4th Any 5 values 'circled' A1 C added 4th Any 5 values 'circled' A1 C added 4th Any 5 values 'circled' A1 Correct values circled and lines crossed out, either as shown or as mirror image. Order of vertices must be clearly shown. Condone omission of line at G. (ii) 43 43 + (4 + 7) = 54 A1 B1 A	(b)(i)		A1 A1	4	Visits all 7 vertices
(c)(i) $\begin{array}{c c} \hline (1) \hline (2) \hline (4) \hline (3) \hline (5) \hline (6) \\ \hline A & B & C & D & F & G \\ \hline A & - & 2 & 6 & 4 & 16 & 27 \\ \hline A & - & 2 & 6 & 4 & 16 & 27 \\ \hline A & - & 2 & 6 & 4 & 16 & 27 \\ \hline B & 2 & - & 8 & 3 & 15 & 26 \\ \hline C & 6 & 8 & - & 10 & 23 & 32 \\ \hline D & 4 & 3 & 10 & - & 12 & 23 \\ \hline \hline F & 16 & 15 & 23 & 12 & - & 20 \\ \hline G & 27 & 26 & 32 & 23 & 20 \\ \hline \hline & & & & & \\ \end{array}$ (ii) $\begin{array}{c} 43 \\ 43 \\ 43 \\ 43 + (4 + 7) \\ = 54 \end{array}$ M1 M1 M1 M1 M1 M1 M1 M1 M1 M1	(ii)	$B A D E F G \underline{E} C \underline{A} B$		2	
(i) $ \begin{array}{c ccccccccccccccccccccccccccccccccccc$	(iii)	76	B1F	1	Minimum of 76 and their (b)(i)
(ii) $\begin{array}{c ccccccccccccccccccccccccccccccccccc$	(c)(i)		M1		
(ii) $\begin{array}{c c c c c c c c c c c c c c c c c c c $		A - 2 6 4 16 27	A1		C added 4th
(ii) $\begin{array}{c c c c c c c c c c c c c c c c c c c $			B1		Any 5 values 'circled'
(ii) $\begin{array}{cccc} 43 \\ 43 + (4 + 7) \\ = 54 \end{array}$ B1		$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	A1		crossed out, either as shown or as mirror image. Order of vertices must be clearly shown.
	(ii)	43 + (4 + 7)	M 1		Their $43 + 2$ different edges from <i>E</i>
	(iii)	64	B1	1	
	(d)	$64_{t} \leq_{j} T \leq 76$ Total	B1B1	2 19	Must be written in symbols

MD01	(cont)
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				Mun. my mainschoud.com Any of these seen
MD01 (cont)		Marilar	T-4-1	Toud Comments
Q P(a)	Solution	Marks M1	Total	Comments Com
8(a)	$ \begin{array}{c} 2x + 3 > 0 \\ 3x - 5 > 0 \\ x + 1 > 0 \\ 4x - 13 > 0 \end{array} $	M1		Any of these seen Candidates may use ≥ 1 instead of >0
	$x > \frac{13}{4} \text{ or } \ge \frac{14}{4}$ (Integer) so $x \ge 4$	A1	2	Must see both lines. Ignore further work on other inequalities. Accept 4.6 or 4.7 AWRT
(b)(i)	2x + 3 > 3x - 5	M1		Any correct ISW, condone use of \geq
	> <i>x</i> + 1	A1		2nd correct ISW
	> 4x - 13	A1	3	All correct ISW
(ii)	3x-5 > x+1 > 4x-13	M1 A1	2	Either correct ISW, condone use of \geq Both correct ISW
	>4x-15	AI	۷	Both correct is w
(iii)	x + 1 > 4x - 13	B1	1	ISW
(c)	$\frac{13}{4} < x < \frac{14}{3}$	M1		Or $4 \le x < \frac{14}{3}$, condone $3 < x < \frac{14}{3}$
	<i>x</i> = 4	A1	2	(Ignore all other inequalities) Must have scored 9/9 earlier
	,			SC $x < \frac{14}{3}$: $x = 4 \frac{1}{2}$
	Total	+	10	
	TOTAL	[]	75	