

# GCE 2005

## *January Series*



# Mark Scheme

## Mathematics A

*(MAD1)*

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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.

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## Key to Mark Scheme

<b>M</b> .....	mark is for .....	method
<b>m</b> .....	mark is dependent on one or more M marks and is for .....	method
<b>A</b> .....	mark is dependent on M or m marks and is for .....	accuracy
<b>B</b> .....	mark is independent of M or m marks and is for .....	method and accuracy
<b>E</b> .....	mark is for .....	explanation
✓ or ft or F .....	follow through from previous incorrect result	
<b>CAO</b> .....	correct answer only	
<b>AWFW</b> .....	anything which falls within	
<b>AWRT</b> .....	anything which rounds to	
<b>AG</b> .....	answer given	
<b>SC</b> .....	special case	
<b>OE</b> .....	or equivalent	
<b>A2,1</b> .....	2 or 1 (or 0) accuracy marks	
<b>-x EE</b> .....	deduct x marks for each error	
<b>NMS</b> .....	no method shown	
<b>PI</b> .....	possibly implied	
<b>SCA</b> .....	substantially correct approach	
<b>c</b> .....	candidate	
<b>SF</b> .....	significant figure(s)	
<b>DP</b> .....	decimal place(s)	

## Abbreviations used in Marking

<b>MC – x</b> .....	deducted x marks for mis-copy
<b>MR – x</b> .....	deducted x marks for mis-read
<b>ISW</b> .....	ignored subsequent working
<b>BOD</b> .....	given benefit of doubt
<b>WR</b> .....	work replaced by candidate
<b>FB</b> .....	formulae booklet

## Application of Mark Scheme

### **No method shown:**

Correct answer without working ..... mark as in scheme

Incorrect answer without working ..... zero marks unless specified otherwise

### **More than one method/choice of solution:**

2 or more complete attempts, neither/none crossed out ..... mark both/all fully and award the mean mark rounded down

1 complete and 1 partial attempt, neither crossed out ..... award credit for the complete solution only

### **Crossed out work**

do not mark unless it has not been replaced

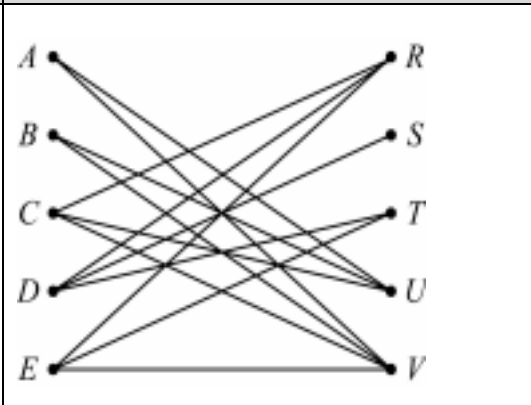
**Alternative solution** using a correct or partially correct method

award method and accuracy marks as appropriate

**MAD1**

Q	Solution	Marks	Total	Comments
1(a)	<i>AB</i> 8	M1		SCA
	<i>IH</i> 9	A1		HI second
	<i>CD</i> 10			SC (Prims Max 3/6)
	<i>EF</i> 11			1(a) B1 8 edges
	<i>BE</i> 13			1(b) B1 107
	<i>BC</i> 14			1(c) B1 MST
	(not <i>AF</i> )			
	(not <i>DE</i> )	A1		May be implied
	<i>DI</i> 20			
<i>HG</i> 22	A1	4	All correct	
(b)	Total 107	B1	1	
(c)		B1F	1	(Must be 8 edges)
<b>Total</b>			<b>6</b>	

**MAD1 (cont)**

Q	Solution	Marks	Total	Comments
<p><b>2(a)</b></p>  <p><b>(b)</b> Initial Path  <math>A - U, B - V, D - R, E - T</math>  <math>C - R + D - S</math>  <math>\therefore</math> Match  <math>(AU, BV, CR, DS, ET)</math></p> <p><b>(c)</b> <math>S</math> can only be with <math>D</math>  <math>\therefore</math> Impossible</p>	<p>M1A1</p> <p>M1 A1</p> <p>B1</p> <p>E1</p>	<p>2</p> <p>3</p> <p>1</p>	<p>Using initial match, starting from <math>S</math> or <math>C</math>                      (or <math>S - D + R - C</math>)</p> <p>or 3 boys <math>ABC \neq</math> 2 girls <math>UV</math></p>	
	<b>Total</b>		<b>6</b>	

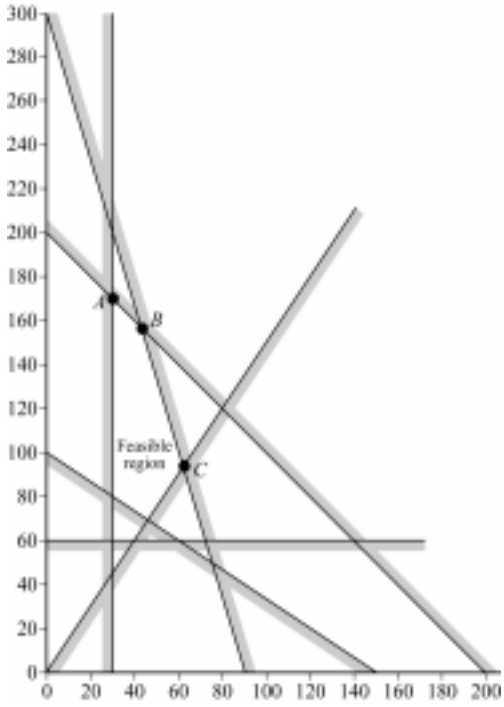
**MAD1 (cont)**

Q	Solution	Marks	Total	Comments
<p><b>3(a)(i)</b></p>		<p>M1</p> <p>A1</p> <p>M1</p> <p>M1</p> <p>A1</p> <p>B1</p> <p>B1</p> <p>M1</p> <p>A1</p> <p>E1</p> <p>B1</p>	<p>6</p> <p>2</p> <p>4</p>	<p>SCA</p> <p>Correct at <i>M</i></p> <p>3 values at <i>S</i></p> <p>3 values at <i>X</i></p> <p><i>R</i> and <i>I</i> correct</p> <p>120 at <i>X</i></p> <p>or reverse order</p> <p>Either route for 125</p> <p>CAO</p>
	<p><b>(ii)</b> Route <i>NUMBERSIX</i></p>	<p>B1</p>	<p>1</p>	<p></p>
	<p><b>(iii)</b> New min using <i>YIX</i></p> <p><math>\therefore</math> extra = 5</p>	<p>M1</p> <p>A1</p>	<p>2</p>	<p>Either route for 125</p> <p>CAO</p>
	<p><b>(b)</b> Odd vertices <i>N, A, I, X</i></p> <p>Min <math>NA + IX = 65</math></p> <p>No other pairings quicker</p> <p><math>\therefore</math> total time 790 (secs)</p>	<p>M1</p> <p>A1</p> <p>E1</p> <p>B1</p>	<p>4</p>	<p></p>
	<p><b>Total</b></p>		<p><b>13</b></p>	

**MAD1 (cont)**

Q	Solution	Marks	Total	Comments
4(a)(i)	$A G C V B A = 13 + 5 + 4 + 9 + 11$ $= 42 \text{ (km)}$	B1	1	
(ii)	$A \quad V \quad C \quad G \quad B \quad A$ $8 \quad 4 \quad 5 \quad 11 \quad 11$ $= 39 \text{ (km)}$	M1 M1 A1 B1	4	Tour Visits all vertices Correct order
(b)(i)	Delete $A$ $(4 + 5 + 9) + (8 + 10)$ $= 36 \text{ (km)}$	M1 A1 B1	3	MST – 3 edges Correct MST or $(4 + 5 + 9) + 16 = 34$
(ii)	Delete $G$ $(4 + 9 + 8) + (5 + 6)$ $= 32 \text{ (km)}$	M1 A1 B1	3	MST – 3 edges Correct MST or $(4 + 9 + 8) + 10 = 31$
(c)	$36 \leq T \leq 39$	B1FB1F	2	$34 \leq T \leq 39$ Their(max(b)) $\leq T \leq$ Their(min(a))
	<b>Total</b>		<b>13</b>	

**MAD1 (cont)**

Q	Solution	Marks	Total	Comments
<p><b>5(a)</b></p>	<p>At least 30 &amp; 60 }                      In total <math>\leq 200</math> }</p> <p>Area <math>2x + 3y \geq 300</math></p> <p>Cost <math>40x + 12y \leq 3600</math> }  <math>10x + 3y \leq 900</math> }</p> <p><math>y</math> at least 150% <math>x</math></p>	<p>B1</p> <p>B1</p> <p>B1</p> <p>B1</p>	<p>4</p>	<p>(strict)</p>
<p><b>(b)</b></p>		<p>B1</p> <p>B1 <math>\times</math> 4</p> <p>B1</p>	<p>6</p>	<p><math>x = 30, y = 60</math></p> <p>other lines region</p>
<p><b>(c)</b></p>	<p><math>y \geq 60</math></p>	<p>B1</p>	<p>1</p>	
<p><b>(d)</b></p>	<p><math>P = 4x + 5y</math></p> <p>Max at A</p> <p><math>x = 30</math> }  <math>y = 170</math> }</p> <p><math>P = 970</math></p>	<p>M1</p> <p>A1</p> <p>B1</p>	<p>3</p>	<p>Considering extreme point(s)</p>
	<p><b>Total</b></p>		<p><b>14</b></p>	



**MAD1 (cont)**

Q	Solution				Marks	Total	Comments	
<b>6(a)</b>	<i>N</i>	<i>K</i>	<i>A</i>	(Print)	M1		SCA	
	5			(10)				
		0		(20)				
			1	(30)				
		1		(40)				
					(1)	(50)	A1	1 <sup>st</sup> pass
	2			(60)				
			0	(30)				
		2		(40)				
					(0)	(50)	A1	2 <sup>nd</sup> pass
1			(60)					
		1	(30)					
	3		(40)					
				(1)	(50)	A1	3 <sup>rd</sup> pass	
0			(60)					
			Print 1, 0, 1				AG	
<b>(b)</b>	<i>N</i>	<i>K</i>	<i>A</i>	Print				
	11				M1		Trace starting with <i>N</i> = 1	
		0						
			1					
		1		1				
5								
Continues as above								
Print 1, 1, 0, 1						A1	2	CAO
<b>(c)</b>	<i>N</i> = 40		<i>K</i> = 0, 1		M1		Trace starting with <i>N</i> = 40	
	20		<i>K</i> = 2					
	10		<i>K</i> = 3					
	5		<i>K</i> = 4					
	2		<i>K</i> = 5					
	1		<i>K</i> = 6		A1	2	CAO	
				<b>Total</b>		<b>8</b>		
				<b>Total</b>		<b>60</b>		