

Centre Number						Candidate Number				
Surname										
Other Names										
Candidate Signature										

For Examiner's Use	
Examiner's Initials	
Question	Mark
1	
2	
3	
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7	
8	
9	
TOTAL	



General Certificate of Education
Advanced Subsidiary Examination
January 2013

Mathematics

MD01

Unit Decision 1

Friday 25 January 2013 1.30 pm to 3.00 pm

For this paper you must have:

- the blue AQA booklet of formulae and statistical tables.

You may use a graphics calculator.

Time allowed

- 1 hour 30 minutes

Instructions

- Use black ink or black ball-point pen. Pencil should only be used for drawing.
- Fill in the boxes at the top of this page.
- Answer **all** questions.
- Write the question part reference (eg (a), (b)(i) etc) in the left-hand margin.
- You must answer each question in the space provided for that question. If you require extra space, use an AQA supplementary answer book; do **not** use the space provided for a different question.
- Do not write outside the box around each page.
- Show all necessary working; otherwise marks for method may be lost.
- Do all rough work in this book. Cross through any work that you do not want to be marked.
- The **final** answer to questions requiring the use of calculators should be given to three significant figures, unless stated otherwise.

Information

- The marks for questions are shown in brackets.
- The maximum mark for this paper is 75.

Advice

- You do not necessarily need to use all the space provided.



J A N 1 3 M D 0 1 0 1

QUESTION
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QUESTION
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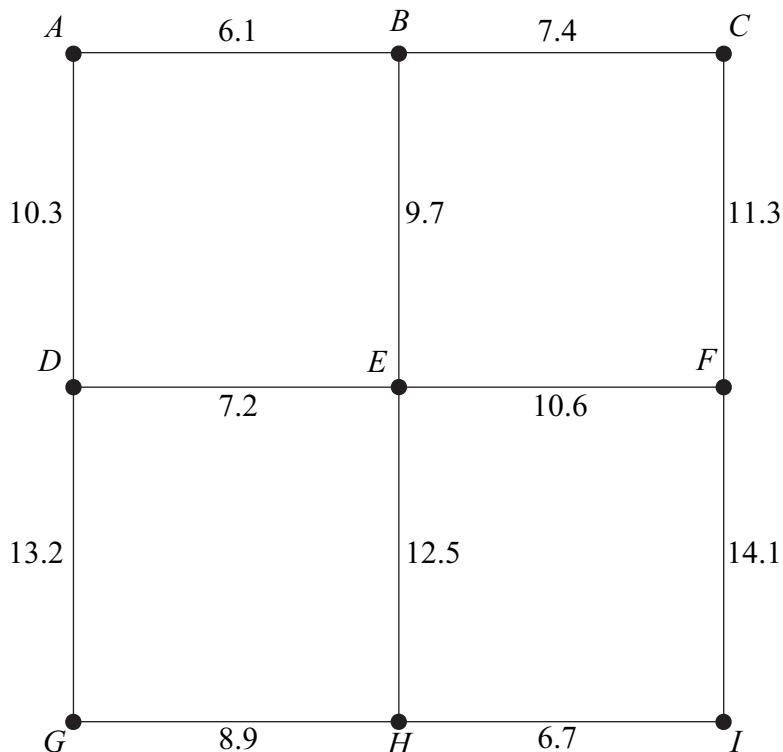
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3 The following network shows the lengths, in miles, of roads connecting nine villages, A, B, \dots, I .

A delivery man lives in village A and is to drive along all the roads at least once before returning to A .



Total length of all the roads is 118 miles

- (a) Find the length of an optimal Chinese postman route around the nine villages, starting and finishing at A . (5 marks)
- (b) For an optimal Chinese postman route corresponding to your answer in part (a), state:
 - (i) the number of times village E would be visited;
 - (ii) the number of times village I would be visited. (2 marks)

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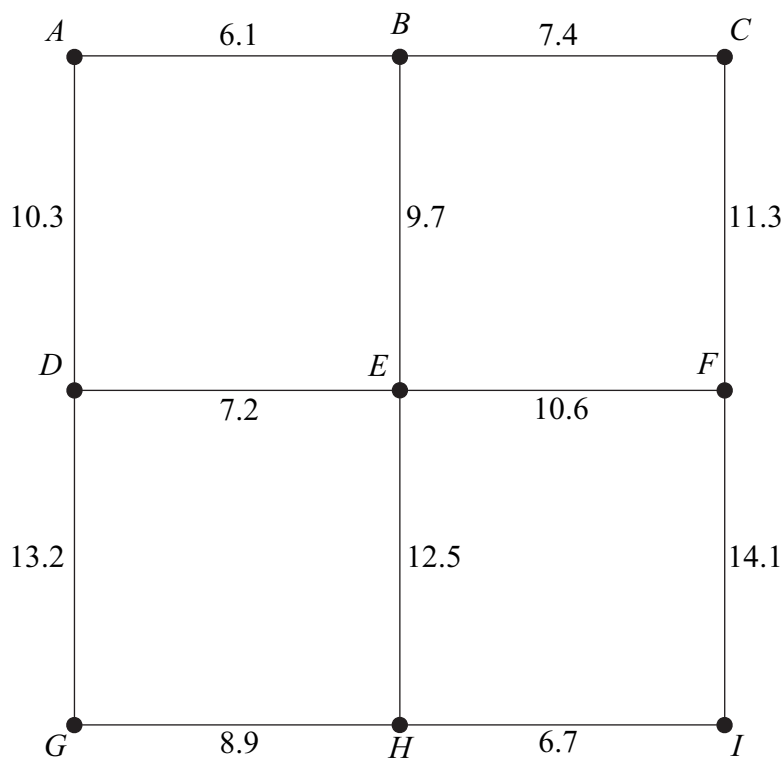
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4 The following network shows the lengths, in miles, of roads connecting nine villages, A, B, \dots, I .

A programme of resurfacing some roads is undertaken to ensure that each village can access all other villages along a resurfaced road, while keeping the amount of road to be resurfaced to a minimum.



- (a) (i)** Use Prim's algorithm starting from A , showing the order in which you select the edges, to find a minimum spanning tree for the network.
- (ii)** State the length of your minimum spanning tree.
- (iii)** Draw your minimum spanning tree. (7 marks)
- (b)** Given that Prim's algorithm is used with different start vertices, state the final edge to be added to the minimum spanning tree if:
- (i)** the start vertex is E ;
- (ii)** the start vertex is G . (2 marks)
- (c)** Given that Kruskal's algorithm is used to find the minimum spanning tree, state which edge would be:
- (i)** the first to be included in the tree;
- (ii)** the last to be included in the tree. (2 marks)



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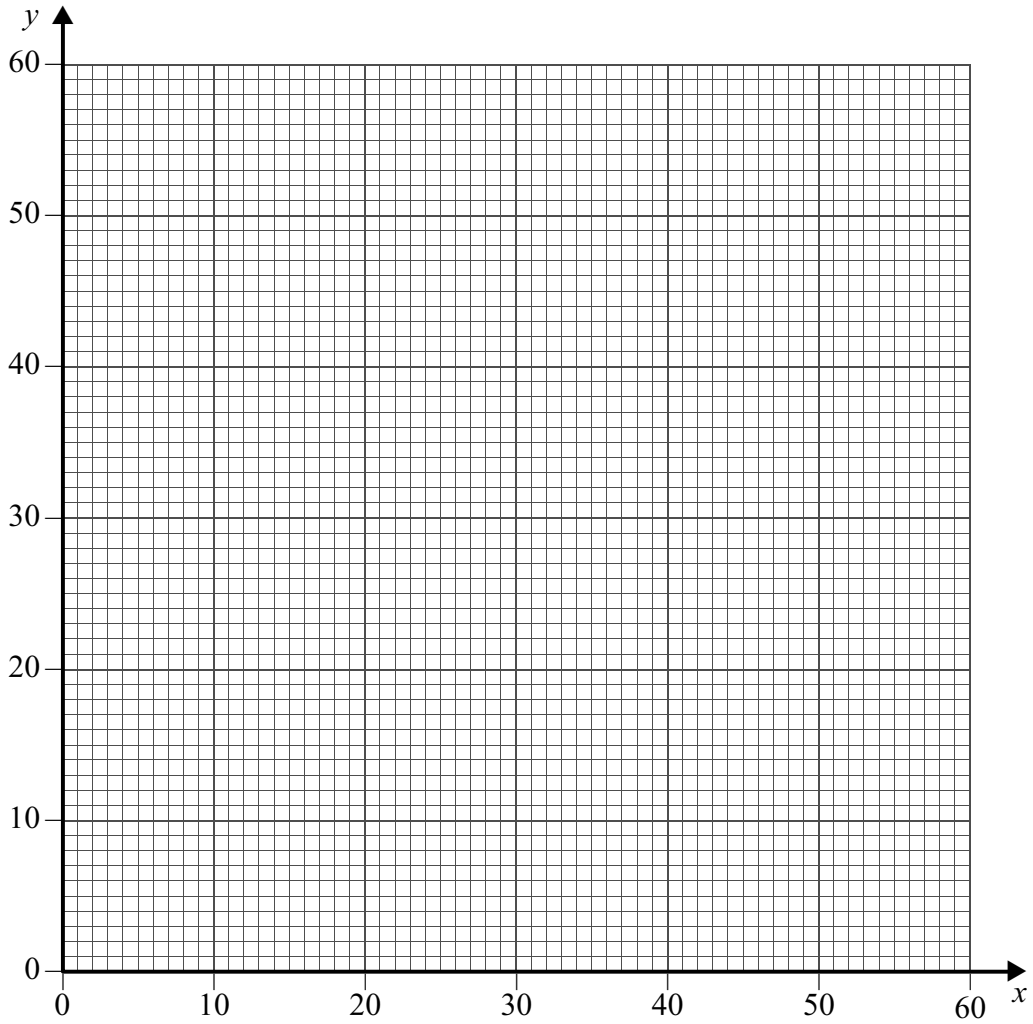
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QUESTION
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(a)



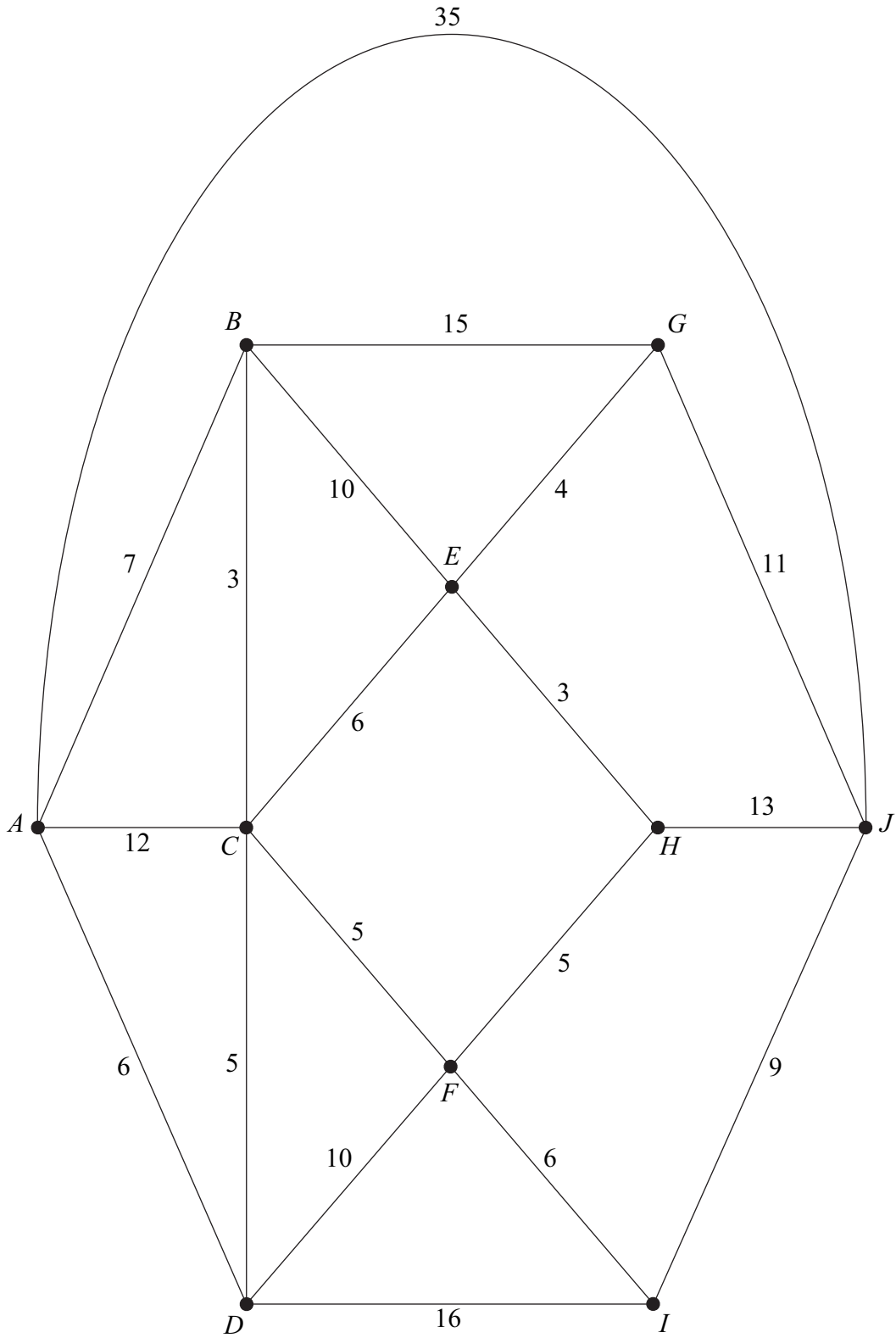
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QUESTION
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(a)



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QUESTION
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8 Tony delivers paper to five offices, *A*, *B*, *C*, *D* and *E*. Tony starts his deliveries at office *E* and travels to each of the other offices once, before returning to office *E*. Tony wishes to keep his travelling time to a minimum.

The table shows the travelling times, in minutes, between the offices.

	<i>A</i>	<i>B</i>	<i>C</i>	<i>D</i>	<i>E</i>
<i>A</i>	–	10	16	20	8
<i>B</i>	10	–	21	15	9
<i>C</i>	16	21	–	10	23
<i>D</i>	20	15	10	–	17
<i>E</i>	8	9	23	17	–

- (a) Find the travelling time of the tour *ACDBEA*. (1 mark)
- (b) Hence write down a tour, starting at *E*, which has the same total travelling time as your answer to part (a). (1 mark)
- (c) Use the nearest neighbour algorithm, starting at *E*, to find an upper bound for the minimum travelling time for Tony’s tour. (4 marks)
- (d) By deleting *E*, find a lower bound for the minimum travelling time for Tony’s tour. (4 marks)
- (e) Sketch a network showing the edges that give the lower bound in part (d), and comment on its significance. (2 marks)

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