

Centre Number						Candidate Number				
Surname										
Other Names										
Candidate Signature										

For Examiner's Use	
Examiner's Initials	
Question	Mark
1	
2	
3	
4	
5	
6	
TOTAL	



Free-Standing Mathematics Qualification
Advanced Level
June 2013

Using and Applying Decision Mathematics

6994/2

Unit 14

Tuesday 14 May 2013 1.30 pm to 3.00 pm

- For this paper you must have:**
- a clean copy of the Data Sheet (enclosed)
 - a calculator
 - a ruler.

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.
- You may **not** refer to the copy of the Data Sheet that was available prior to this examination. A clean copy is enclosed for your use.

Information

- The marks for questions are shown in brackets.
- The maximum mark for this paper is 60.
- You may use either a scientific calculator or a graphics calculator.

Advice

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



J U N 1 3 6 9 9 4 / 2 0 1

Section AAnswer **all** questions.

Answer each question in the space provided for that question.

Use **Flat construction** on page 2 of the Data Sheet.

- 1** The shell of a flat has been constructed. The inside is to be completed and the following activities need to be carried out.

Activity	Tradesperson	Immediate predecessor	Duration (days)
A: Studding	Builder	–	2.5
B: Electrics (first fix)	Electrician	A	1.5
C: Plumbing (first fix)	Plumber	A	2
D: Plasterboarding	Plasterer	B, C	1.5
E: Plastering	Plasterer	D	1.5
F: Artexing	Plasterer	E	1.5
G: Electrics (second fix)	Electrician	E	1
H: Joinery (first fix)	Joiner	E	1.5
I: Plumbing (second fix)	Plumber	E	1.5
J: Joinery (second fix)	Joiner	G, H, I	2.5
K: Painting	Decorator	F, J	1.5
L: Tiling	Tiler	J	1
M: Cleaning	Cleaner	K, L	1

- (a) Construct an activity network for the project. (4 marks)
- (b) Find the earliest start time for each activity. (2 marks)
- (c) Find the latest finish time for each activity. (3 marks)
- (d) List the critical activities and state the shortest completion time for the project. (2 marks)
- (e) Using the grid on page 5, construct a Gantt (cascade) diagram for the project. (4 marks)
- (f) The foreman of the project would like to speed up the project by using either an extra plumber or an extra joiner.
An extra plumber would reduce the time for all the plumbing work by 25 %, and an extra joiner would reduce the time for all the joinery work by 40 %.
- Explain which tradesperson the foreman should use, and find the new minimum time to complete the project. (5 marks)



QUESTION
PART
REFERENCE

Answer space for question 1

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QUESTION
PART
REFERENCE

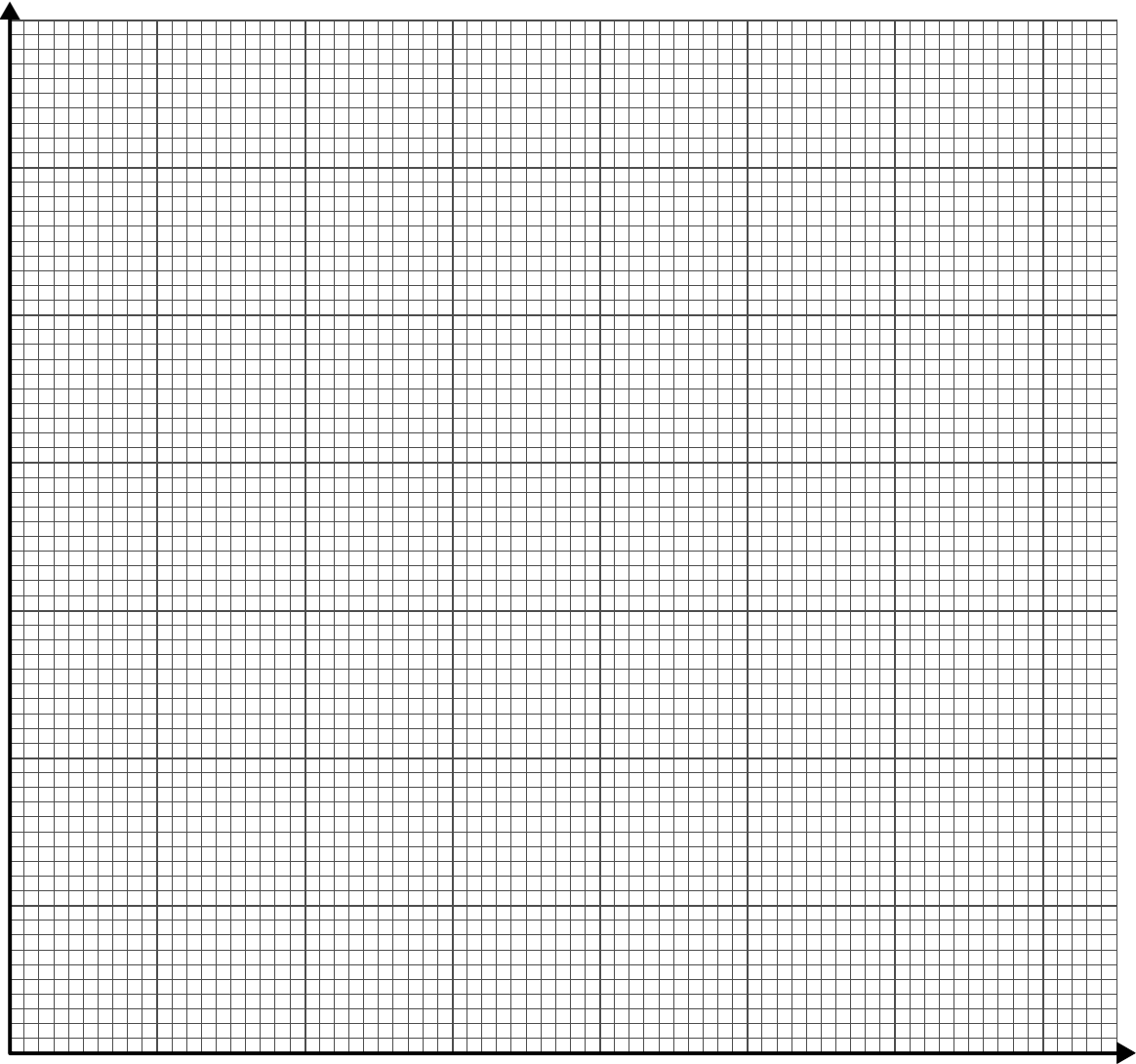
Answer space for question 1

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QUESTION
PART
REFERENCE

Answer space for question 1



Below the grid, there are ten horizontal dotted lines for writing the answer.



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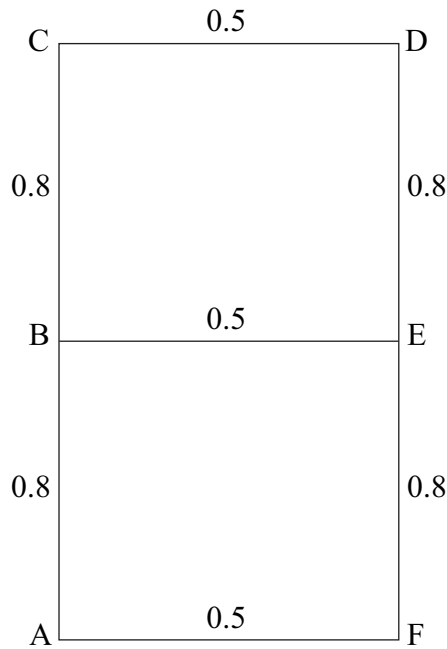
Section B

Answer **all** questions.

Answer each question in the space provided for that question.

Use **Wind farms** on page 2 of the Data Sheet.

- 2** The diagram shows the locations of wind turbines at A, B, C, D, E and F. The number on each edge shows the distance, in kilometres, between pairs of turbines.



- (a) Showing the order in which you select the edges, use Prim's algorithm starting from A to find a minimum spanning tree for the six turbines. (3 marks)
- (b) State the length of your minimum spanning tree. (1 mark)
- (c) Draw your minimum spanning tree. (1 mark)

QUESTION
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Answer space for question 2

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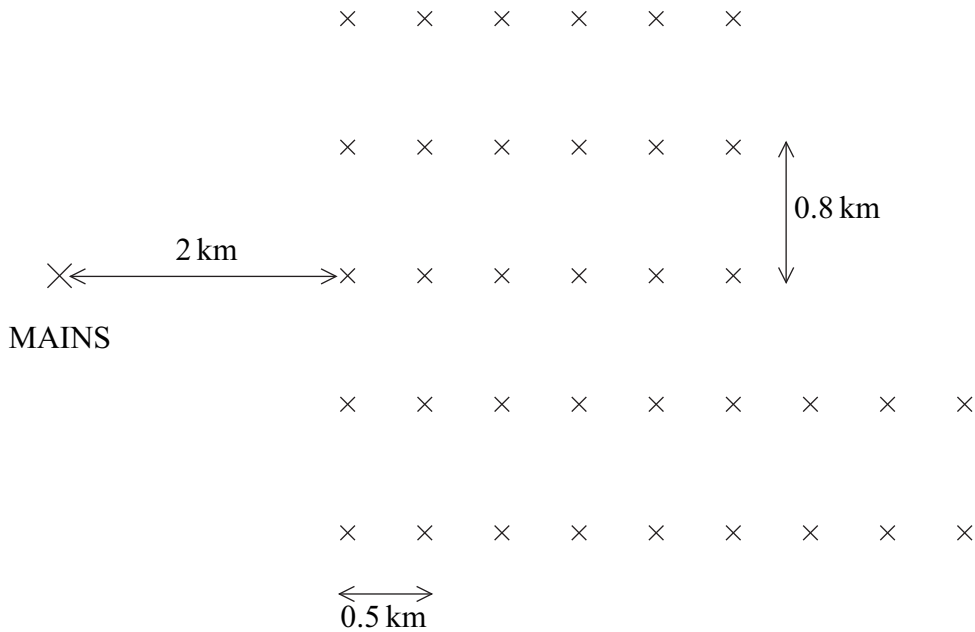


3 Two hundred wind turbines are to be arranged in rows, with a gap of 500 metres between each turbine. The rows are 800 metres apart.

Each turbine must be connected, either directly or indirectly, to the mains electricity grid by cabling.

The mains electricity grid is 2 kilometres from the nearest turbine.

The diagram shows part of one possible arrangement.



- (a) If 200 turbines are to be situated with 100 turbines in each of two rows, show that the minimum length of cabling needed is 101.8 kilometres. (2 marks)
- (b) Find the minimum length of cabling needed if 200 turbines are to be situated with 50 turbines in each of four rows. (2 marks)
- (c) A company is building a new wind farm and it has to decide on the layout of the turbines. Use parts (a) and (b) to advise the company. (1 mark)

QUESTION
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Answer space for question 3

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QUESTION
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Answer space for question 3

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Section C

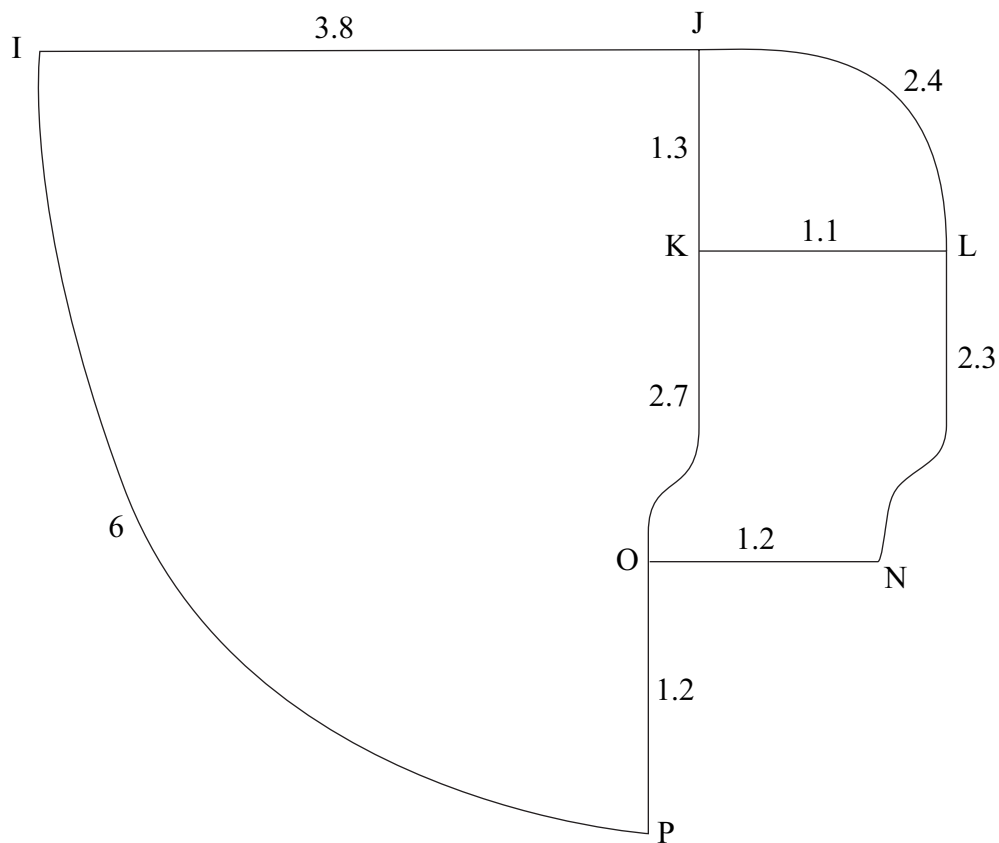
Answer **all** questions.

Answer each question in the space provided for that question.

Use **Palm Springs** on pages 3 and 4 of the Data Sheet.

- 4** The diagram shows a network of roads and the locations of seven houses in Palm Springs. The number on each edge represents the **distance**, in kilometres, between pairs of houses.

The total length of these roads is 22 kilometres.



- (a)** Ron, a policeman, has to patrol the area, by driving along all of the roads shown on the diagram at least once.
- (i)** Find the length of an optimal Chinese Postman route around the roads shown **on the diagram**, starting and finishing at P. *(6 marks)*
- (ii)** In an optimal route corresponding to your answer in part **(a)(i)**, state the number of times the letter L would appear. *(1 mark)*
- (b)** George is to drive along all of the roads delivering leaflets. George starts at house J and finishes at house K. Find the length of George's optimal route. *(2 marks)*



QUESTION
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REFERENCE

Answer space for question 4

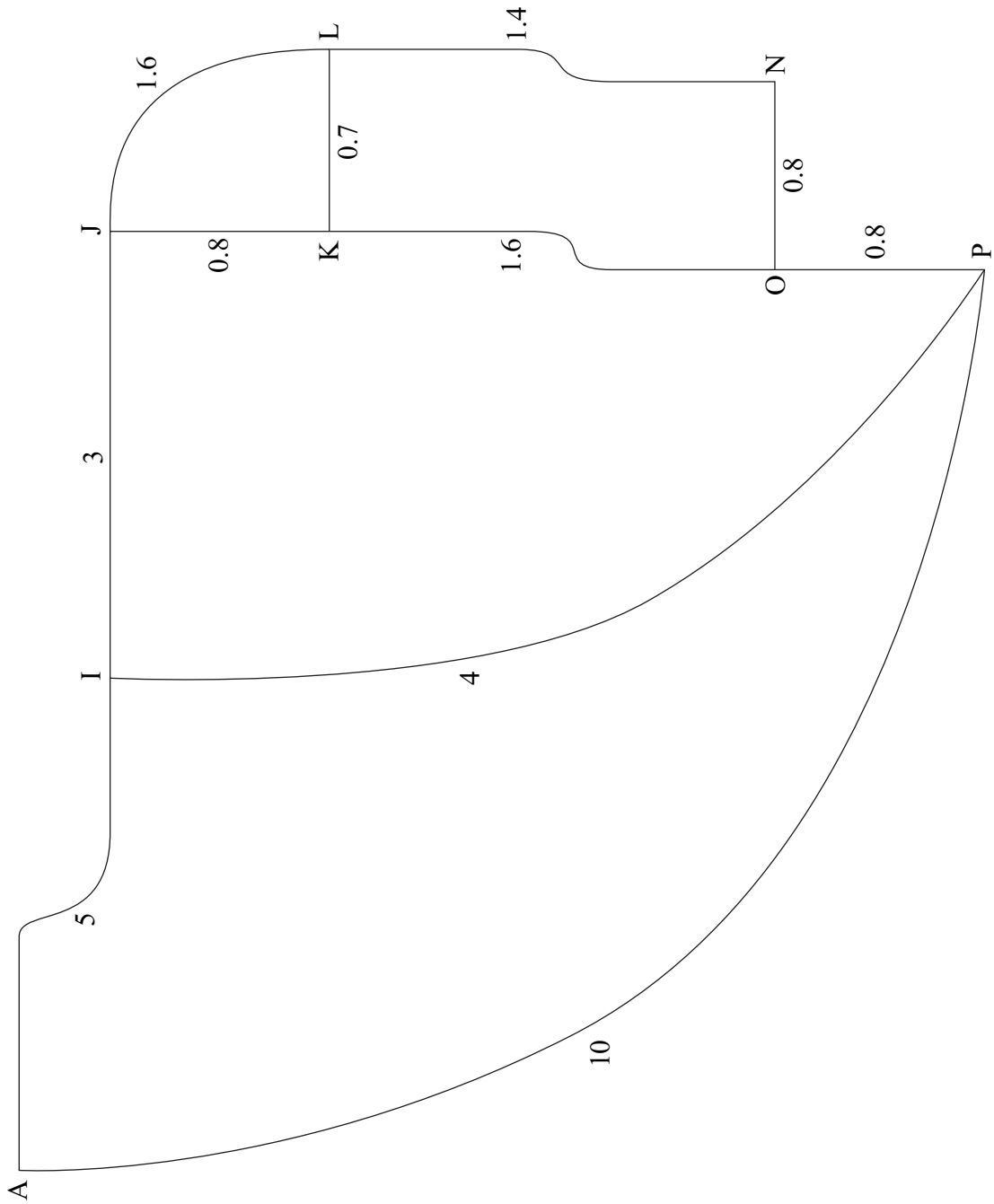
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QUESTION
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Answer space for question 5



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QUESTION
PART
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Answer space for question 6

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