Pearson Edexcel International Advanced Level

Tuesday 20 January 2026

Afternoon (Time: 1 hour 30 minutes)

Paper reference **WDM11/01A**

Mathematics

International Advanced Subsidiary/Advanced Level
Decision Mathematics D1
Question Paper

You must have:
Answer book (sent separately).
Do not return this question paper with the answer book.

Turn over ▶

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1.

5.0 1.8 6.2 2.8 3.0 4.0 3.8 2.4 0.6 0.8 7.8

The numbers in the list are the lengths, in feet, of eleven pieces of wood. They are to be cut from planks of wood of length 10 feet. You should ignore wastage due to cutting.

(a) Calculate a lower bound for the number of planks needed. You must make your method clear.

(2)

(b) Use the first-fit bin packing algorithm to determine how these pieces could be cut from 10 feet planks.

(3)

(c) Carry out a quick sort to produce a list of the lengths in descending order. You should show the result of each pass and identify your pivots clearly.

(4)

(d) Use the first-fit decreasing bin packing algorithm to determine how these pieces could be cut from 10 feet planks.

(2)

(Total for Question 1 is 11 marks)

2.

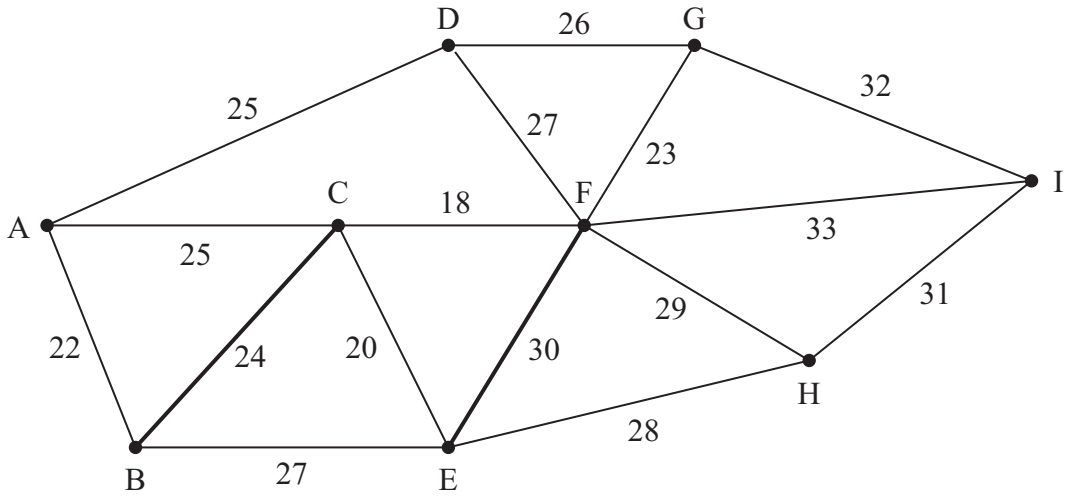

Figure 1

Figure 1 represents nine buildings, A, B, C, D, E, F, G, H and I, recently bought by Newberry Enterprises. The company wishes to connect the alarm systems between the buildings to form a single network. The number on each arc represents the cost, in pounds, of connecting the alarm systems between the buildings.

(a) Use **Prim's** algorithm, starting at A, to find the minimum spanning tree for this network. You must list the **arcs** that form your tree in the order that you select them.

(3)

(b) State the minimum cost of connecting the alarm systems in the nine buildings.

(1)

It is discovered that some alarm systems are already connected.
There are connections along **BC** and **EF**.
Since these already exist, it is decided to use these arcs as part of the spanning tree.

(c) Use **Kruskal's** algorithm to find the minimum spanning tree that includes arcs **BC** and **EF**. You must list the arcs in the order that you consider them. In each case, state whether you are adding the arc to your spanning tree.

(3)

Since arcs **BC** and **EF** already exist, there is no cost for these connections.

(d) State the new minimum cost of connecting the nine buildings.

(1)

(Total for Question 2 is 8 marks)

3.

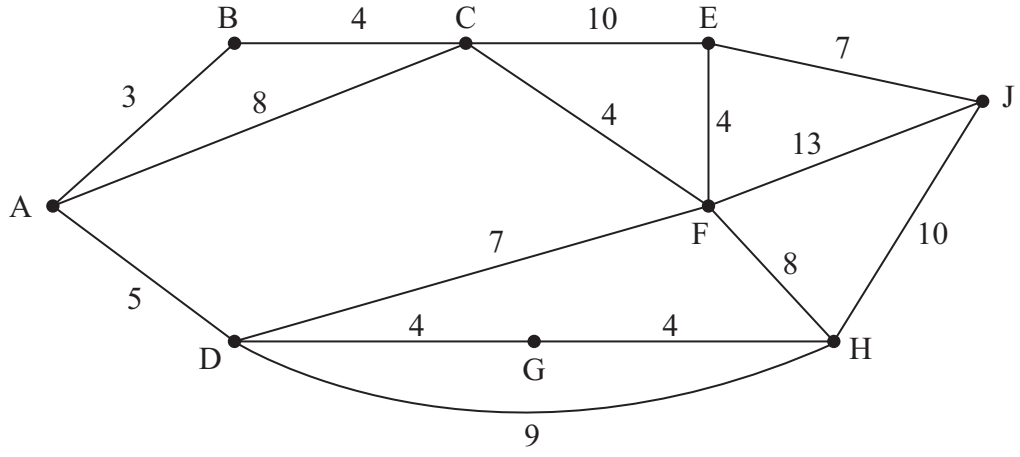

Figure 2

[*The total weight of the network is 100*]

Figure 2 represents a network of pipes in a building. The number on each arc represents the length, in metres, of the corresponding pipe.

(a) Use Dijkstra's algorithm to find the shortest path from A to J. State your path and its length.

(6)

On a particular day Kim needs to check each pipe. A route of minimum length, which traverses each pipe at least once and starts and finishes at A, needs to be found.

(b) Use an appropriate algorithm to find the arcs that will need to be traversed twice. You must make your method and working clear.

(4)

(c) Write down a possible route, giving its length.

(2)

All the pipes directly attached to B are removed. Kim needs to check all the remaining pipes and may now start at any vertex and finish at any vertex. A route is required that excludes all those pipes directly attached to B.

(d) State all possible combinations of starting and finishing points so that the length of Kim's route is minimised. State the length of Kim's route.

(3)

(Total for Question 3 is 15 marks)

4. Draw the activity network described in this precedence table, using activity on arc and dummies only where necessary.

(5)

Activity	Immediately preceding activities
A	–
B	–
C	–
D	*B, C*
E	*A*
F	*C*
G	*D, E*
H	*D, E*
I	*F, G*
J	*C*
K	*G, H*

(Total for Question 4 is 5 marks)

5. Michael and his team are making toys to give to children at a summer fair. They make two types of toy, a soft toy and a craft set.

Let x be the number of soft toys they make and y be the number of craft sets they make.

Each soft toy costs £3 to make and each craft set costs £5 to make.

Michael and his team have a budget of £1000 to spend on making the toys for the summer fair.

(a) Write down an inequality, in terms of x and y, to model this constraint.

(1)

Two further constraints are:

$$y \leqslant 2x$$

$$4y - x \geqslant 210$$

(b) Add lines and shading to Diagram 1 in the answer book to represent all of these constraints.
Hence determine the feasible region and label it R.

(4)

Michael's objective is to make as many toys as possible.

(c) State the objective.

(1)

(d) Determine the exact coordinates of each of the vertices of the feasible region, and hence use the vertex method to find the optimal number of soft toys and craft sets Michael and his team should make. You should make your method clear.

(7)

(Total for Question 5 is 13 marks)

6.

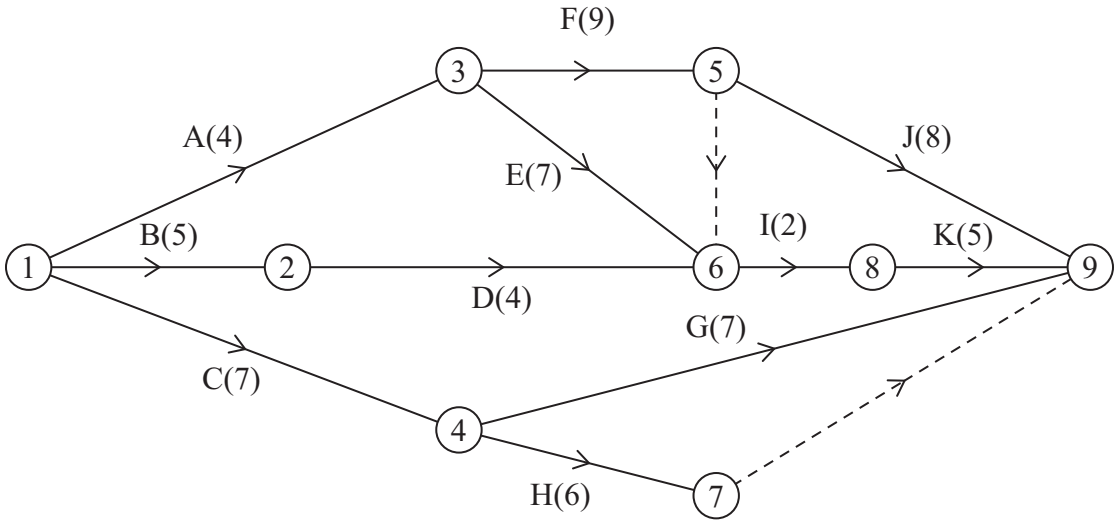

Figure 3

A project is modelled by the activity network shown in Figure 3. The activities are represented by the arcs. The number in brackets on each arc gives the time required, in hours, to complete the activity. The numbers in circles are the event numbers. Each activity requires one worker.

(a) Complete Diagram 1 in the answer book to show the early event times and the late event times.

(4)

(b) State the minimum project completion time.

(1)

(c) Calculate a lower bound for the minimum number of workers required to complete the project in the minimum time. You must show your working.

(2)

(d) On Grid 1 in your answer book, draw a cascade (Gantt) chart for this project.

(4)

(e) On Grid 2 in your answer book, construct a scheduling diagram to show that this project can be completed with three workers in just one more hour than the minimum project completion time.

(3)

(Total for Question 6 is 14 marks)

7. Emily is planning to sell three types of milkshake, strawberry, vanilla and chocolate.

Emily has completed some market research and has used this to form the following constraints on the number of milkshakes that she will sell each week.

- She will sell fewer than 200 non-vanilla milkshakes in total.
- She will sell at most 2.5 times as many strawberry milkshakes as vanilla milkshakes.
- At most, 75% of the milkshakes that she will sell will be vanilla.

The profit on each strawberry milkshake sold is £0.75, the profit on each vanilla milkshake sold is £1.20 and the profit on each chocolate milkshake sold is £1.45

Emily wants to maximise her profit.

Let x represent the number of strawberry milkshakes sold, let y represent the number of vanilla milkshakes sold and let z represent the number of chocolate milkshakes sold.

(a) Formulate this as a linear programming problem, stating the objective and listing the constraints as fully simplified inequalities with integer coefficients.

(6)

In week 1, Emily sells 100 strawberry milkshakes and 25 chocolate milkshakes.

(b) Calculate the maximum possible profit and minimum possible profit, in pounds, for the sale of all milkshakes in week 1. You must show your working.

(3)

(Total for Question 7 is 9 marks)

TOTAL FOR PAPER IS 75 MARKS

Please check the examination details below before entering your candidate information

Candidate surname	Other names

Centre Number | Candidate Number

Pearson Edexcel International Advanced Level

Tuesday 20 January 2026

Afternoon (Time: 1 hour 30 minutes)

Paper reference **WDM11/01A**

▲ △

Mathematics

International Advanced Subsidiary/Advanced Level
Decision Mathematics D1
Answer Book

You must have:
Question paper (sent separately)
Calculator

Total Marks

Candidates may use any calculator allowed by Pearson regulations. Calculators must not have the facility for symbolic algebra manipulation, differentiation and integration, or have retrievable mathematical formulae stored in them.

Instructions

- Use **black** ink or ball-point pen.
- If pencil is used for diagrams/sketches/graphs it must be dark (HB or B). Coloured pencils and highlighter pens must not be used.
- **Fill in the boxes** at the top of this page with your name, centre number and candidate number.
- Answer **all** questions and ensure that your answers to parts of questions are clearly labelled.
- Answer the questions in the spaces provided – *there may be more space than you need.*
- You should show sufficient working to make your methods clear. Answers without working may not gain full credit.
- Inexact answers should be given to three significant figures unless otherwise stated.

Information

- There are 7 questions in this question paper. The total mark for this paper is 75.
- The marks for **each** question are shown in brackets – *use this as a guide as to how much time to spend on each question.*

Advice

- Read each question carefully before you start to answer it.
- Try to answer every question.
- Check your answers if you have time at the end.
- If you change your mind about an answer, cross it out and put your new answer and any working underneath.

Turn over ▶

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Question 1

Write the answer to Question 1 on these 2 pages

5.0 1.8 6.2 2.8 3.0 4.0 3.8 2.4 0.6 0.8 7.8

Question 1 continued

5.0 1.8 6.2 2.8 3.0 4.0 3.8 2.4 0.6 0.8 7.8

This is the end of Question 1 answer space. Please turn the page for Question 2 answer space.

(Total for Question 1 is 11 marks)

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DO NOT WRITE IN THIS AREA

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Question 2

Write the answer to Question 2 on these 2 pages

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DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

Question 2 continued

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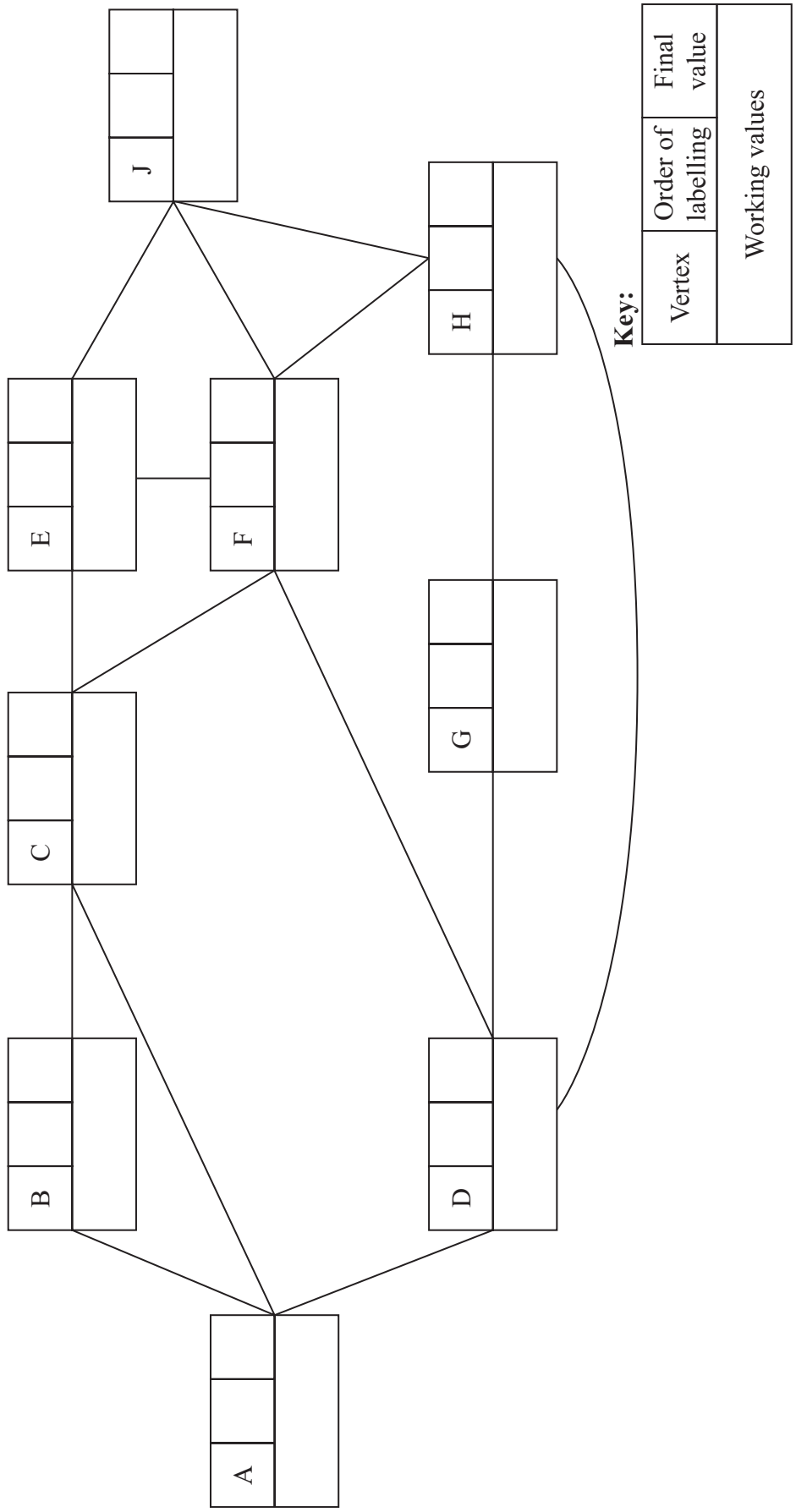
(Total for Question 2 is 8 marks)

Question 3

Write the answer to Question 3 on these 4 pages



Shortest path _____

Length of shortest path _____

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Question 3 continued

Question 3 continued

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Question 3 continued

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(Total for Question 3 is 15 marks)

Question 4

Write the answer to Question 4 on these 2 pages

Question 4 continued

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(Total for Question 4 is 5 marks)

Question 5

Write the answer to Question 5 on these 4 pages

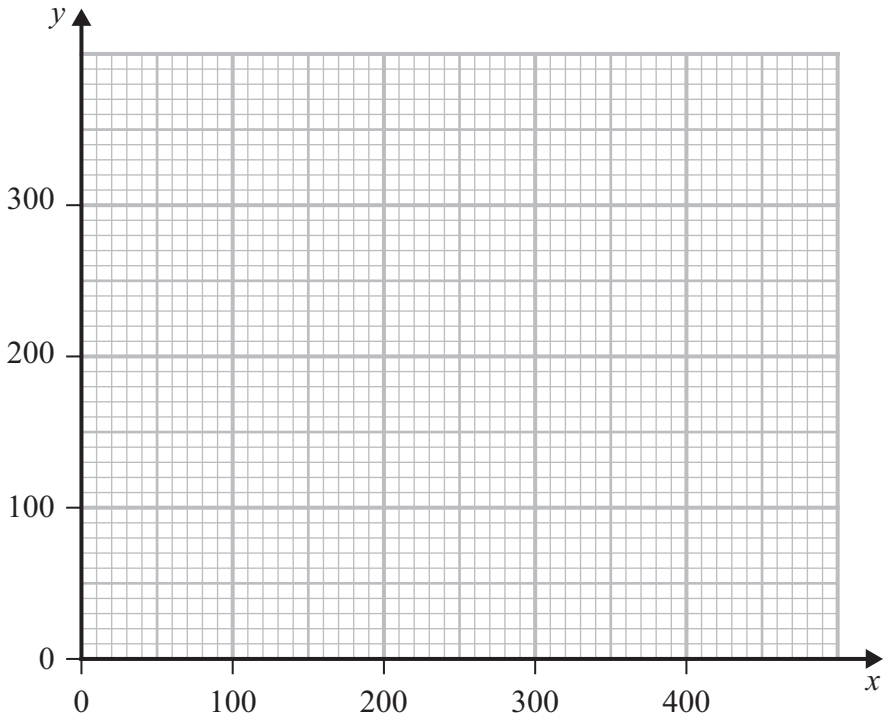

Diagram 1

Question 5 continued

Question 5 continued

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Question 5 continued

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(Total for Question 5 is 13 marks)

Question 6

Write the answer to Question 6 on these 2 pages

(a)

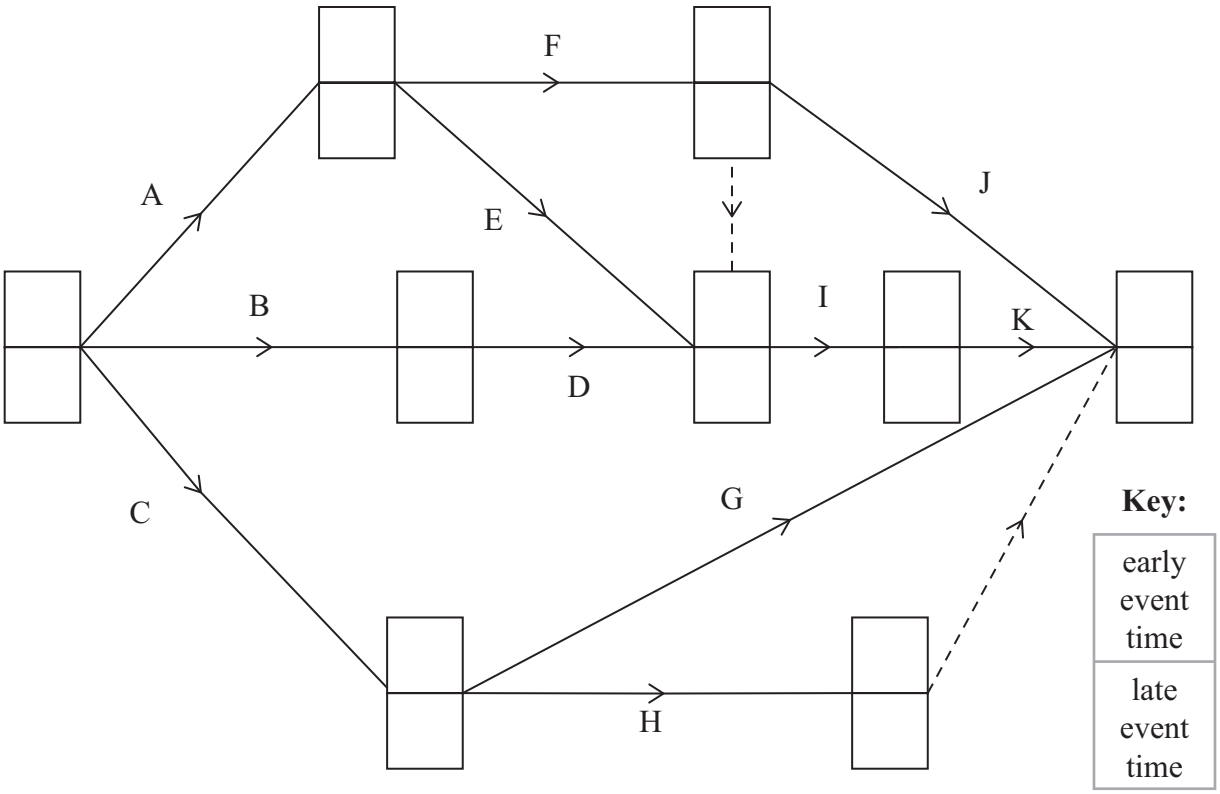


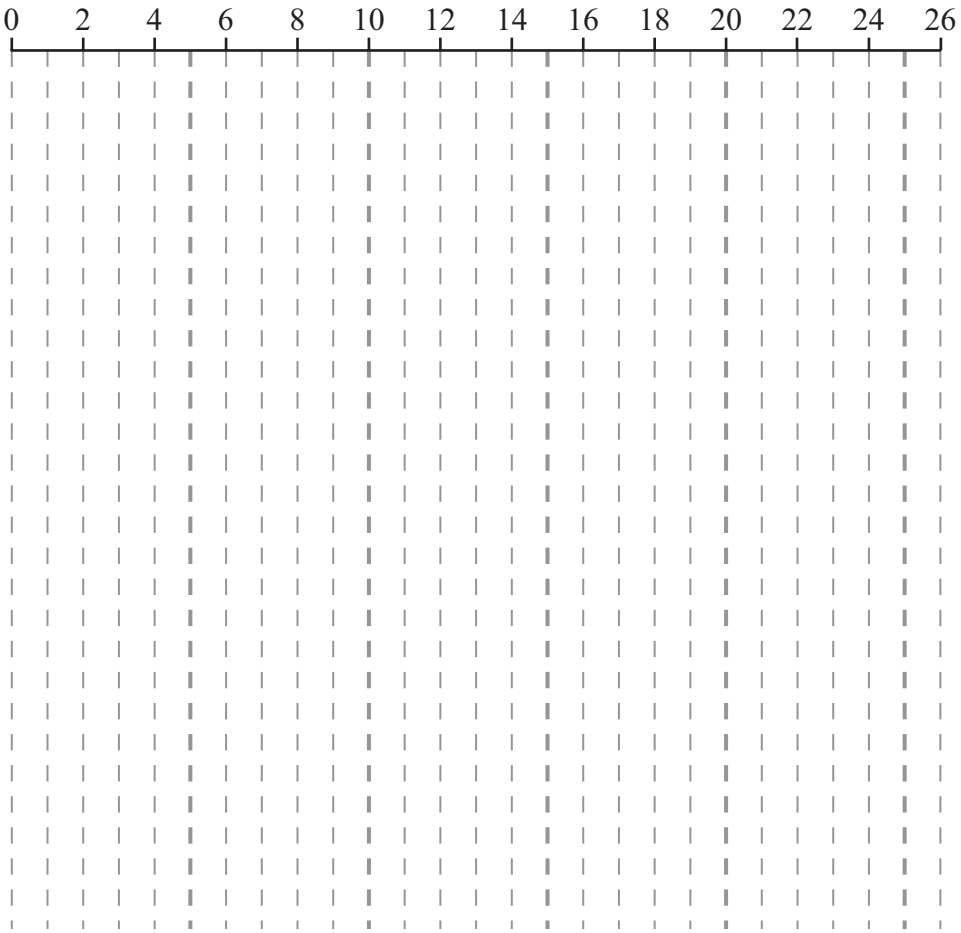
Diagram 1

(b)

(c)

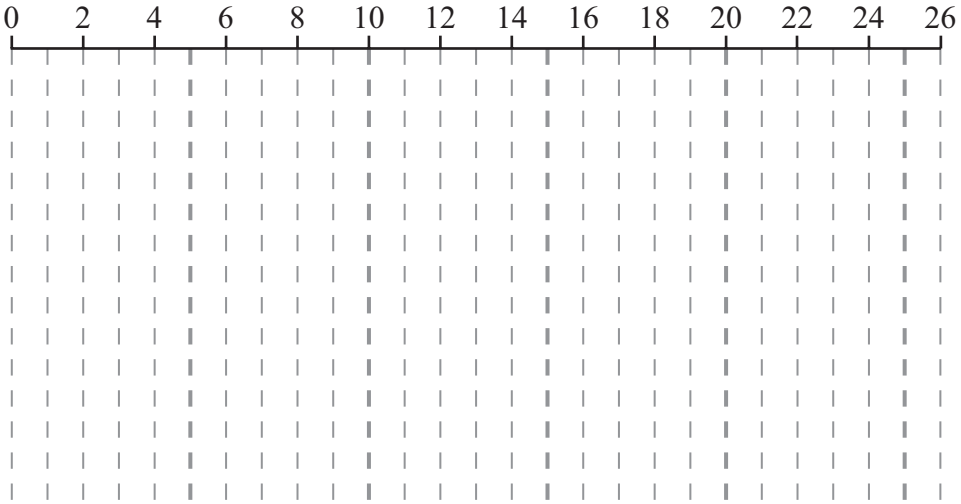
Question 6 continued

(d)



Grid 1

(e)



Grid 2

This is the end of Question 6 answer space. Please turn the page for Question 7 answer space.

(Total for Question 6 is 14 marks)

Question 7

Write the answer to Question 7 on these 3 pages

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DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

Question 7 continued

Question 7 continued

(Total for Question 7 is 9 marks)

TOTAL FOR PAPER IS 75 MARKS

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