



Oxford Cambridge and RSA

**Wednesday 20 October 2021 – Afternoon**

**AS Level Further Mathematics B (MEI)**

**Y413/01 Modelling with Algorithms**

**Printed Answer Booklet**

**Time allowed: 1 hour 15 minutes**



**You must have:**

- Question Paper Y413/01 (inside this document)
- the Formulae Booklet for Further Mathematics B (MEI)
- a scientific or graphical calculator



Please write clearly in black ink. **Do not write in the barcodes.**

Centre number

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Candidate number

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First name(s)

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Last name

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**INSTRUCTIONS**

- Use black ink. You can use an HB pencil, but only for graphs and diagrams.
- Write your answer to each question in the space provided in the **Printed Answer Booklet**. If you need extra space use the lined pages at the end of the Printed Answer Booklet. The question numbers must be clearly shown.
- Answer **all** the questions.
- Where appropriate, your answer should be supported with working. Marks might be given for using a correct method, even if your answer is wrong.
- Give your final answers to a degree of accuracy that is appropriate to the context.

**INFORMATION**

- This document has **12** pages.

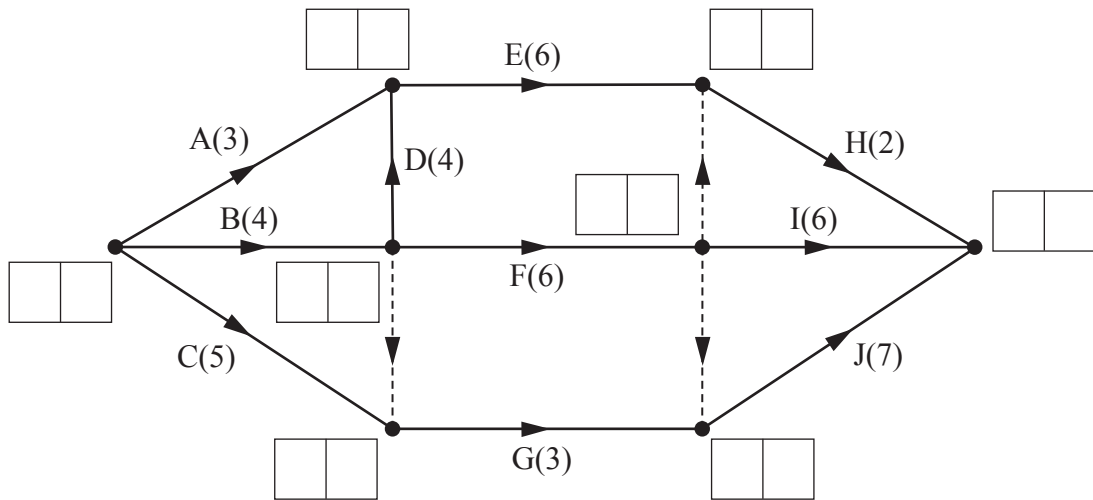
**ADVICE**

- Read each question carefully before you start your answer.

1(a)

| Activity | Immediate Predecessor(s) |
|----------|--------------------------|
| A        |                          |
| B        |                          |
| C        |                          |
| D        |                          |
| E        |                          |
| F        |                          |
| G        |                          |
| H        |                          |
| I        |                          |
| J        |                          |

1(b)(i)



1(b)(ii)

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1(c)

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| <b>2(a)</b> | 15 | 4 | 23 | 16 | 2 | 12 | 14 | 11 | 20 | 13 | 22 |
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| <b>2(b)</b> |    |   |    |    |   |    |    |    |    |    |    |
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| <b>2(c)</b> |    |   |    |    |   |    |    |    |    |    |    |
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| <b>2(d)</b> |    |   |    |    |   |    |    |    |    |    |    |
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| <b>2(e)</b> |    |   |    |    |   |    |    |    |    |    |    |
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| <b>3(a)</b>   |  |     |     |       |       |       |       |     |     |     |       |       |       |       |     |   |   |   |     |   |   |   |     |   |   |   |    |   |   |   |     |   |   |   |    |   |   |   |     |   |   |   |   |   |   |   |    |
|---|--|-----|-----|-------|-------|-------|-------|-----|-----|-----|-------|-------|-------|-------|-----|---|---|---|-----|---|---|---|-----|---|---|---|----|---|---|---|-----|---|---|---|----|---|---|---|-----|---|---|---|---|---|---|---|----|
|   |  |     |     |       |       |       |       |     |     |     |       |       |       |       |     |   |   |   |     |   |   |   |     |   |   |   |    |   |   |   |     |   |   |   |    |   |   |   |     |   |   |   |   |   |   |   |    |
|   |  |     |     |       |       |       |       |     |     |     |       |       |       |       |     |   |   |   |     |   |   |   |     |   |   |   |    |   |   |   |     |   |   |   |    |   |   |   |     |   |   |   |   |   |   |   |    |
|   |  |     |     |       |       |       |       |     |     |     |       |       |       |       |     |   |   |   |     |   |   |   |     |   |   |   |    |   |   |   |     |   |   |   |    |   |   |   |     |   |   |   |   |   |   |   |    |
| <b>3(b)</b>   |  |     |     |       |       |       |       |     |     |     |       |       |       |       |     |   |   |   |     |   |   |   |     |   |   |   |    |   |   |   |     |   |   |   |    |   |   |   |     |   |   |   |   |   |   |   |    |
|   |  |     |     |       |       |       |       |     |     |     |       |       |       |       |     |   |   |   |     |   |   |   |     |   |   |   |    |   |   |   |     |   |   |   |    |   |   |   |     |   |   |   |   |   |   |   |    |
|   |  |     |     |       |       |       |       |     |     |     |       |       |       |       |     |   |   |   |     |   |   |   |     |   |   |   |    |   |   |   |     |   |   |   |    |   |   |   |     |   |   |   |   |   |   |   |    |
|   |  |     |     |       |       |       |       |     |     |     |       |       |       |       |     |   |   |   |     |   |   |   |     |   |   |   |    |   |   |   |     |   |   |   |    |   |   |   |     |   |   |   |   |   |   |   |    |
|   | <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="width: 10%;"><math>P</math></th> <th style="width: 10%;"><math>x</math></th> <th style="width: 10%;"><math>y</math></th> <th style="width: 10%;"><math>z</math></th> <th style="width: 10%;"><math>s_1</math></th> <th style="width: 10%;"><math>s_2</math></th> <th style="width: 10%;"><math>s_3</math></th> <th style="width: 10%;">RHS</th> </tr> </thead> <tbody> <tr> <td style="text-align: center;">1</td> <td style="text-align: center;">0</td> <td style="text-align: center;">0</td> <td style="text-align: center;">-10</td> <td style="text-align: center;">3</td> <td style="text-align: center;">7</td> <td style="text-align: center;">0</td> <td style="text-align: center;">485</td> </tr> <tr> <td style="text-align: center;">0</td> <td style="text-align: center;">0</td> <td style="text-align: center;">1</td> <td style="text-align: center;">-3</td> <td style="text-align: center;">1</td> <td style="text-align: center;">2</td> <td style="text-align: center;">0</td> <td style="text-align: center;">145</td> </tr> <tr> <td style="text-align: center;">0</td> <td style="text-align: center;">1</td> <td style="text-align: center;">0</td> <td style="text-align: center;">-5</td> <td style="text-align: center;">1</td> <td style="text-align: center;">3</td> <td style="text-align: center;">0</td> <td style="text-align: center;">195</td> </tr> <tr> <td style="text-align: center;">0</td> <td style="text-align: center;">0</td> <td style="text-align: center;">0</td> <td style="text-align: center;">1</td> <td style="text-align: center;">0</td> <td style="text-align: center;">1</td> <td style="text-align: center;">1</td> <td style="text-align: center;">75</td> </tr> </tbody> </table> |     |     |       |       |       |       | $P$ | $x$ | $y$ | $z$   | $s_1$ | $s_2$ | $s_3$ | RHS | 1 | 0 | 0 | -10 | 3 | 7 | 0 | 485 | 0 | 0 | 1 | -3 | 1 | 2 | 0 | 145 | 0 | 1 | 0 | -5 | 1 | 3 | 0 | 195 | 0 | 0 | 0 | 1 | 0 | 1 | 1 | 75 |
|   | $P$  | $x$ | $y$ | $z$   | $s_1$ | $s_2$ | $s_3$ | RHS |     |     |       |       |       |       |     |   |   |   |     |   |   |   |     |   |   |   |    |   |   |   |     |   |   |   |    |   |   |   |     |   |   |   |   |   |   |   |    |
|   | 1  | 0   | 0   | -10   | 3     | 7     | 0     | 485 |     |     |       |       |       |       |     |   |   |   |     |   |   |   |     |   |   |   |    |   |   |   |     |   |   |   |    |   |   |   |     |   |   |   |   |   |   |   |    |
|   | 0  | 0   | 1   | -3    | 1     | 2     | 0     | 145 |     |     |       |       |       |       |     |   |   |   |     |   |   |   |     |   |   |   |    |   |   |   |     |   |   |   |    |   |   |   |     |   |   |   |   |   |   |   |    |
|   | 0  | 1   | 0   | -5    | 1     | 3     | 0     | 195 |     |     |       |       |       |       |     |   |   |   |     |   |   |   |     |   |   |   |    |   |   |   |     |   |   |   |    |   |   |   |     |   |   |   |   |   |   |   |    |
|   | 0  | 0   | 0   | 1     | 0     | 1     | 1     | 75  |     |     |       |       |       |       |     |   |   |   |     |   |   |   |     |   |   |   |    |   |   |   |     |   |   |   |    |   |   |   |     |   |   |   |   |   |   |   |    |
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| $P$   | $x$  | $y$ | $z$ | $s_1$ | $s_2$ | $s_3$ | RHS   |     |     |     |       |       |       |       |     |   |   |   |     |   |   |   |     |   |   |   |    |   |   |   |     |   |   |   |    |   |   |   |     |   |   |   |   |   |   |   |    |
|   |  |     |     |       |       |       |       |     |     |     |       |       |       |       |     |   |   |   |     |   |   |   |     |   |   |   |    |   |   |   |     |   |   |   |    |   |   |   |     |   |   |   |   |   |   |   |    |
|   |  |     |     |       |       |       |       |     |     |     |       |       |       |       |     |   |   |   |     |   |   |   |     |   |   |   |    |   |   |   |     |   |   |   |    |   |   |   |     |   |   |   |   |   |   |   |    |
|   |  |     |     |       |       |       |       |     |     |     |       |       |       |       |     |   |   |   |     |   |   |   |     |   |   |   |    |   |   |   |     |   |   |   |    |   |   |   |     |   |   |   |   |   |   |   |    |
|   |  |     |     |       |       |       |       |     |     |     |       |       |       |       |     |   |   |   |     |   |   |   |     |   |   |   |    |   |   |   |     |   |   |   |    |   |   |   |     |   |   |   |   |   |   |   |    |
|   |  |     |     |       |       |       |       |     |     |     |       |       |       |       |     |   |   |   |     |   |   |   |     |   |   |   |    |   |   |   |     |   |   |   |    |   |   |   |     |   |   |   |   |   |   |   |    |
|   |  |     |     |       |       |       |       |     |     |     |       |       |       |       |     |   |   |   |     |   |   |   |     |   |   |   |    |   |   |   |     |   |   |   |    |   |   |   |     |   |   |   |   |   |   |   |    |
| <b>3(d)(i)</b>  | $x =$  |     |     |       |       |       |       |     |     |     |       |       |       |       |     |   |   |   |     |   |   |   |     |   |   |   |    |   |   |   |     |   |   |   |    |   |   |   |     |   |   |   |   |   |   |   |    |
|   | $y =$  |     |     |       |       |       |       |     |     |     |       |       |       |       |     |   |   |   |     |   |   |   |     |   |   |   |    |   |   |   |     |   |   |   |    |   |   |   |     |   |   |   |   |   |   |   |    |
|   | $z =$  |     |     |       |       |       |       |     |     |     |       |       |       |       |     |   |   |   |     |   |   |   |     |   |   |   |    |   |   |   |     |   |   |   |    |   |   |   |     |   |   |   |   |   |   |   |    |
| <b>3(d)(ii)</b>   |  |     |     |       |       |       |       |     |     |     |       |       |       |       |     |   |   |   |     |   |   |   |     |   |   |   |    |   |   |   |     |   |   |   |    |   |   |   |     |   |   |   |   |   |   |   |    |
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4(a)

| <i>a</i> | <i>b</i> | <i>n</i> | <i>h</i> | <i>c</i> | <i>d</i> | <i>e</i> |
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4(b)

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4(c)

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4(d)

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**5(a)**

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**5(b)**  
**5(c)(i)**

Key:  
 Order of labelling → 

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 ← Label  
 Working values (do not cross out) → 

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F

Length of shortest path from A to G:

**5(c)(ii)** Shortest path from A to G:

**5(d)**

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**5(e)**

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**5(f)**

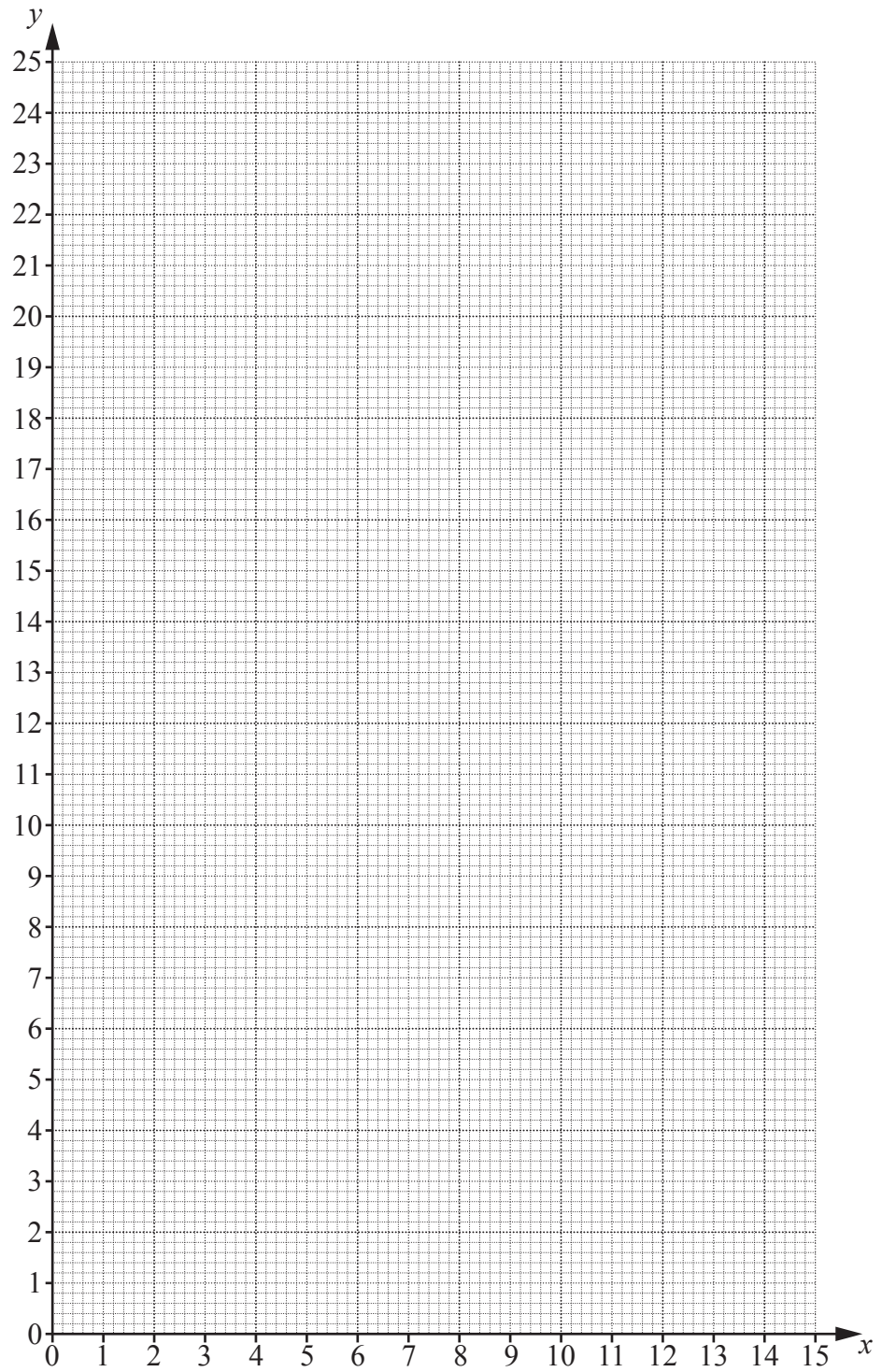
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6(c) continued

 $P =$  $x =$  $y =$  $z =$



