

# Level 3 Certificate MATHEMATICAL STUDIES

Paper 2B – Critical path and risk analysis

Date Morning Time allowed: 1 hour 30 minutes

**Materials**

For this paper you must have:

- a clean copy of the Preliminary Material (enclosed)
- a scientific calculator or a graphics calculator
- a copy of the formulae sheet
- a ruler.

**Instructions**

- Use black ink or black ball-point pen. Pencil should only be used for drawing.
- Fill in the boxes at the bottom of this page.
- Answer **all** questions.
- 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. You do not necessarily need to use all the space provided.
- 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 should be given to an appropriate degree of accuracy.
- You may **not** refer to the copy of the Preliminary Material 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.
- The paper reference for this paper is 1350/2B.

Please write clearly, in block capitals, to allow character computer recognition.

Centre number       Candidate number

Surname

Forename(s)

Candidate signature \_\_\_\_\_

Answer **all** questions in the spaces provided.

- 1 Ben has been asked to write a short report on the average number of text messages sent per day by students in his class.

Ben's complete report is given below.

To study the number of text messages sent and received by students, I asked my friends to count the number of messages they sent and received. To display this information clearly, I entered the 9 pieces of data into a spreadsheet, as shown below.

	A	B	C	D
1	<b>Person</b>	<b>Number of messages sent</b>	<b>Number of messages received</b>	<b>Total number of messages</b>
2	Olivia	16	28	44
3	Josh	18	5	33
4	Ava	7	18	25

Analyse Ben's report, identifying any errors.

Suggest any improvements he could make.

**[4 marks]**

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**2** Pete wants to buy a house.  
His annual salary is £66 000  
The bank will lend him three times his annual salary for a mortgage.  
This is 90% of the house price.  
He makes these notes:

$3 \times 66\,000 = 188\,000$   
 $188\,000 \times 0.9 = 169\,200$   
So I can buy a house up to £169 200  
This does not look right. What have I done wrong?

Critically analyse Pete's notes making corrections where necessary.

**[3 marks]**

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3 Use **Positive spin** on the Preliminary Material.

3 (a) The editor of the local newspaper received a letter of complaint to say the data had been badly presented.

Was the complaint justified?

[2 marks]

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3 (b) The newspaper headline for the 2014 by-election result said:

**Half of Newark voters did not vote and UKIP  
made the biggest gain**

Does the data support these claims?

[3 marks]

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- 3 (c)** Comment on the validity of each of the statements made by the three candidates on page 3 of the Preliminary Material.

Show working to justify your comments.

[8 marks]

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- 4 Monty's garden is overgrown and needs to be completely redesigned. He has divided the work involved into a number of tasks.

The table below shows

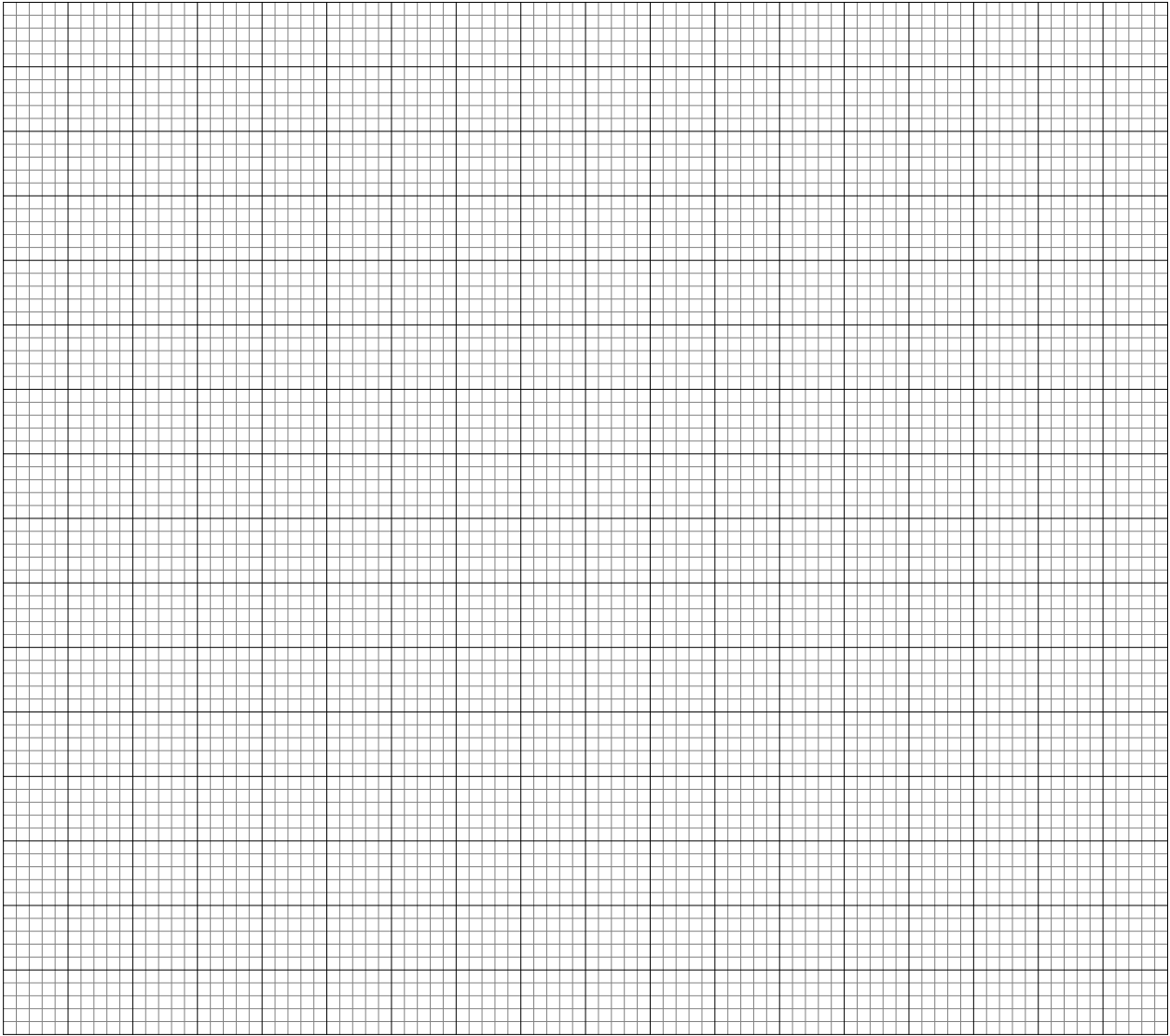
- the minimum time required to complete each task
- the earliest start time for each task
- the latest finish time for each task.

The project needs to be completed in the minimum possible time.

Activity	Duration (hours)	Earliest start time	Latest finish time
A: Demolish garage	4	0	8
B: Cut down trees	3	0	5
C: Remove all plants	5	0	5
D: Remove garage	2	4	10
E: Remove all weeds	5	5	10
F: Level sub-soil in front garden	3	10	27
G: Level sub-soil in rear garden	6	10	16
H: Cover front garden with top soil	3	16	30
I: Build rockery in rear garden	5	16	21
J: Fit pond in rockery	4	21	25
K: Cover rear garden with top soil	5	25	30
L: Lay turf	8	30	38
M: Fill pond	1	25	$x$
N: Plant flowers and shrubs	5	38	43
O: Water lawn and plants	2	43	45

- 4 (a) On the grid opposite draw a Gantt chart (cascade diagram) for the project. Assume that each activity starts as early as possible. State the minimum **and** maximum value of  $x$ .

[6 marks]



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- 4 (b) Activities D and N each overrun by 2 hours.  
Find the new minimum completion time for the project.

[2 marks]

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- 5** John takes part in a Go Kart race every Saturday.  
The probability that he finishes a race is 0.8  
If he finishes a race the probability that he wins is 0.5  
For each race there is an entry fee of £50  
For each race there is a prize of £500 for the winner.  
John enters 20 races.
- How much money should he win?  
You **must** show your working to justify your answer.

**[6 marks]**



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**Turn over for the next question**

**6** A quiz book is to be written.

The work involved has been divided into a number of activities, as shown in the table below.

The minimum duration needed to complete each activity is also shown.

<b>Activity</b>	<b>Immediate predecessor</b>	<b>Duration (weeks)</b>
A Author writes first draft	–	4
B Editor comments on author's first draft	A	3
C Publisher produces first draft	A	5
D Author writes second draft	B, C	2
E Editor checks second draft	D	1
F Assessor works quizzes	D	1
G Second assessor works quizzes	D	2
H Author writes final draft	E, F, G	1
I Publisher produces final draft	H	2
J Proof reader checks final draft	H	1
K Books are printed	I, J	2

**6 (a)** On the page opposite construct an activity network for the project.

**[7 marks]**

6 (b) List the critical path.

[1 mark]

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6 (c) The publishers commission the book on 1<sup>st</sup> July

Will they be able to publish it for the start of the Christmas market on 1<sup>st</sup> November?

You must show your working to justify your answer.

[3 marks]

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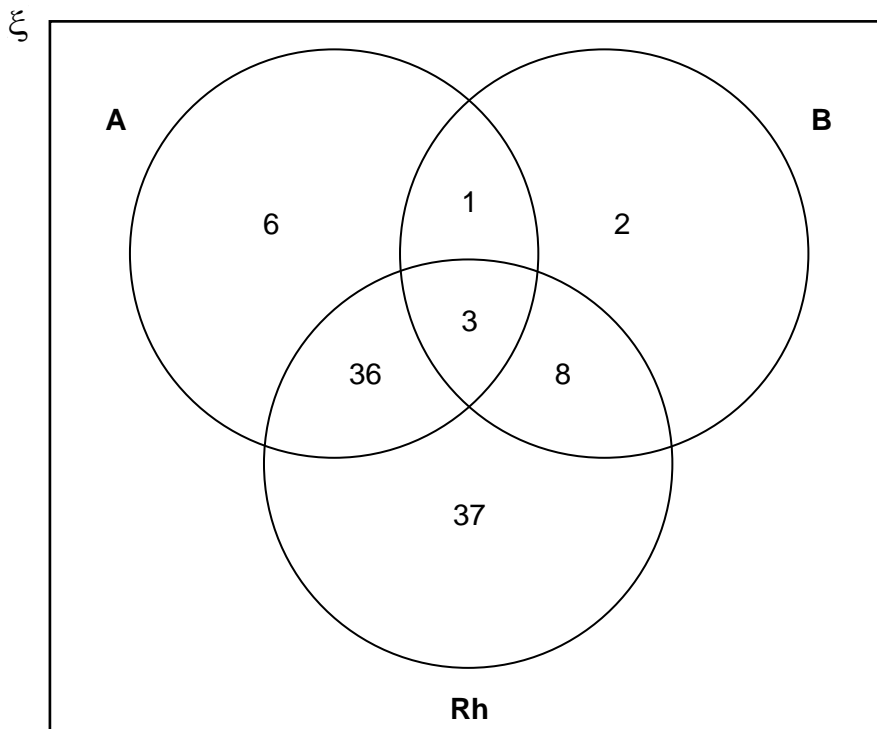
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7 Your blood has none, some or all of three substances: A, B and Rh.

The Venn diagram shows the **percentages** of people in a population whose blood has different combinations of these substances.



- 7 (a) What is the probability that a person whose blood contains substance B also contains substance A?

[2 marks]

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- 7 (b) David's blood contains substances A and B but not Rh.

For Sarah to be able to donate her blood to David, any substance found in her blood must also be in David's blood.

What is the probability that Sarah can donate her blood to David?

[3 marks]

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**Turn over for the next question**

- 8 A contractor has carried out a critical path analysis for a small project.  
There will be a £30 000 penalty if the project is delayed.  
The project will be delayed if one or both of two critical activities ( $x$  and  $y$ ) are delayed.
- The probability of  $x$  being delayed is 0.1
  - The cost of implementing a control measure that will prevent  $x$  from being delayed is £4000
  - The probability of  $y$  being delayed is 0.3
  - The cost of implementing a control measure that will prevent  $y$  from being delayed is £7000

- 8 (a) Work out what the expected penalty would be if no control measures are taken.  
State any assumptions that you have made.

[5 marks]

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The table below shows information for the control measures  $x$  only,  $y$  only and both  $x$  and  $y$ .

Control measure	Cost of control measure (£)	Probability of delay	Expected penalty (£)
For $x$ only	4 000	0.3	9 000
For $y$ only	7 000	0.1	3 000
For both	11 000	0	0

- 8 (b) Which control measures, if any, would you recommend the contractor to take?  
Fully justify your recommendation.

[5 marks]

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**END OF QUESTIONS**

**There are no questions printed on this page**

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