AQA

Please write clearly in block capitals.

Centre number | | | | | | Candidate number | | | | |

Surname _____

Forename(s) _____

Candidate signature _____

I declare this is my own work.

Level 3 Certificate
MATHEMATICAL STUDIES

Paper 2B Critical Path and Risk Analysis

Time allowed: 1 hour 30 minutes

Materials

For this paper you must have:
- a clean copy of the Preliminary Material and the Formulae Sheet (enclosed)
- a scientific calculator or a graphics calculator
- a ruler.

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.
- You must answer the questions in the spaces provided. Do not write outside the box around each page or on blank pages.
- If you need extra space for your answer(s), use the lined pages at the end of this book. Write the question number against your answer(s).
- Show all necessary working; otherwise, marks for method may be lost.
- Do all rough work in this book. Cross through any work 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.

For Examiner's Use	
Question	Mark
1	
2	
3	
4	
5	
6	
7	
TOTAL	

Information
- The marks for questions are shown in brackets.
- The maximum mark for this paper is 60.
- You may ask for more answer paper or graph paper, which must be tagged securely to this answer booklet.

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

1 The plans for a new housing estate include 80 properties of different types.
The table shows the planned number of each type of property.

Type of property	Planned number of this type
1-bedroom flat	10
2-bedroom flat	15
2-bedroom house	25
3-bedroom house	20
4-bedroom house	5
5-bedroom house	5

1 (a) Work out the ratio of houses to flats.
Circle your answer.

[1 mark]

5 : 11 11 : 5 5 : 16 16 : 11

Do not write outside the box

The local council must approve the plans for the housing estate.

To be approved, the plans must meet some minimum requirements.

1 (b) Here are the minimum requirements for the number of cycle parking spaces.

- 1 space **per bedroom** up to and including 3-bedroom properties
- 3 spaces for 4-bedroom properties
- 4 spaces for 5-bedroom properties
- **plus** some visitor cycle parking

The plans for the housing estate include 185 cycle parking spaces.

Do the plans meet the minimum requirements?

You **must** show your working.

[3 marks]

Question 1 continues on the next page

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1 (c) The developers building the housing estate want to change their plans.

They make more profit on 2-bedroom houses than on 2-bedroom flats.

To approve the plans, the local council insists that

- there must still be 80 properties
- at least 23% of the properties are classified as 'affordable housing'.

The table shows which properties are classified as 'affordable housing'.

Type of property	Affordable housing	Planned number of this type
1-bedroom flat	✓	10
2-bedroom flat	✓	
2-bedroom house	×	
3-bedroom house	×	20
4-bedroom house	×	5
5-bedroom house	×	5

Complete the table to show the number of 2-bedroom flats and 2-bedroom houses that would be approved and make the greatest profit.

[3 marks]

7

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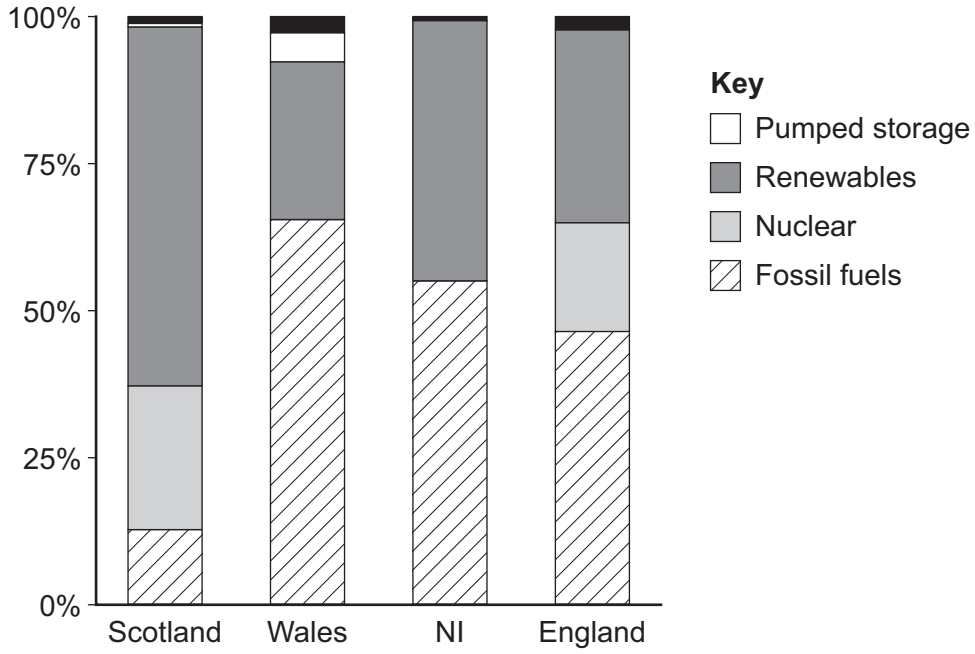
2 Use **Electricity generation** from the Preliminary Material.

2 (a) The bar chart shows how each of the four nations of the United Kingdom generated electricity in 2019



Suggest **two** improvements that could be made to the bar chart.

[2 marks]

Improvement 1

Improvement 2

Question 2 continues on the next page

Turn over ▶

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2 (b) Two newspapers reported on electricity generation in England in 2019

> Electricity generated by renewables reached more than 70% of that generated from fossil fuels.
>
> *Morning Record*

> The ratio of wind to other renewables is about 13 : 17
>
> *Daily Bulletin Review*

Using **Table 1** in the Preliminary Material, comment on the validity of each newspaper's claim.

You **must** show your working.

[5 marks]

Morning Record

Daily Bulletin Review

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2 (c) In 2019, Northern Ireland generated 4189 GWh of electricity by renewables.

The average cost of electricity was 14.4p per kWh

1 GWh = 1 000 000 kWh

Anna says,

> "In 2019, Northern Ireland generated electricity by renewables worth over 600 million pounds."

Is she correct?

You **must** show your working.

[3 marks]

Question 2 continues on the next page

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2 (d) In 2019, Wales generated 7700 GWh of electricity by renewables.

Work out the total amount of electricity generated in Wales from all fuels.

[2 marks]

Answer _____ GWh

Do not write outside the box

2 (e) Bobby wants to work out the mean percentage of electricity generated by renewables in the UK.

Here is his calculation, which uses the values from **Chart 1** in the Preliminary Material.

$61.1 + 44.6 + 33.0 + 26.9 = 165.6$

$165.6 \div 4 = 41.4$

So 41.4% of energy generated in the UK in 2019 was by renewables.

The article states that 37.1% of energy generated in the UK in 2019 was by renewables.

Critically analyse Bobby's method, explaining why his percentage does not agree with the article.

You do **not** need to carry out any calculations.

[1 mark]

13

Turn over for the next question

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3 Matilda is going to compete in a cross-country running race.

The runners who finish first, second or third in the race will win a cash prize.

The table shows the value of the prize for each place.

Place	First	Second	Third
Prize	£50	£20	£10

Matilda asked her coach to estimate the probability of her finishing in each of the first three places.

His estimates are in the table.

Place	First	Second	Third
Probability	0.15	0.55	0.2

3 (a) Work out the coach's estimate of the probability that Matilda will **not** win a prize.

[1 mark]

Answer _____

3 (b) Use the coach's estimates to work out the expected value of Matilda's prize.

[3 marks]

Answer £ _____

4

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4 An insurance policy covers up to £100 000 for medical costs due to a water sports accident.

Statistics show that each year

95% of people who buy water sports insurance do **not** make a claim

and

the average claim is £1300

Feryal is considering buying the policy for a water sports holiday.

The policy would cost £70

4 (a) Advise Feryal on whether she should buy the policy.

You should base your advice on the expected cost.

[4 marks]

4 (b) Give a reason why Feryal may not follow your advice.

[1 mark]

5

Turn over ▶

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5 An office is being redecorated.

The project manager started to draw an activity network for the project.

The unfinished network is on the opposite page.

5 (a) Complete the precedence table for the project.

Write down the immediate predecessor(s) and the duration for each activity.

[3 marks]

Task	Activity	Immediate predecessor(s)	Duration (hours)
A	Remove furniture		
B	Remove blinds		
C	Remove carpet tiles		
D	Prepare ceiling		
E	Prepare walls		
F	Paint ceiling		
G	Paint walls		
H	Allow paint to dry		
I	Prepare floor		
J	Install carpet tiles		
K	Install blinds		
L	Replace furniture		
M	Check redecoration and clean		

5 (b) Complete the activity network for the project.

[4 marks]

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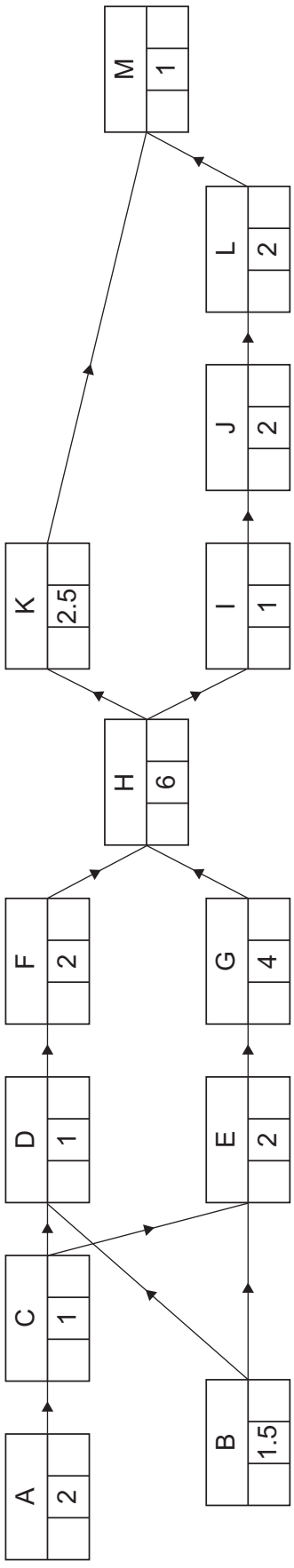

Question 5 continues on the next page

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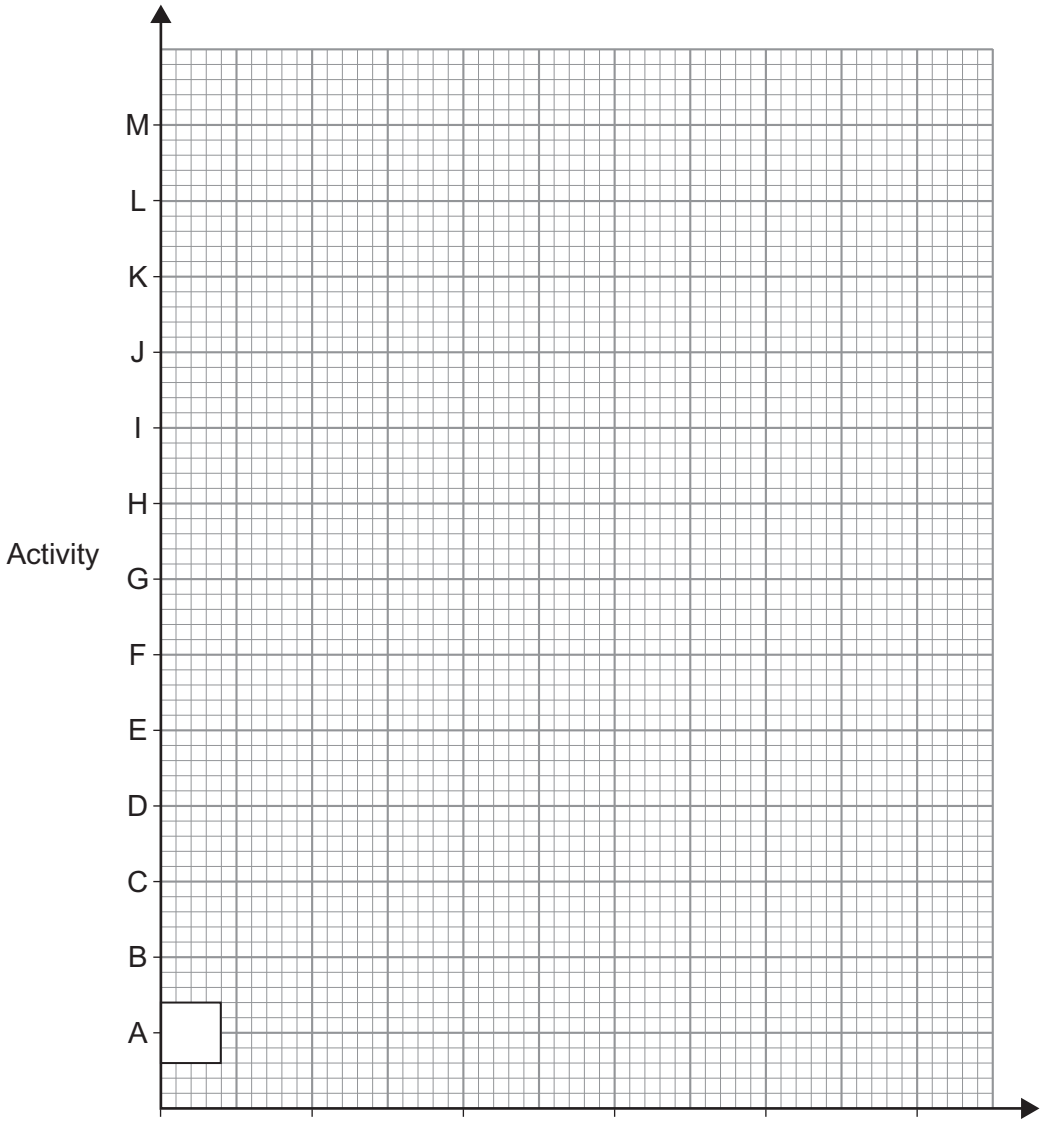
5 (c) State the critical path.

[1 mark]

Answer _____

5 (d) Complete the Gantt chart for the project.

[4 marks]



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5 (e) The project manager decides to start the project on Saturday and complete it on Sunday.

Activity H will take place overnight.

All other activities need to take place between 7 am and 5 pm each day.

There are enough workers for multiple tasks to take place at the same time.

5 (e) (i) Work out the latest time that the project can start on Saturday.

[1 mark]

Answer _____

5 (e) (ii) Work out the earliest time that the project can be completed on Sunday.

[1 mark]

Answer _____

14

Turn over for the next question

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6 Between January and March 2020, 97.4% of trains were early or on time in the UK.
The rest of the trains were late.
Trains were late for one of three reasons.

The table shows the reasons why trains were late.

Reason	Percentage of late trains
Extreme weather	2.0%
Rail infrastructure	57.6%
Train operation	40.4%

6 (a) Work out the percentage of **all** trains that were late due to extreme weather.

[3 marks]

Answer _____ %

Do not write outside the box

6 (b) In Scotland, between January and March 2020, approximately 3370 trains were late due to rail infrastructure.

Estimate, for the same period, how many trains were late due to train operation.

[2 marks]

Answer _____

6 (c) State one assumption you made in **Question 6(b)**.

[1 mark]

_____

_____

_____

6

Turn over for the next question

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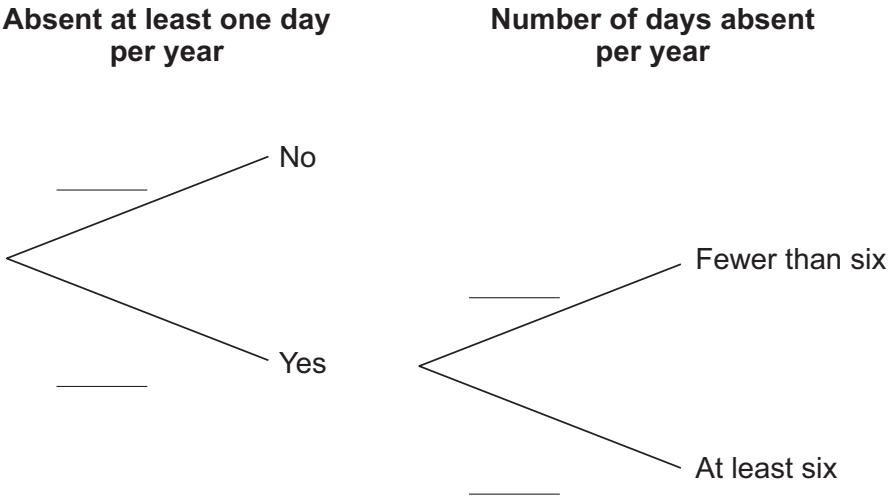
7 The owners of a business are concerned about the cost of employee absence.

Experience shows that 60% of employees are absent for at least one day per year.

Of those employees who are absent, 30% are absent for at least six days.

7 (a) Complete the tree diagram.

[2 marks]



7 (b) Each employee costs the business £200 per day that they are absent.

The table shows the average number of days that employees are absent.

Absence in the year	Average number of days absent
Fewer than six days	3
At least six days	12

Work out the expected cost of absence per employee per year.

[5 marks]

Answer £ _____

Do not write outside the box

7 (c) The business can buy an Employee Absence insurance policy.

The policy costs £600 per employee per year.

The policy pays the business £150 per employee for each day they are absent.

Advise the business owners on whether they should buy the policy.

You should base your advice on the expected costs.

[4 marks]

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11

END OF QUESTIONS

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