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

Thursday 22 May 2025 Morning 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.

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.

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

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

1 Total solar eclipses happen when the moon fully blocks the Sun's light on Earth.

They occur approximately every 18 months.

The table below shows where and when total solar eclipses can be seen in the years 2026 to 2035

It also includes the maximum length of time the eclipses can be seen in one place, stated as duration in minutes (m) and seconds (s).

There can only be one total solar eclipse in any year, but it may be visible in more than one continent.

Year	Continents where the total solar eclipses can be seen					Duration
	Europe	North America	Asia	Africa	Australia	
2026	✓	✓				2 m 18 s
2027	✓		✓	✓		6 m 23 s
2028			✓		✓	5 m 10 s
2029						–
2030				✓	✓	3 m 44 s
2031						–
2032						–
2033		✓	✓			2 m 36 s
2034			✓	✓		4 m 09 s
2035			✓			3 m 53 s

1 (a) What fraction of the total solar eclipses that can be seen in **Asia** in these years will last longer than 4.5 minutes?

Circle your answer.

[1 mark]

$\frac{2}{7}$ $\frac{3}{7}$ $\frac{2}{5}$ $\frac{3}{5}$

Do not write outside the box

Jaydon is analysing the data in the table.

1 (b) He claims that the range of eclipse duration in Europe is **more than double** the range of eclipse duration in Africa.

Does the data support this claim?

Show working to justify your answer.

[2 marks]

_____

_____

_____

_____

1 (c) Jaydon incorrectly works out the median duration of total solar eclipses in Europe **and/or** North America in these years as 2 m 27 s

Explain the mistake Jaydon has made in his **method** and state the correct median duration.

[2 marks]

Mistake _____

_____

_____

Correct median _____ m _____ s

5

Turn over for the next question

Do not write outside the box

2 Use **European Champions Report, 2023**, from the Preliminary Material.

Charlie is writing a report on the finances of football clubs.

She uses information from the European Champions Report, 2023

2 (a) Charlie's report states

> The proportion of revenue received from broadcasting is approximately equal for Manchester City FC and AFC Ajax.

Is this correct?

You **must** show your working.

[3 marks]

2 (b) Charlie analyses the ratio of revenue sources

Commercial : Broadcasting : Matchday

Show that for one club this ratio is approximately 3 : 4 : 1 and state the club.

[3 marks]

Club _____

Do not write outside the box

2 (c) Charlie notices that the total revenue stated for Real Madrid CF in **Table 1** and **Extract 1** does not match the figures in **Graph 1**

She assumes this must be due to rounding of the raw data values used in **Graph 1**

Give an example calculation that would justify her assumption.

[1 mark]

_____

_____

_____

2 (d) From the 2020/21 season to the 2021/22 season, the total revenue of AC Milan increased by 16% and the total revenue of FC Porto decreased by 6%

Work out the difference between AC Milan's total revenue and FC Porto's total revenue for the **2020/21** season.

Give your answer to the **nearest million** euros (€).

You **must** show your working.

[3 marks]

_____

_____

_____

_____

_____

_____

Answer € _____ million

Question 2 continues on the next page

Do not write outside the box

2 (e) Make two criticisms of **Graph 2** from the Preliminary Material.

[2 marks]

Criticism 1 _____

_____

Criticism 2 _____

_____

2 (f) Use **Extract 2** and **Graph 2** from the Preliminary Material.

Charlie analyses the profit/loss of the eight clubs.

Her report states

> On average, clubs in Europe that win their league make a loss of about €50 m every year.

2 (f) (i) Show how one statistical measure supports this statement.

[2 marks]

_____

_____

_____

_____

2 (f) (ii) Give **one** reason why this statement might be misleading.

[1 mark]

_____

_____

15

Do not write outside the box

Turn over for the next question

DO NOT WRITE ON THIS PAGE
ANSWER IN THE SPACES PROVIDED

Do not write outside the box

3 Desalination is the process of removing salt from sea water.

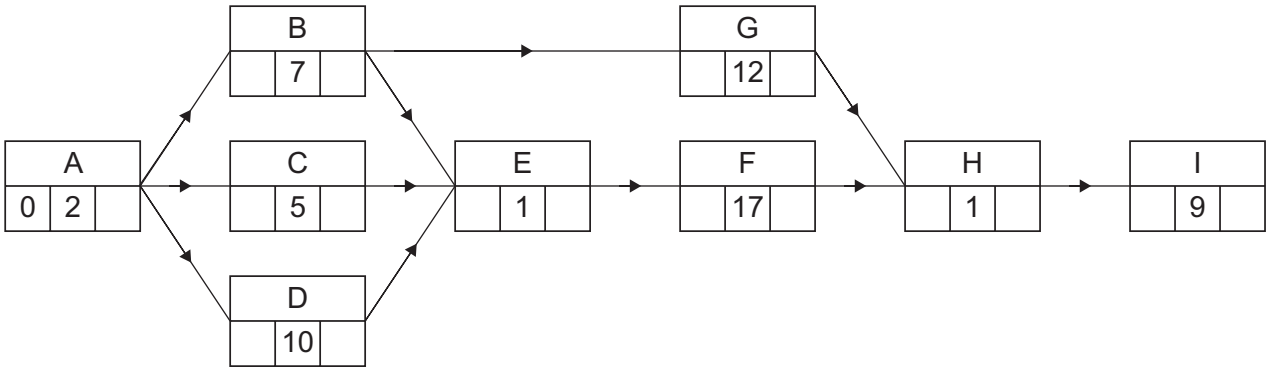
A company is hired to build a desalination plant.

The table lists the activities which need to be completed before construction can begin.

Task	Activity	Immediate predecessor(s)	Duration (months)
A	Data collection 1	–	2
B	Data collection 2	A	7
C	Phase 1 modelling	A	5
D	Outline of marine impacts	A	10
E	Feasibility 1	B, C, D	1
F	Phase 2 modelling	E	17
G	Sea and tunnelling profile	B	12
H	Outline design	F, G	1
I	Statutory approvals and feasibility 2	H	9

3 (a) Complete the activity network for this project.

[4 marks]



3 (b) State the critical path.

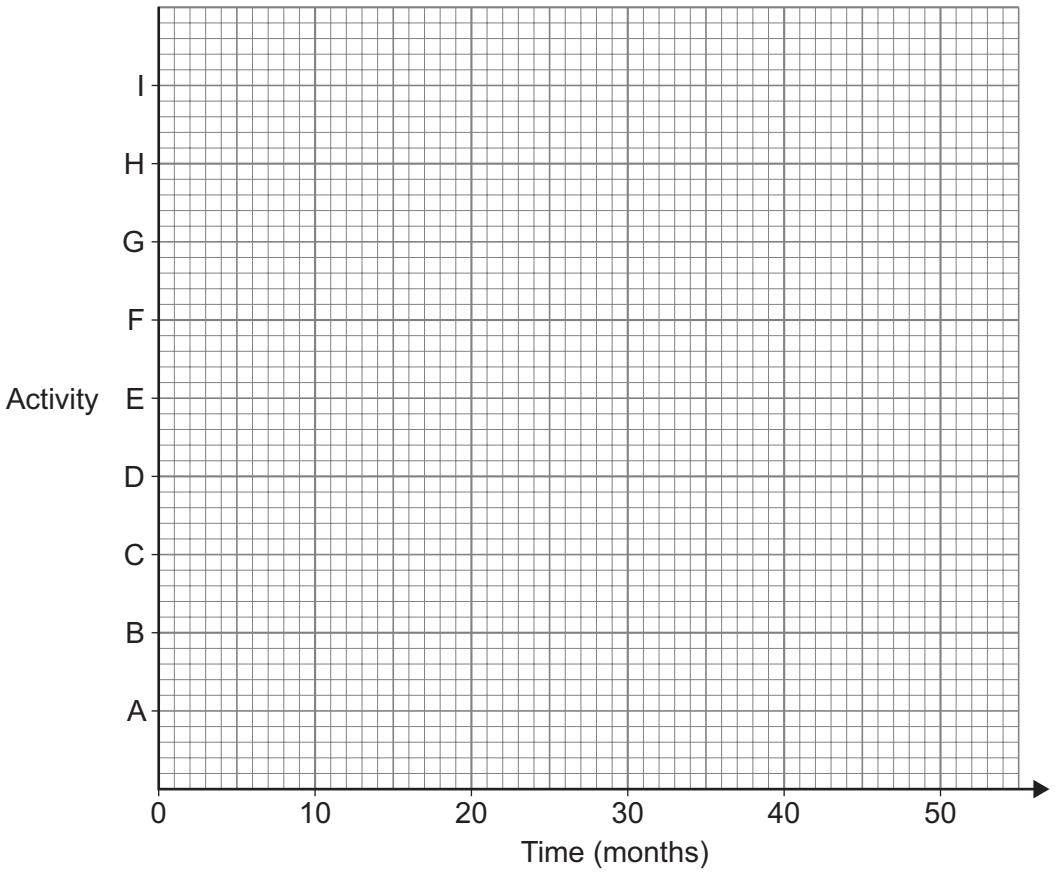
[1 mark]

Answer _____

Do not write outside the box

3 (c) Complete the Gantt chart for this project.

[4 marks]



9

Turn over for the next question

Do not write outside the box

4 Megan owns a hotel in a ski resort.

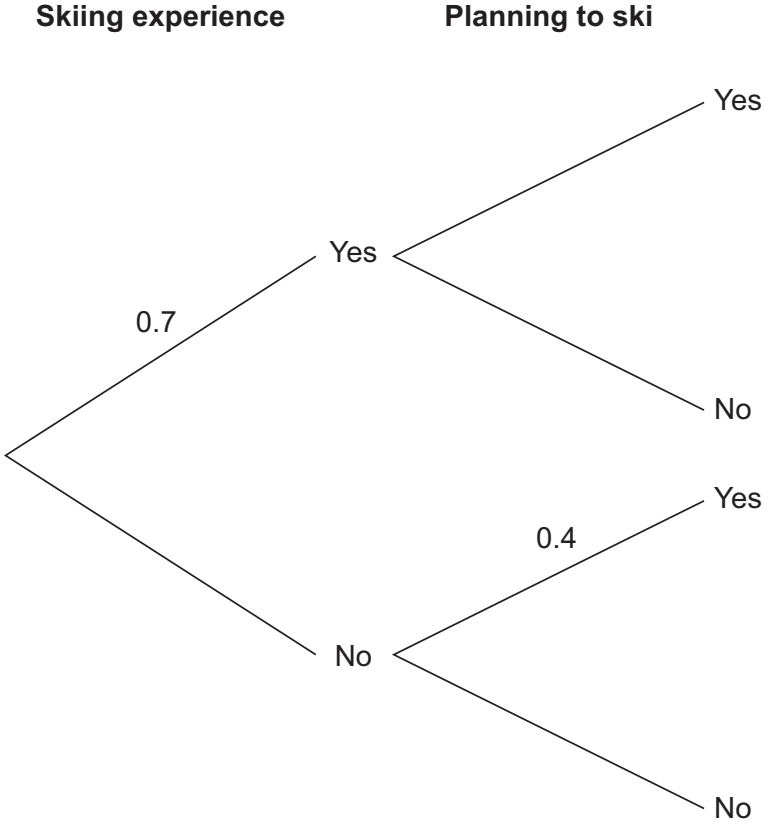
She asks 100 guests if they

have skiing experience

are planning to ski during their stay at the hotel.

A guest with skiing experience is **twice** as likely to be planning to ski as one with no skiing experience.

The tree diagram shows some of the information.



Do not write outside the box

4 (a) One of the 100 guests is chosen at random.

Work out the probability that they have no skiing experience but are planning to ski.

[3 marks]

Answer _____

4 (b) Between December and March, the hotel expects to have 6500 guests.

Work out the expected number of guests that are planning to ski.

[4 marks]

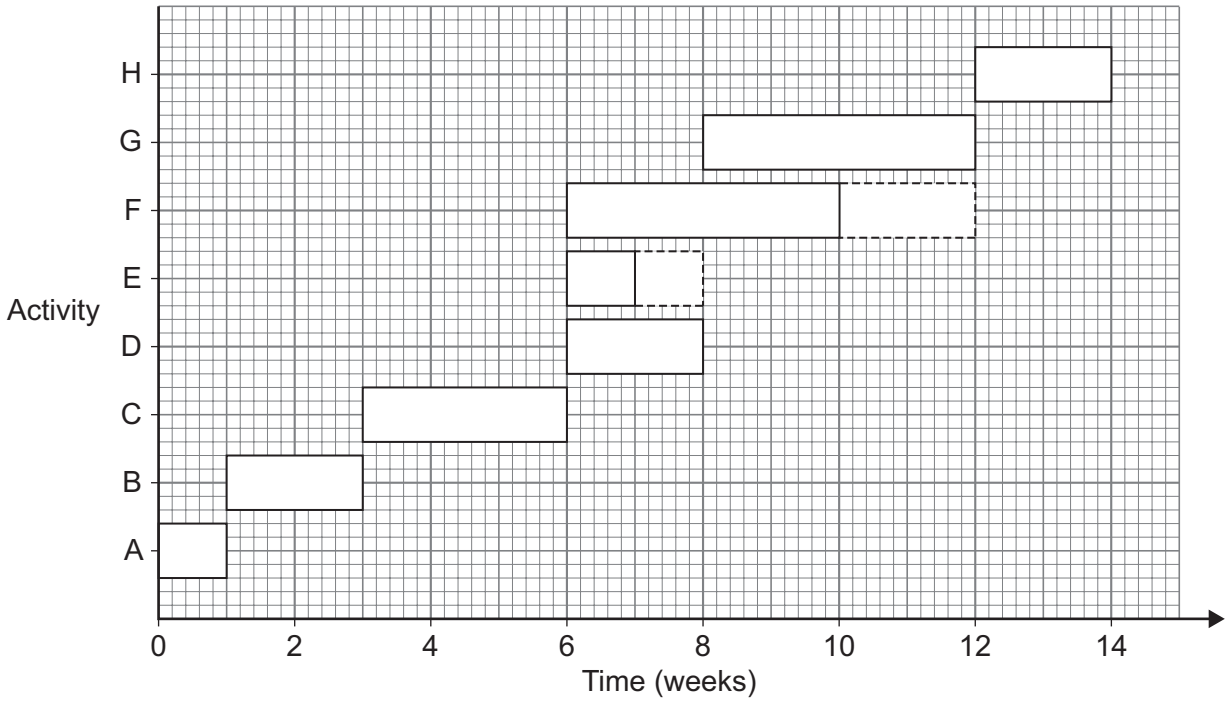
Answer _____

7

Turn over for the next question

Do not write outside the box

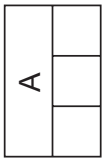
5 Faisal draws this Gantt chart for the design of a product.



Complete an activity network for the design of this product on the opposite page.

[5 marks]

Do not write outside the box



5

Do not write outside the box

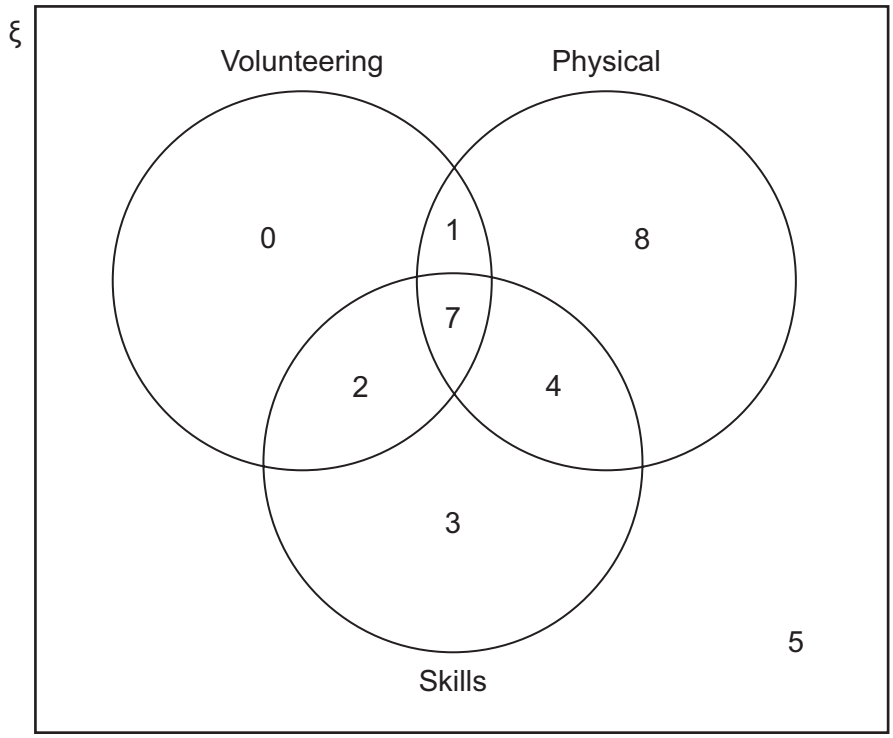
6 At a school, all Year 10 students participate in the Duke of Edinburgh's Bronze Award.

To gain the Bronze Award, students must complete four sections: Volunteering, Physical, Skills and Expedition.

The school organises the Expedition section and all Year 10 students have completed this.

The remaining three sections are organised by students themselves.

The Venn diagram shows the number of students that have completed these sections for one Year 10 class.



Do not write outside the box

6 (a) Two students from this Year 10 class are chosen at random.

Work out the probability that **both** students have completed all sections.

[3 marks]

Answer _____

6 (b) There are 270 students in Year 10

Estimate the total number of students in Year 10 that still need to complete **at least** two sections.

[3 marks]

Answer _____

6

Turn over for the next question

Do not write outside the box

7 Keira is going on a six-day trip.

She will hire a car for the six days from a company near to her airport hotel.

For the first five days, Keira will attend business meetings.

On each of these days she will drive 50 miles.

On the sixth day,

if the weather is good, Keira will drive a **total** of 90 miles to visit a beach

if the weather is **not** good, Keira will drive a **total** of 10 miles to visit a shopping mall.

There is a 60% chance of the weather being good on the sixth day.

The car hire company offers three fuel plans.

Silver plan	**Customer refuels** Just before returning the car, Keira must go to a local petrol station and refuel the car to full.
Gold plan	**Company refuels** Keira can return the car with any fuel level. The car hire company will refuel the car to full. The cost of fuel will be \$0.55 per gallon **cheaper** than local petrol stations. An additional \$9 service charge will apply.
Diamond plan	**Customer pre-pays for a full tank of fuel** Keira will pay the car hire company for a **full** tank of fuel in advance. The cost of fuel will be \$0.55 per gallon **cheaper** than local petrol stations. There is no service charge. However, there is **no** refund for unused fuel.

The car that Keira will hire

has a fuel tank that can hold 12 gallons

will initially have a full fuel tank

can drive 30 miles on each gallon of fuel.

The price of fuel at the local petrol station is \$4.80 per gallon.

Do not write outside the box

7 (a) Show that the Silver plan has the lowest expected fuel cost for Keira.

[10 marks]

Question 7 continues on the next page

Do not write outside the box

7 (b) Keira takes the Silver plan.

However, if she does not refuel the car, she will need to pay the fuel cost **and** service charge of the Gold plan.

An employee of the car hire company says,

> "If you run late and do not refuel the car yourself, the Diamond plan would save you money."

There is a 25% chance that Keira will **not** have time to refuel the car.

Should Keira have taken the Diamond plan?

Show working to justify your answer.

[3 marks]

13

END OF QUESTIONS

Do not write outside the box

There are no questions printed on this page

DO NOT WRITE ON THIS PAGE
ANSWER IN THE SPACES PROVIDED

Do not write outside the box

Question number	**Additional page, if required.** **Write the question numbers in the left-hand margin.**

Do not write outside the box

Question number	**Additional page, if required.** **Write the question numbers in the left-hand margin.**

Do not write outside the box

Question number	**Additional page, if required.** **Write the question numbers in the left-hand margin.**

Do not write outside the box

Question number	**Additional page, if required.** **Write the question numbers in the left-hand margin.**

Do not write outside the box

There are no questions printed on this page

DO NOT WRITE ON THIS PAGE
ANSWER IN THE SPACES PROVIDED