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.

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	
TOTAL	

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

1 Eva is a newspaper reporter.

She collected data about the degree results achieved by students at a university over 3 years.

Some students failed their course and were not awarded a degree.

Eva recorded the results in this table.

		Degree class awarded					
		First	**Upper Second**	**Lower Second**	**Third**	**Fail**	**Total completed**
Year course completed	**2018**	2615	1750	981	371	93	5810
	2019	3358	2300	1042	140	60	6900
	2020	5450	1509	375	229	77	7640

1 (a) Work out the ratio of students in **2019** awarded an Upper Second class degree to the total number of students completing their course that year.

Circle your answer.

[1 mark]

1 : 2 2 : 1 1 : 3 3 : 1

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1 (b) In an article on the data Eva made the following statements.

Statement 1

'The average amount a student paid for a degree course was £27 000. This means that the university collected more than half a billion pounds from these students.'

Statement 2

'The percentage of students in the year group awarded a First class degree increased by more than half from 2018 to 2020'

Does the data support these statements?

Show working to support your answers.

[6 marks]

Statement 1

Statement 2

7

Turn over for the next question

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2 Use **Plastic waste** from the Preliminary Material.

2 (a) Suggest **two** improvements that could be made to the charts in the Preliminary Material.
[2 marks]

Improvement 1

Improvement 2

2 (b) Readers of the extract from the briefing paper commented that it was difficult to follow in places.

Give **three** reasons why they might have said this.

You should **not** comment on the charts.
[3 marks]

Reason 1

Reason 2

Reason 3

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2 (c) The following statements were made about the data on two online forums.

The amount of plastic waste going to landfill fell by more than 60% from 2012 to 2016

Ecofriends

UK production of plastic waste in 2016 had increased by about 0.3 million tonnes since 2010

Greenusers

Using the data given, comment on the validity of these statements.

[6 marks]

Ecofriends

Greenusers

Question 2 continues on the next page

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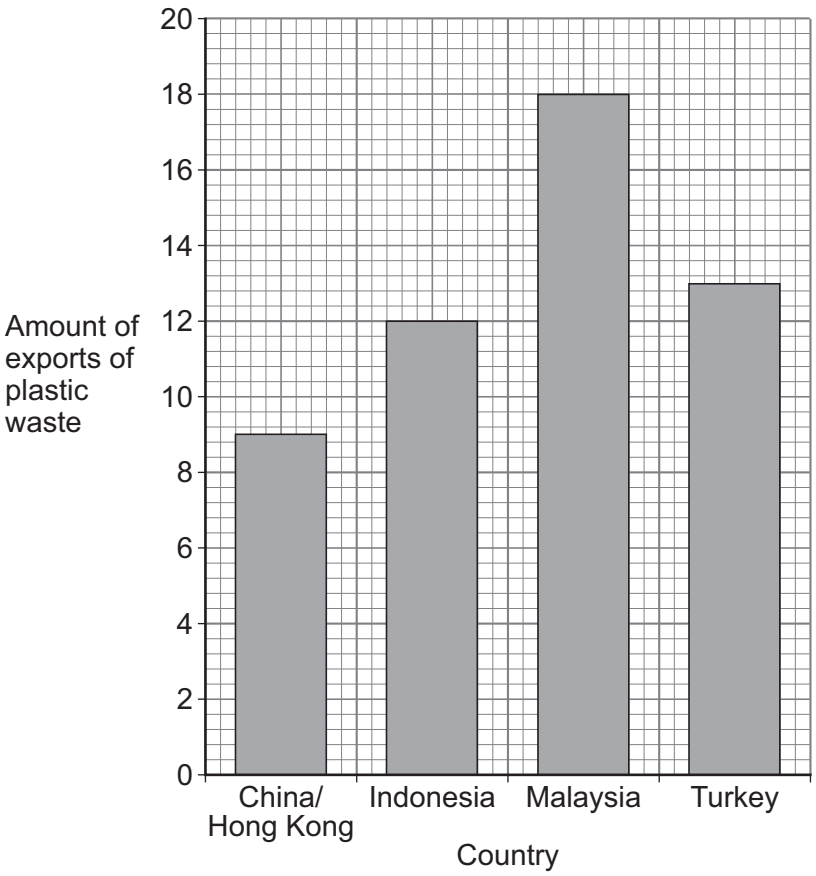
2 (d) The bar chart shows information about the exports of plastic waste from the UK in 2018



State **two** errors in the bar chart.

[2 marks]

Error 1

Error 2

13

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Turn over for the next question

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3 There are 55 countries in the African Union.

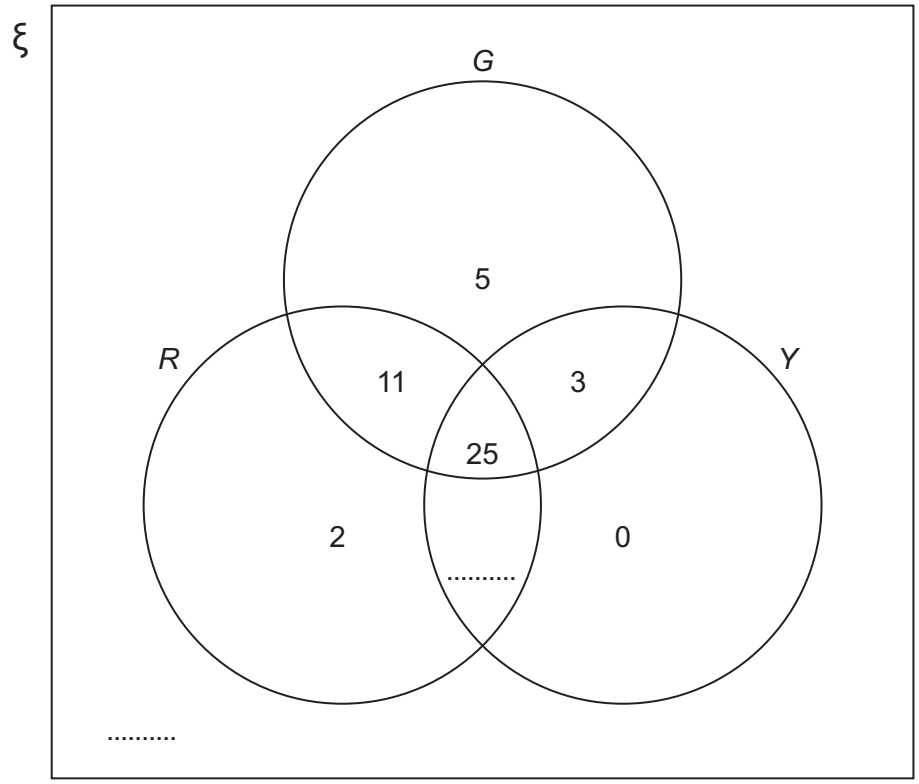
In the Venn diagram,

ξ represents the 55 countries in the African Union

R represents the 45 countries with red in their flag

G represents the countries with green in their flag

Y represents the countries with yellow in their flag.



3 (a) Complete the Venn diagram with the missing two numbers.

[2 marks]

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3 (b) One of the countries is chosen at random.

Work out P($G \cup Y$)

[2 marks]

Answer _____

3 (c) Describe the flag of a country in the section $R' \cap G$

You do **not** need to work out the probability of choosing the country.

[1 mark]

3 (d) One of the countries with red in their flag is chosen at random.

Work out the probability that the flag also has yellow.

[2 marks]

Answer _____

7

Turn over for the next question

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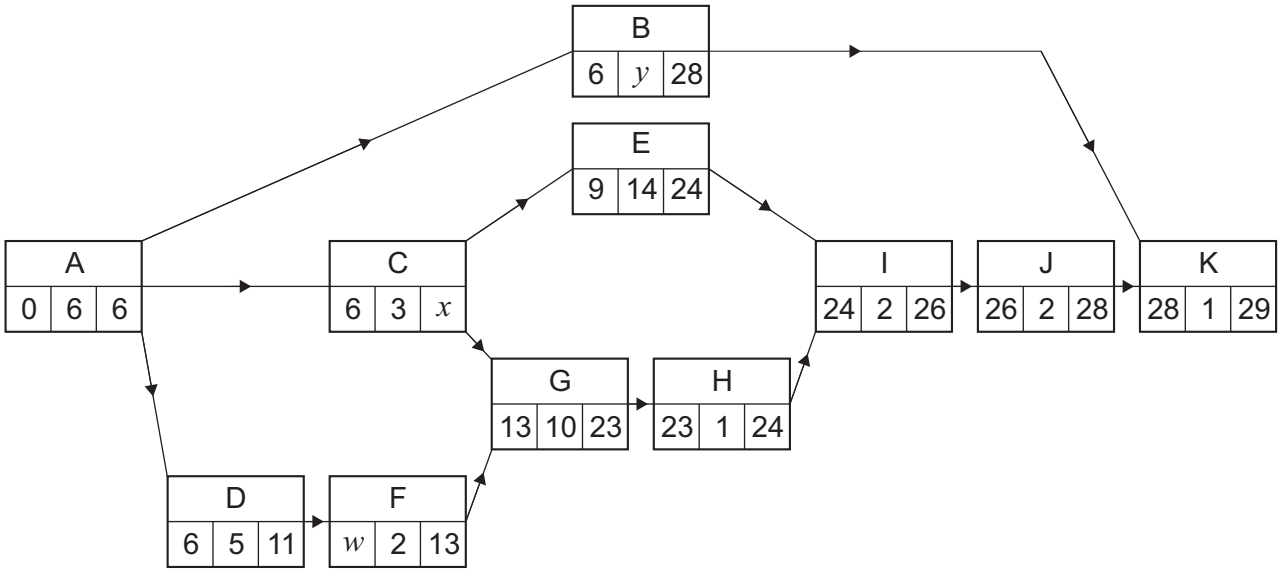
4 A company is planning to redesign its website to include some new features.

The company will carry out research on how customers navigate the current website. This will be used to influence the design of the new website.

The table lists the activities needed.

Task	Activity	Immediate predecessor(s)	Duration (days)
A	Review current website	-	6
B	Create promotional campaign	A	y
C	Create a project plan	A	3
D	Perform customer research	A	5
E	Code new features	C	14
F	Analyse findings	D	2
G	Design webpages	C, F	10
H	Produce site map	G	1
I	User trials	E, H	2
J	Finalise website redesign	I	2
K	Launch	B, J	1

Zeeshan, the project manager, draws this activity network.



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4 (a) In the activity network, three unknown times are labelled w, x and y

4 (a) (i) Write down the value of w, the early event time of activity F.

[1 mark]

$w =$ _____

4 (a) (ii) Work out the value of x, the late event time of activity C.

[2 marks]

_____

_____

$x =$ _____

4 (a) (iii) Task B has a float of 7 days.

Work out the value of y, the duration of activity B.

[2 marks]

_____

_____

$y =$ _____

4 (a) (iv) State the critical path.

[1 mark]

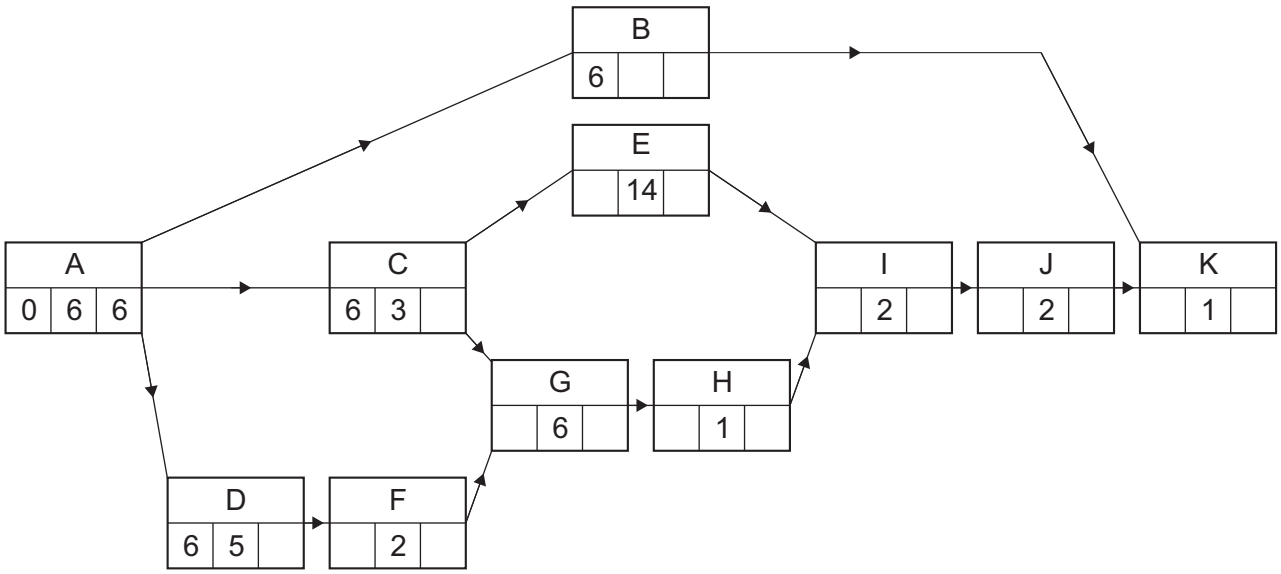
Answer _____

Question 4 continues on the next page

4 (b) Before the start of the project, Zeeshan finds out that the activity G will only take 6 days.

4 (b) (i) Complete the new activity network below.

[4 marks]



4 (b) (ii) State an activity that was critical, but is no longer critical.

[1 mark]

Answer _____

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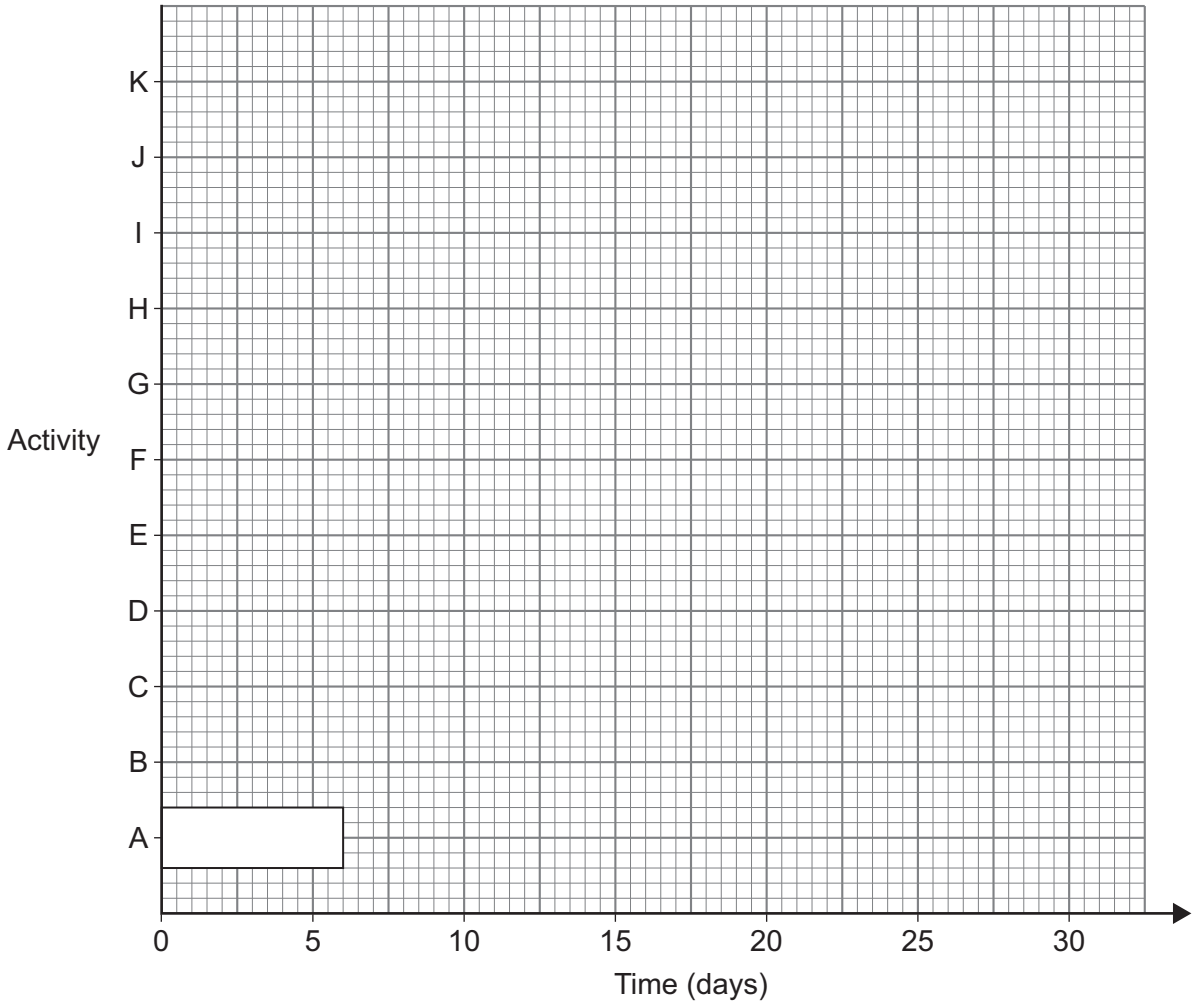
4 (b) (iii) Draw a Gantt chart to represent your activity network in Question **4 (b) (i)**.

[4 marks]



15

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5 Sue sells reading glasses online.

She is considering changing her packaging supplier.

The table shows information about the costs of packaging and delivery.

	Cost of packaging	**Cost of delivery**
Current packaging	65p	£3
New packaging	95p	£3.20

Currently, 6.5% of orders arrive damaged and have to be replaced.

The total cost of replacing each damaged order, including packaging and delivery, is £18

In a small trial using the new packaging, Sue finds that only 4% of orders arrive damaged.

She estimates that the total cost of replacing each damaged order using the new packaging will be £18.75

5 (a) Verify that the expected cost of using the new packaging is **more** than the cost of using the current packaging.

Take into account the cost of sending each order and the expected cost of replacing orders that are damaged.

[5 marks]

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5 (b) The supplier of the new packaging offers to reduce the cost to c pence per order.

The delivery costs would still be £3.20

Assume that the total cost of replacing each damaged order is still £18.75

Work out the value of c that means using the new packaging would have the same expected cost as using the current packaging.

[2 marks]

c = _____

5 (c) The supplier reduces the cost of the new packaging to be less than c pence per order.

Explain why Sue may **not** save money by using the new packaging.

[1 mark]

8

Turn over for the next question

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6 A polygraph machine shows whether the answer to a question is the truth or a lie.

When a person answers a question, the polygraph shows one of two results.

Result	Meaning
Truth	The polygraph believes the answer is the truth
Lie	The polygraph believes the answer is a lie

However, the result shown on the polygraph is not always correct.

When the answer is the truth, the polygraph **incorrectly** shows 'Lie' 10% of the time.

When the answer is a lie, the polygraph **incorrectly** shows 'Truth' 5% of the time.

A group of people are asked to test a polygraph by answering the question, "In what year were you born?"

80% of the group are told to answer with the truth.

The rest of the group are told to answer with a lie.

6 (a) A person in the group is chosen at random to answer the question.

Work out the probability that the polygraph **incorrectly** shows 'Lie'.

[2 marks]

Answer _____

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6 (b) Each person in the group answers the question once.

The polygraph **incorrectly** shows 'Lie' 56 times to answers that are the truth.

The polygraph **correctly** shows 'Lie' x times to answers that are a lie.

Work out the value of x

[5 marks]

x = _____

6 (c) One person in the group is chosen at random.

When this person answered the question the polygraph showed 'Truth'.

Work out the probability that this person did tell the truth.

[3 marks]

Answer _____

10

END OF QUESTIONS

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