AQA

Please write clearly in block capitals.

Centre number ☐☐☐☐☐   Candidate number ☐☐☐☐

Surname _____

Forename(s) _____

Candidate signature _____

Level 3 Certificate
MATHEMATICAL STUDIES

Paper 2B   Critical path and risk analysis

Wednesday 22 May 2019   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.
- 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 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	

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

1 Helen is researching the amount of fat in 25-gram packets of ready salted and prawn cocktail crisps for three brands, **A**, **B** and **C**.

The table shows the amount of fat for each of the six packets.

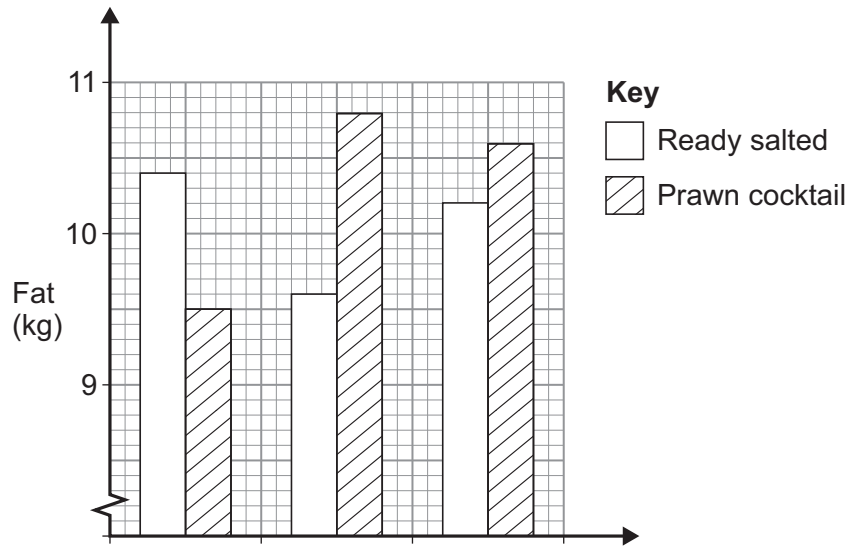|	Ready salted (g)	Prawn cocktail (g)
A	10.4	9.5
B	9.6	10.8
C	10.3	10.6

1 (a) Draw lines below to match each box on the left to the correct box on the right.

[3 marks]

0.15 g

0.20 g

Mean fat content of the six packets

1.30 g

Median fat content of the six packets

10.20 g

Difference in the mean fat content between the ready salted packets and the prawn cocktail packets

10.30 g

10.35 g

1 (b)   Helen produces a bar chart to show the information for the six packets.

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

[2 marks]

Error 1

_____

_____

_____

Error 2

_____

_____

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Question 1 continues on the next page

Turn over ▶

1 (c)   Helen buys a packet of brand **B**'s prawn cocktail crisps weighing 160 grams.

This packet costs £2.30

Helen thinks that for every 10 pence worth of crisps in this packet, there are approximately 3 grams of fat.

Is Helen correct?

Assume that this packet and brand **B**'s 25-gram packet of prawn cocktail crisps have the same fat content **per gram**.

Show working to support your answer.

[4 marks]

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9

2 Use **PISA** from the Preliminary Material.

2 (a) Suggest **three** improvements that could be made to the article in the Preliminary Material, including the graphs.

[3 marks]

Improvement 1

_____

_____

_____

Improvement 2

_____

_____

_____

Improvement 3

_____

_____

_____

Question 2 continues on the next page

Turn over ▶

2 (b) A research assistant is comparing the UK average science score with the overall OECD average science score.

She wants to find out how many per cent higher the UK average is than the overall average.

Here is her calculation.

> 509 − 493 = 16
>
> 16 ÷ 509 = 0.0314
>
> So 0.0314% higher

Critically analyse her calculation, making corrections where necessary.

[3 marks]

_____

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2 (c) The following comments were made on social media after the 2015 results were published.

'For PISA maths in 2015, the range of average scores of the four UK nations is above 10'

Simon

'If Scotland's percentage decline in reading score from 2012 to 2015 is repeated in the next PISA test, the score will drop below 485'

Rukshana

2 (c) (i) Is Simon correct?
Show working to support your answer.

[2 marks]

_____

_____

_____

_____

2 (c) (ii) Is Rukshana correct?
Show working to support your answer.

[3 marks]

_____

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11

Turn over ▶

3 A survey asked adults whether they suffered from asthma and whether they suffered from migraine.

The table shows the results.

		Asthma	
		Yes	No
Migraine	Yes	13	52
	No	28	398

3 (a) Work out the probability that an adult in the survey who suffers from asthma does **not** suffer from migraine.

[1 mark]

Answer _____

3 (b) In the UK, 5.4 million people suffer from asthma.

Use the information in the table to estimate the number of people in the UK who suffer from migraine.

[3 marks]

_____

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Answer _____

3 (c) Give **one** reason why your answer to **question 3(b)** might **not** be a good estimate.

[1 mark]

_____

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Turn over ▶

5

4 A toy company has a contract to supply a new kind of toy for a supermarket.

The toy company will design and make the toys.

The packaging will be made by another company, based overseas.

When completed, the packaging will be delivered to the toy company by ship.

The toy company will then pack the finished toys and deliver them to the supermarket.

The table below lists the activities needed to deliver the toy to the supermarket.
The duration of each activity and its immediate predecessors are shown.

Task	Activity	Immediate predecessor(s)	Duration (days)
A	Design toy	–	8
B	Test toy	A	7
C	Finalise toy design	B	5
D	Make toy	C	18
E	Write instructions for use	C	2
F	Print instructions	E	2
G	Design packaging	A	2
H	Make packaging	G	4
I	Deliver packaging	H	23
J	Package toy	D, F, I	3
K	Deliver toy to supermarket	J	2

4 (a) Complete the activity network for this project on the page opposite.
Include the earliest start time and latest finish time for each activity.
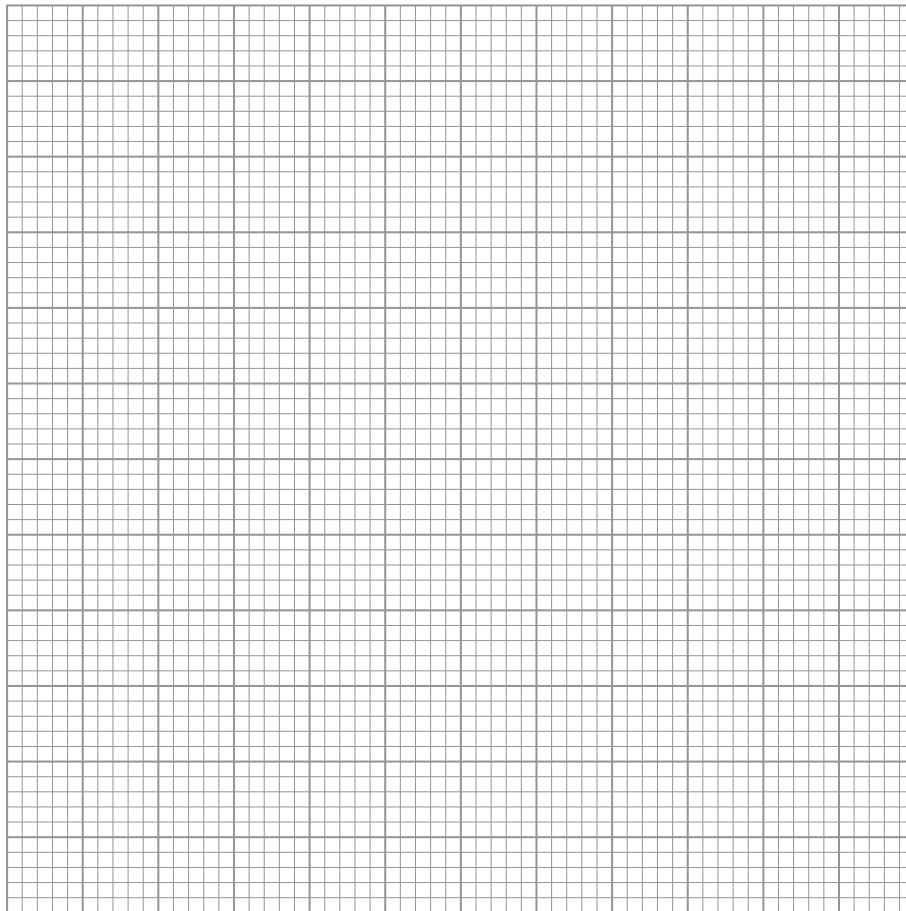
[7 marks]

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Question 4 continues on the next page

Turn over ▶

4 (b) Draw a Gantt chart (cascade diagram) for the project.

[4 marks]

4 (c)   The toy company has been warned that bad weather may cause the delivery of the packaging to take longer than the expected 23 days.

4 (c) (i)   What is the float, in days, for activity **I** (Deliver packaging)?
Circle your answer.

[1 mark]

1   14   15   23

4 (c) (ii)   The company delivering the packaging estimates the probability of delay as follows.

Delay (days)	Probability
0	0.08
1	0.21
2	0.35
3	0.30
4 or more	0.06

Estimate the probability that the delivery of the toys to the supermarket will be delayed.

[2 marks]

Answer _____

14

Turn over ▶

5 20 000 students enrolled at a university in 2017

Of these 20 000 students,

- 6800 students were aged 25 or over
- 10 800 students were female, and the rest were male
- 4400 were non-UK students, with 2000 of these being female.

5 (a) Complete the Venn diagram.

[4 marks]

Key: **A** aged 25 or over
B female
C non-UK

ξ

A   B

2000   3000   ....

800

....

....

C

....

_____

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_____
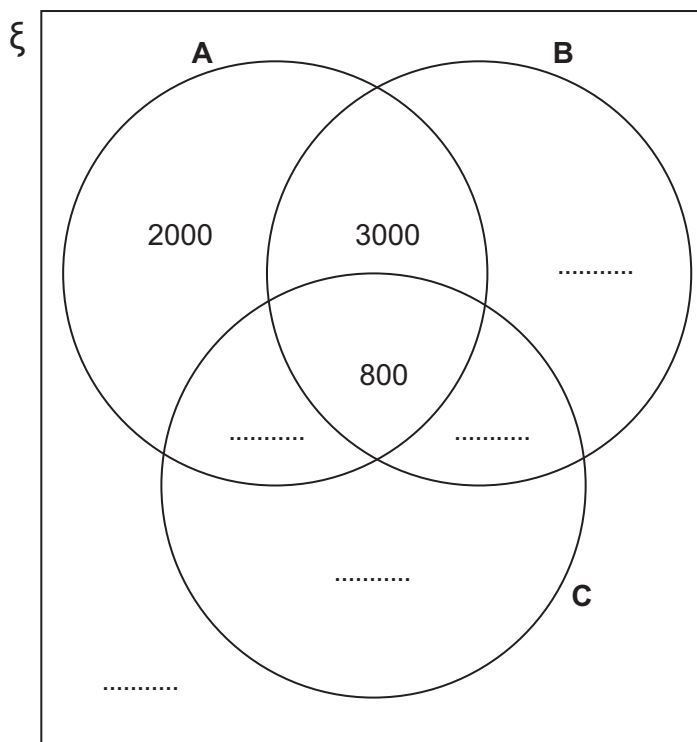
5 (b) Use the Venn diagram to state how many male students from the UK aged under 25 enrolled at the university in 2017

[1 mark]

Answer _____

5 (c) A female student is chosen at random from the 20 000 students.

Work out the probability that she is aged under 25
Give your answer as a fraction in its lowest terms.

[2 marks]

Answer _____

5 (d) Two students are chosen at random from the 20 000 students.

Work out the probability that one is a non-UK student and the other is from the UK.
Give your answer to two decimal places.

[2 marks]

Answer _____

9

Turn over ▶

6   A film unit is making a wildlife documentary series.

Humpback whales sometimes appear at the location where the unit is filming.

The producer wants to film these whales, but is concerned about the costs, and there are only two more weeks before the deadline for the end of filming.

You are working on the project as an assistant producer.

You have been given the following estimated probability and costs.

- The probability that the whales will appear in any one week is 0.4
- The cost of staying at the location is £50 000 per week
- The cost of filming the whales if they appear is £30 000
- If the unit films the whales, the income from the film will increase by £200 000

The producer is considering these three options:

Option A
Stop filming and leave immediately.

Option B
Stay at the location for one more week.
If the whales appear in this week, film the whales.
If not, stop filming and leave.

Option C
Stay at the location for up to two more weeks.
If the whales appear in any week, film the whales, and then leave the location at the end of that week.
If the whales have not appeared after two weeks, stop filming and leave.

6 (a)   Advise the producer which option she should take, based on the expected costs of each option.

[11 marks]

Question 6 continues on the next page

Turn over ▶

6 (b)   Give **one** reason why the producer might decide **not** to follow your advice.

[1 mark]

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12

END OF QUESTIONS

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