Rewarding Learning

Centre Number

Candidate Number

General Certificate of Secondary Education
2025

Further Mathematics

Unit 4 **(With calculator)** Discrete and Decision Mathematics

[GFM41]

GFM41

FRIDAY 20 JUNE, MORNING

TIME

1 hour.

INSTRUCTIONS TO CANDIDATES

Write your Centre Number and Candidate Number in the spaces provided at the top of this page.
You must answer the questions in the spaces provided.
Do not write outside the boxed area on each page or on blank pages.
Complete in black ink only. **Do not write with a gel pen.**
Questions which require drawing can be completed using an HB pencil.
All working **must** be clearly shown in the spaces provided. Marks may be awarded for partially correct solutions.
Answer **all five** questions.

INFORMATION FOR CANDIDATES

The total mark for this paper is 50.
Figures in brackets printed down the right-hand side of pages indicate the marks awarded to each question or part question.
You may use a calculator.

1 **(a)** Dealz on Mealz sells a burger meal deal for two people.

Each burger meal deal consists of three parts: a Burger Combo, Sides and Drinks as detailed in the table below.

Burger Combo Choose any **two different** burgers	**Sides** Choose any **three different** sides	**Drinks** Choose any **two different** flavours
Beef Burger	Chips	Pineapple
Chicken Burger	Skinny Fries	Cola
Veggie Burger	Garlic Chips	Diet Cola
Hawaiian Burger	Onion Rings	Mango
Vegan Burger	Chunky Chips	Orange
Cheese Burger		Lemon
		Lime

(i) How many different burger meal deals can be made?

Answer _____ [4]

The manager introduces a pizza meal deal for three people.

The meal deal consists of three parts as detailed in the table below.

Pizza Choose any **two different** pizzas	**Sides** Choose any **three different** sides	**Drinks** Choose any **three different** flavours
Margherita	Chips	Pineapple
Vegetarian	Skinny Fries	Cola
Hawaiian	Garlic Chips	Diet Cola
Pepperoni	Onion Rings	Mango
Meat Feast	Chunky Chips	Orange
Volcano		Lemon
		Lime

The manager claims that the number of choices in the pizza meal deal is more than the number of choices in the burger meal deal.

(ii) Prove the manager's claim is true and calculate the percentage increase in choices.

Answer _____ % [4]

[Turn over

(b) A ‘pattern-word’ of 11 letters is made by arranging the six consonants ‘b’, ‘f’, ‘g’, ‘m’, ‘t’ and ‘w’ with a **different** vowel between each pair.

A **different** vowel chosen from ‘a’, ‘e’, ‘i’, ‘o’ and ‘u’ is placed between each pair of consonants.

So, each pattern-word is made of 11 **different** letters and has the shape CVCVCVCVCVC, where C is a consonant and V is a vowel.

An example pattern-word is ‘batefimoguw’:

b	a	t	e	f	i	m	o	g	u	w
C	V	C	V	C	V	C	V	C	V	C

How many pattern-words are there?

Answer _____ [4]

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(Questions continue overleaf)

[Turn over

2 Poppy saves 10p and 50p coins in her money box.

Let x represent the number of 10p coins saved and y the number of 50p coins saved.

At the end of the month, she has at least £3.50 saved.

(i) Express this condition as an inequality.

Answer _____ [2]

There is room for no more than twenty 10p coins in her money box.

(ii) Express this condition as an inequality.

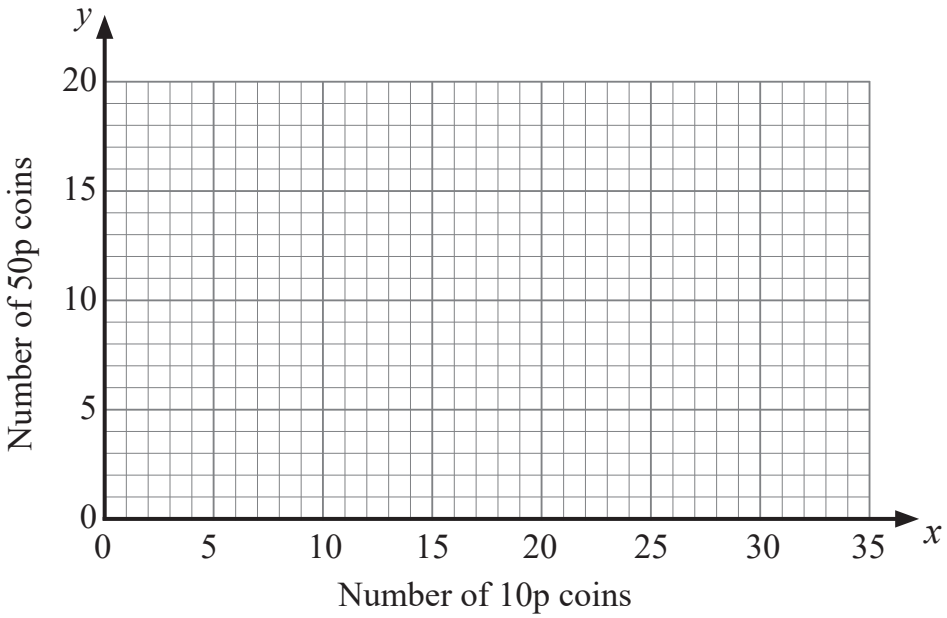
Answer _____ [1]

The number of 50p coins is not more than the number of 10p coins.

(iii) Express this condition as an inequality.

Answer _____ [2]

(iv) Illustrate the three inequalities by a suitable diagram on the graph below.



Identify with the letter R the region containing the set of points satisfying all three inequalities. [3]

(v) Using your solution set, find the minimum amount of money Poppy could have in her money box and the number of each coin saved.

Answer Minimum amount saved £ _____

Number of 10p coins _____

Number of 50p coins _____ [3]

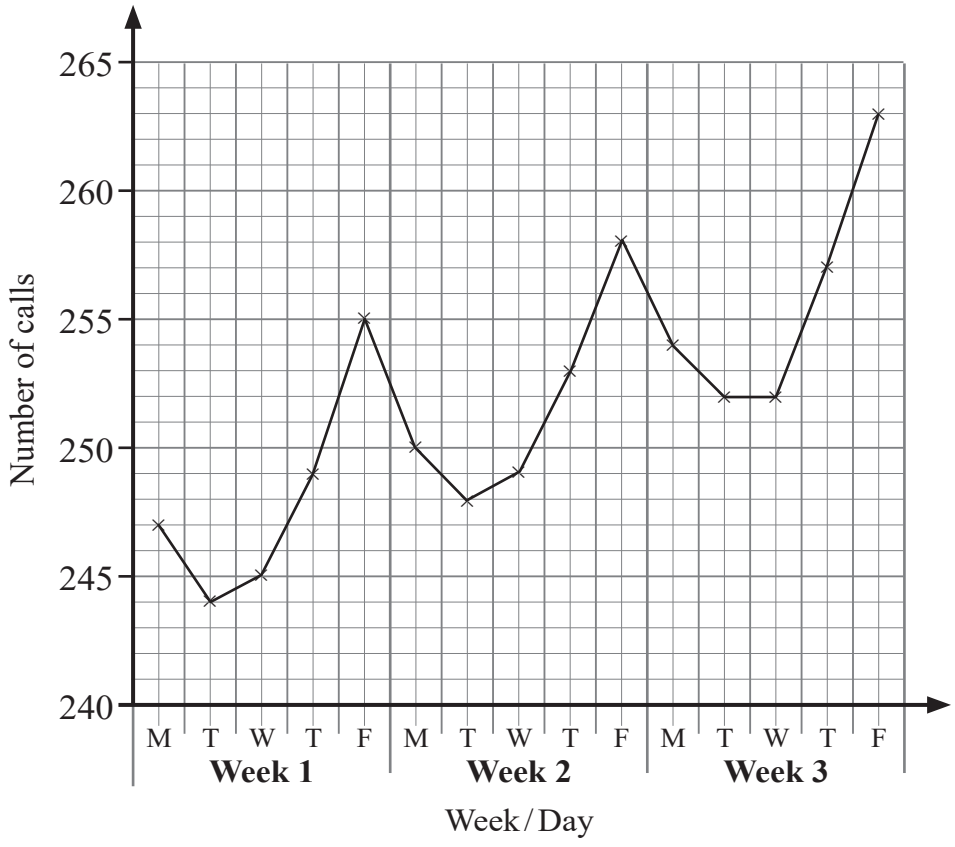
[Turn over

3 During the first three weeks in November, a credit union call centre recorded how many calls they received each day.

The results are summarised in the table below.

	Monday	**Tuesday**	**Wednesday**	**Thursday**	**Friday**
Week 1	247	244	245	249	255
Week 2	250	248	249	253	258
Week 3	254	252	252	257	263

These data have been plotted on the graph below.



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(i) Calculate appropriate moving averages using the information below to smooth the data. [3]

247

244

245

249

255

250

248

249

253

258

254

252

252

257

263

(ii) Plot these averages on the graph opposite and draw the trend line. [3]

(iii) Showing clearly where any reading is taken, use the trend line to estimate the number of calls likely on Monday of Week 4

Answer _____ [3]

[Turn over

4 Let p and q be two expressions.

(i) By completing the truth tables below, show that the two expressions

(p **and not** q) **or** (**not** p **and** q),

(**not** p **or not** q) **and** (p **or** q)

are equivalent.

p	q	**not** p	**not** q	p **and not** q	**not** p **and** q	(p **and not** q) **or** (**not** p **and** q)
T	T					
T	F					
F	T					
F	F					

p	q	**not** p	**not** q	**not** p **or not** q	p **or** q	(p **or** q) **and** (**not** p **or not** q)
T	T					
T	F					
F	T					
F	F					

[8]

In a trial, **Witness A** states:

> "Either the Butler was in the Library and the Maid wasn't in the Dining Room, or the Butler wasn't in the Library and the Maid was in the Dining Room."

The second part of the written statement by **Witness B** is unreadable. It states:

> "Both (the Butler was in the Library or the Maid was in the Dining Room)
>
> And [... unreadable...] "

Represent the statements

"the Butler was in the Library" by p

and

"the Maid was in the Dining Room" by q

(ii) Using part **(i)**, find what words would make up the unreadable part of **Witness B**'s statement (after the word "And") for both witness statements to be identical in meaning.

Answer _____

_____ [3]

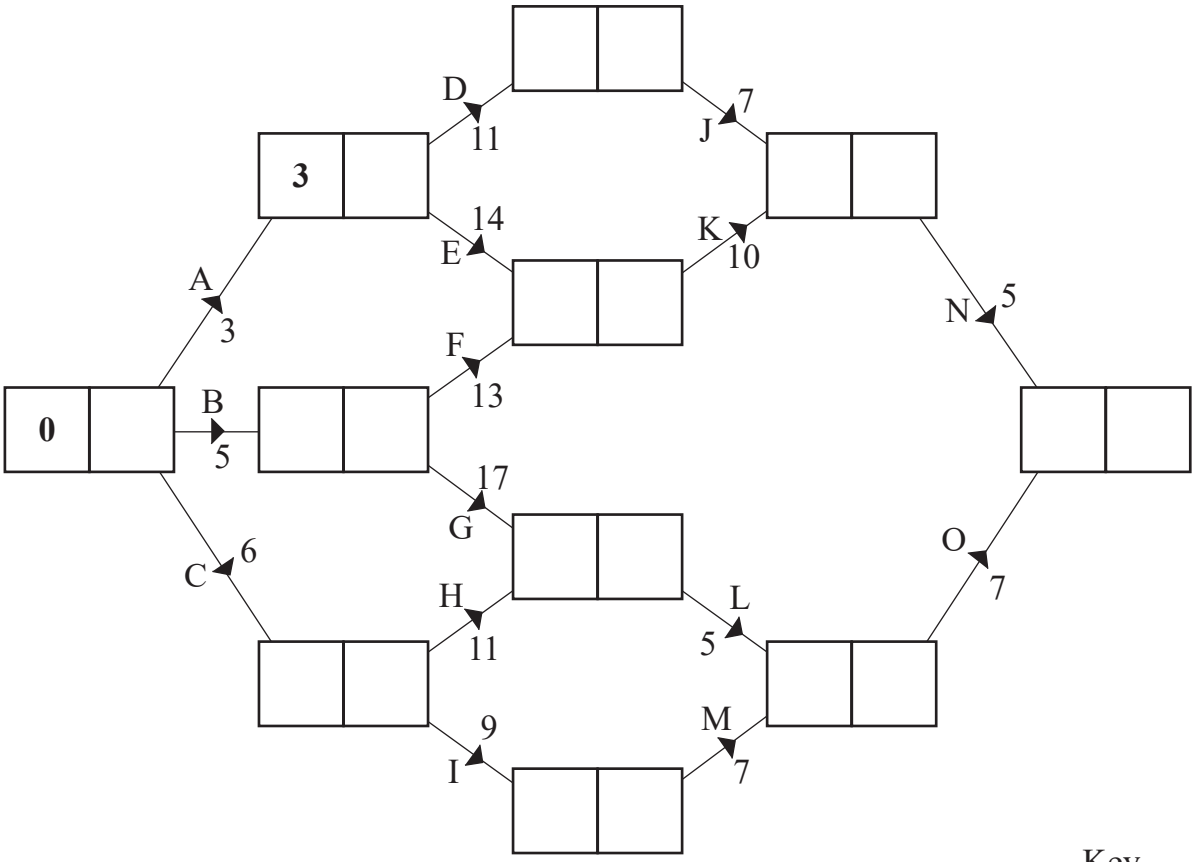
[Turn over

5 The diagram below shows the activity network used to install a large kitchen.

The activities involved are labelled A, B, C, …, O and are represented by the edges.

Each activity requires one staff member.

The number on each edge represents the time in hours required to complete that activity.



Key

Early time	Late time

(i) Complete the diagram above by filling in the missing early times and late times. [5]

(ii) List the critical activities and determine the length of the critical path.

Answer Critical activities _____ [1]

Length of critical path _____ hours [1]

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For Examiner's use only	
Question Number	**Marks**
1	
2	
3	
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Total Marks	

Examiner Number