Rewarding Learning

Centre Number

Candidate Number

General Certificate of Secondary Education
2023

Further Mathematics

Unit 3 **(With calculator)**
Statistics

MV24

[GFM31]

FRIDAY 23 JUNE, AFTERNOON

Time

1 hour, plus your additional time allowance.

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.

Complete in black ink only.

All working **must** be clearly shown in the spaces provided.

Marks may be awarded for partially correct solutions.

Where rounding is necessary give answers correct to **2 decimal places** unless stated otherwise. Answer **all six** questions.

Information for Candidates

The total mark for this paper is 50.
Figures in brackets printed at the end of each question indicate the marks awarded to each question or part question.
You may use a calculator.
The Formula Sheet is on page 3 and the Normal Probability Table is on the Insert provided.

Formula Sheet

Statistics

Statistical measures: $\text{Mean} = \dfrac{\Sigma fx}{\Sigma f}$

$$\text{Standard deviation} = \sqrt{\frac{\Sigma fx^2}{\Sigma f} - (\bar{x})^2}$$

where $\bar{x}$ is the mean

Probability: $P(A \cup B) = P(A) + P(B) - P(A \cap B)$

$$P(A \mid B) = \frac{P(A \cap B)}{P(B)}$$

Bivariate Analysis: Spearman's coefficient of rank correlation is given by

$$r = 1 - \frac{6\Sigma d^2}{n(n^2 - 1)}$$

Quadratic equations: If $ax^2 + bx + c = 0 \quad (a \neq 0)$

$$\text{then } x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

1 At a singing contest eight competitors were scored on each of two songs.

The table opposite shows their scores for each song.

(i) Write down, in the table opposite, the rank orders for the first and second songs. [2 marks]

(ii) Calculate Spearman's coefficient of rank correlation. [4 marks]

Answer _____

Competitor	Ann	Brian	Carol	David	Eve	Fred	Gail	Harry
First song	71	78	64	65	73	76	66	75
Second song	68	75	66	69	70	69	71	72
Ranks (First song)								
Ranks (Second song)								

[Turn over

(iii) Interpret your answer to part **(ii)**.
[1 mark]

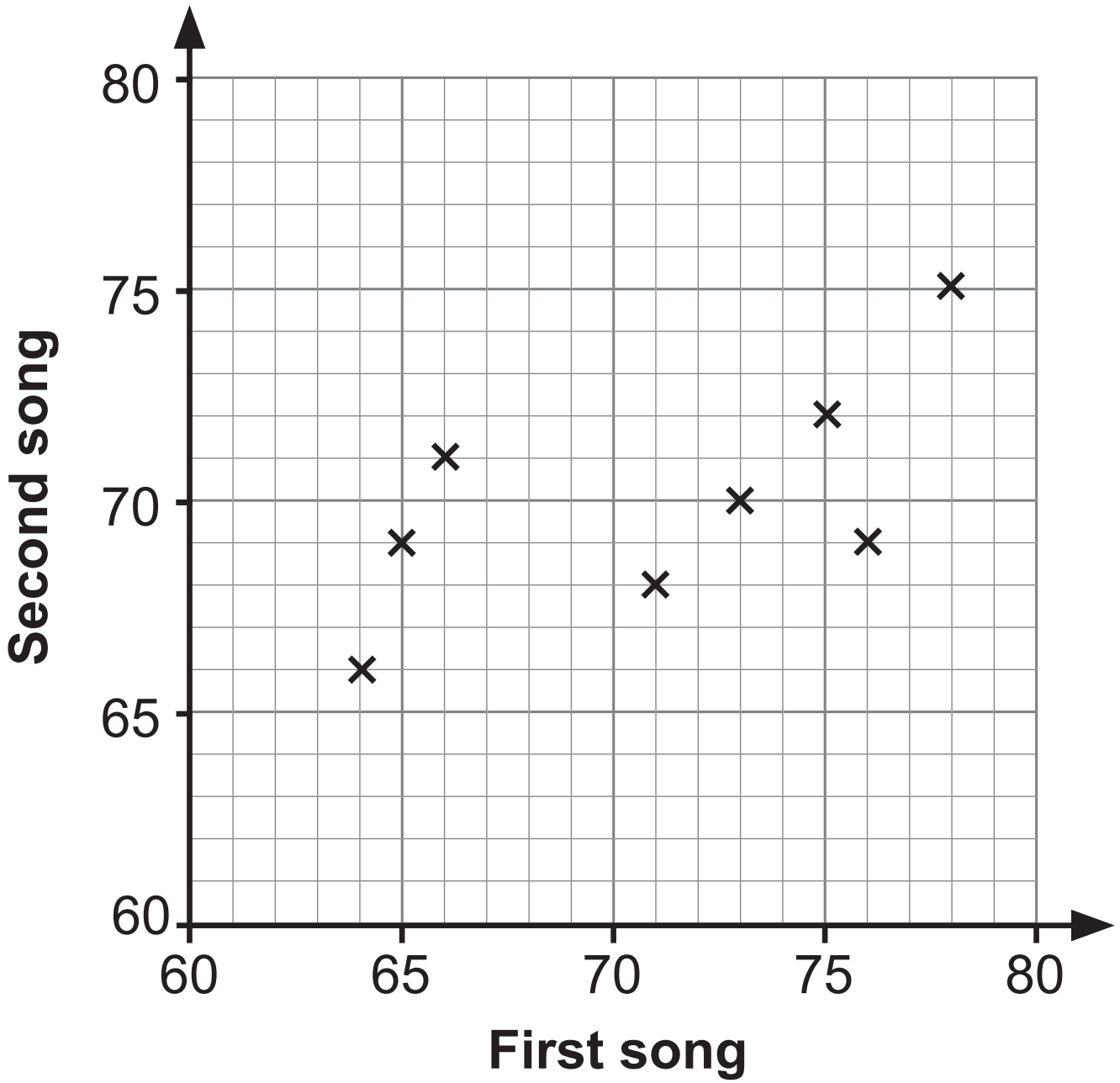
Answer _____

(iv) Calculate the mean mark for the first song and the mean mark for the second song. [1 mark]

Answer Mean first song _____

Mean second song _____

The data from the table are plotted on the graph below.



(v) Draw your line of best fit on the graph.
[2 marks]

(vi) Determine the equation of the line of best fit which you have drawn.
[3 marks]

Answer _____

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(Questions continue overleaf)

2 The speeds of 10 cars and 4 lorries were recorded in a 30 mph zone on a road.

For all 14 vehicles, the mean speed was 32 mph and the standard deviation was 4 mph.

The speeds of the lorries were 28 mph, 30 mph, 33 mph and 40 mph.

Calculate

(i) the mean speed of the cars, [2 marks]

Answer _____ mph

(ii) the standard deviation of the speeds of the cars. [4 marks]

Answer _____ mph

3 Residents in a hotel could book a table for breakfast, lunch or evening meal.

Of the 80 residents on a given day

12 booked a table for all three meals

46 booked a table for breakfast and evening meal

25 booked a table for breakfast and lunch

x booked a table for lunch and evening meal **only**

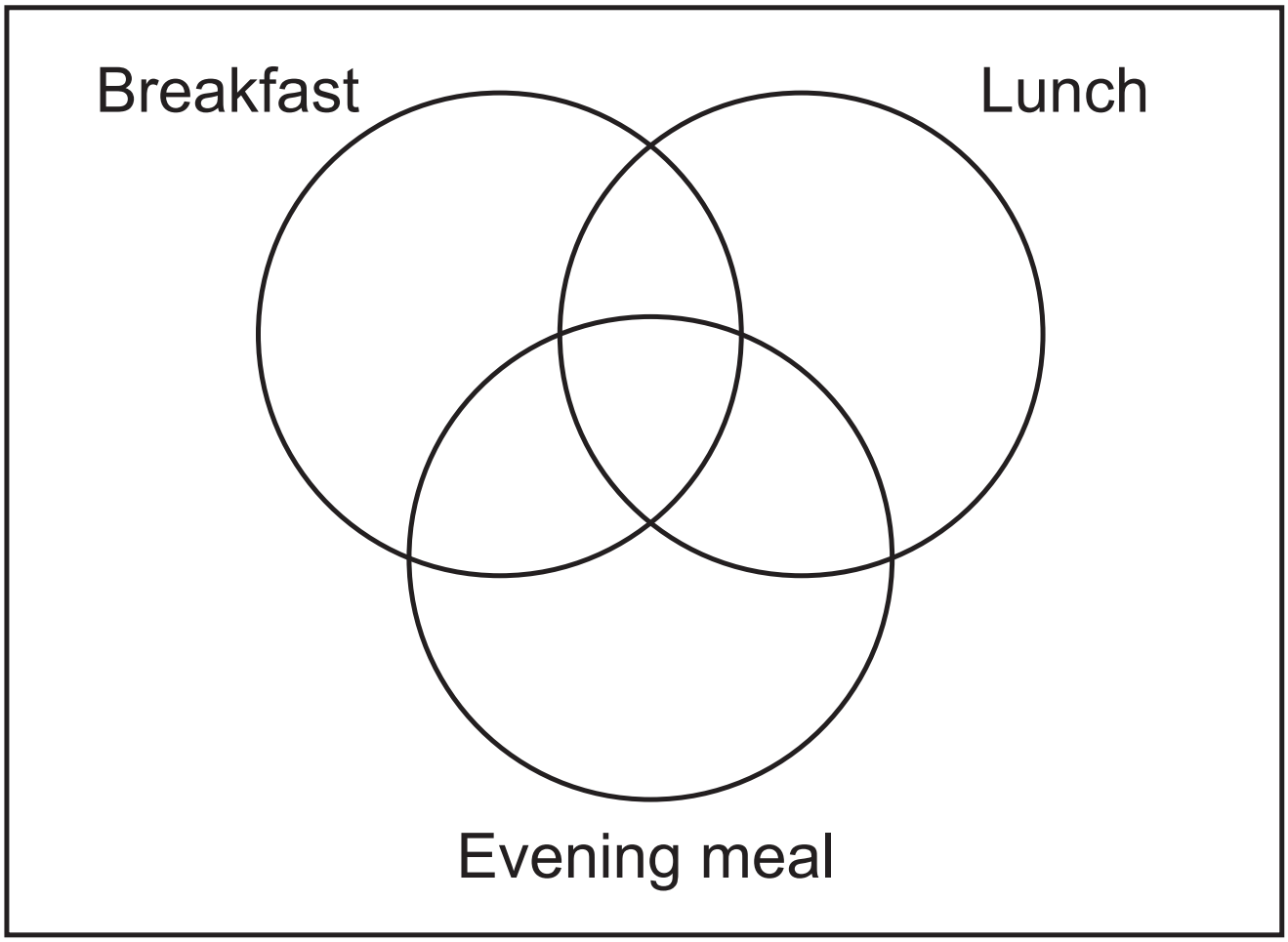
65 booked a table for breakfast

34 booked a table for lunch

57 booked a table for evening meal

2 did not book a table for any meal.

(i) Illustrate this information on the Venn diagram below. [2 marks]



(ii) Hence calculate the value of x.
[2 marks]

Answer _____

(iii) What is the probability that a resident, selected at random, booked a table for **exactly** two meals? [2 marks]

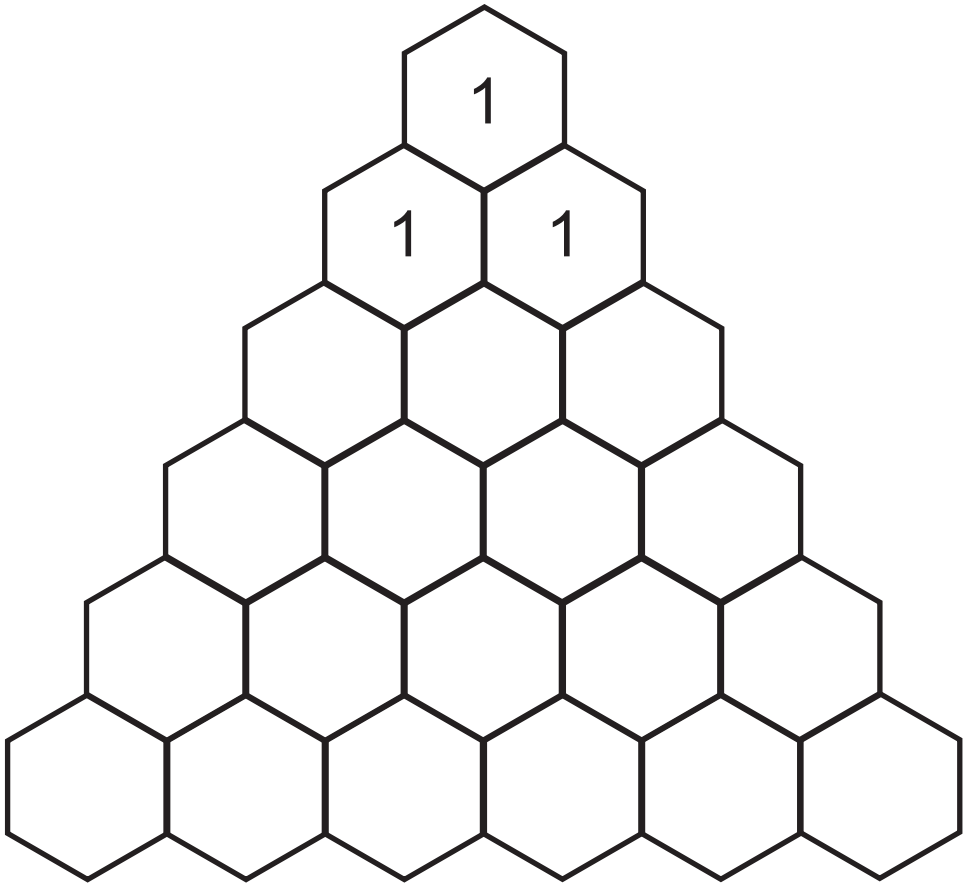
Answer _____

A resident, selected at random, did **not** book a table for breakfast.

(iv) What is the probability that this resident booked a table for lunch? [2 marks]

Answer _____

4 **(i)** Complete Pascal's triangle in the grid below. [1 mark]



(ii) Hence write down the expansion of $(p + q)^5$ [1 mark]

Answer

A biased die is such that the probability of scoring a six with each throw is 0.2

The die is thrown five times and the scores are recorded.

(iii) Find the probability that the score is a six on **exactly** two throws. [3 marks]

Answer _____

(iv) Find the probability that the score is a six on **at least** two throws. [3 marks]

Answer _____

5 The heights of a large number of sunflower plants were measured.

The heights were normally distributed with mean 42 cm and standard deviation 5 cm.

(i) Find the probability that a sunflower, chosen at random, measured less than 50 cm. [3 marks]

Give your answer to 4 decimal places.

Answer _____

(ii) Find the probability that a sunflower, chosen at random, measured less than 36 cm. [4 marks]

Give your answer to 4 decimal places.

Answer _____

(iii) Find the probability that a sunflower, chosen at random, measured less than 36 cm, **given** that it measured less than 50 cm. [2 marks]

Give your answer to 4 decimal places.

Answer _____

Blank Page

(Questions continue overleaf)

6 Jack received the following marks in each section of his last PE exam.

29, 23, 11, 17, 20

(i) Calculate the standard deviation of these marks. [3 marks]

You **must** show your working.

Answer _____

Jack needs to scale his marks so that the mean mark is 45 and the standard deviation is doubled.

He does this by

multiplying each score by a constant m,

and then adding a constant n.

(ii) Calculate the values of m and n.
[3 marks]

Answer $m =$ _____ , $n =$ _____

This is the end of the question paper

For Examiner's use only	
Question Number	**Marks**
1	
2	
3	
4	
5	
6	
Total Marks	