



Rewarding Learning

General Certificate of Secondary Education
2025

Centre Number

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Candidate Number

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Further Mathematics

Unit 3 (With calculator)

Statistics



[GFM31]

GFM31

WEDNESDAY 18 JUNE, AFTERNOON

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.

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

Answer **all seven** 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.

The Formula Sheet is on page 2 and the Normal Probability Table is on page 3.

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FORMULA SHEET

STATISTICS

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

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

where \bar{x} is the mean

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

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

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 $ax^2 + bx + c = 0$ ($a \neq 0$)

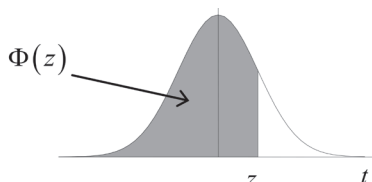
$$\text{then } x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$



NORMAL PROBABILITY TABLE

Table of $\Phi(z)$

Z	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
0.0	0.5000	0.5040	0.5080	0.5120	0.5160	0.5199	0.5239	0.5279	0.5319	0.5359
0.1	0.5398	0.5438	0.5478	0.5517	0.5557	0.5596	0.5636	0.5675	0.5714	0.5753
0.2	0.5793	0.5832	0.5871	0.5910	0.5948	0.5987	0.6026	0.6064	0.6103	0.6141
0.3	0.6179	0.6217	0.6255	0.6293	0.6331	0.6368	0.6406	0.6443	0.6480	0.6517
0.4	0.6554	0.6591	0.6628	0.6664	0.6700	0.6736	0.6772	0.6808	0.6844	0.6879
0.5	0.6915	0.6950	0.6985	0.7019	0.7054	0.7088	0.7123	0.7157	0.7190	0.7224
0.6	0.7257	0.7291	0.7324	0.7357	0.7389	0.7422	0.7454	0.7486	0.7517	0.7549
0.7	0.7580	0.7611	0.7642	0.7673	0.7704	0.7734	0.7764	0.7794	0.7823	0.7852
0.8	0.7881	0.7910	0.7939	0.7967	0.7995	0.8023	0.8051	0.8078	0.8106	0.8133
0.9	0.8159	0.8186	0.8212	0.8238	0.8264	0.8289	0.8315	0.8340	0.8365	0.8389
1.0	0.8413	0.8438	0.8461	0.8485	0.8508	0.8531	0.8554	0.8577	0.8599	0.8621
1.1	0.8643	0.8665	0.8686	0.8708	0.8729	0.8749	0.8770	0.8790	0.8810	0.8830
1.2	0.8849	0.8869	0.8888	0.8907	0.8925	0.8944	0.8962	0.8980	0.8997	0.9015
1.3	0.9032	0.9049	0.9066	0.9082	0.9099	0.9115	0.9131	0.9147	0.9162	0.9177
1.4	0.9192	0.9207	0.9222	0.9236	0.9251	0.9265	0.9279	0.9292	0.9306	0.9319
1.5	0.9332	0.9345	0.9357	0.9370	0.9382	0.9394	0.9406	0.9418	0.9429	0.9441
1.6	0.9452	0.9463	0.9474	0.9484	0.9495	0.9505	0.9515	0.9525	0.9535	0.9545
1.7	0.9554	0.9564	0.9573	0.9582	0.9591	0.9599	0.9608	0.9616	0.9625	0.9633
1.8	0.9641	0.9649	0.9656	0.9664	0.9671	0.9678	0.9686	0.9693	0.9699	0.9706
1.9	0.9713	0.9719	0.9726	0.9732	0.9738	0.9744	0.9750	0.9756	0.9761	0.9767
2.0	0.9772	0.9778	0.9783	0.9788	0.9793	0.9798	0.9803	0.9808	0.9812	0.9817
2.1	0.9821	0.9826	0.9830	0.9834	0.9838	0.9842	0.9846	0.9850	0.9854	0.9857
2.2	0.9861	0.9864	0.9868	0.9871	0.9875	0.9878	0.9881	0.9884	0.9887	0.9890
2.3	0.9893	0.9896	0.9898	0.9901	0.9904	0.9906	0.9909	0.9911	0.9913	0.9916
2.4	0.9918	0.9920	0.9922	0.9925	0.9927	0.9929	0.9931	0.9932	0.9934	0.9936
2.5	0.9938	0.9940	0.9941	0.9943	0.9945	0.9946	0.9948	0.9949	0.9951	0.9952
2.6	0.9953	0.9955	0.9956	0.9957	0.9959	0.9960	0.9961	0.9962	0.9963	0.9964
2.7	0.9965	0.9966	0.9967	0.9968	0.9969	0.9970	0.9971	0.9972	0.9973	0.9974
2.8	0.9974	0.9975	0.9976	0.9977	0.9977	0.9978	0.9979	0.9979	0.9980	0.9981
2.9	0.9981	0.9982	0.9982	0.9983	0.9984	0.9984	0.9985	0.9985	0.9986	0.9986
3.0	0.9987	0.9987	0.9987	0.9988	0.9988	0.9989	0.9989	0.9989	0.9990	0.9990



[Turn over



- 1 The reading speeds (in words per minute) and the intelligence quotients (IQ) of a group of ten children were measured. The results are shown in the table below.

Child	A	B	C	D	E	F	G	H	I	J
Reading speed	120	140	100	170	130	190	220	140	180	240
IQ	80	90	90	100	90	105	110	112	115	120
Ranks (Reading speed)										
Ranks (IQ)										

- (i) Write down, in the table above, the rank orders for the Reading speed and IQ. [2]
- (ii) Calculate Spearman's coefficient of rank correlation.

Answer _____ [4]

- (iii) Interpret your answer to part (ii).

Answer _____ [1]



- 2 For five days, Maurice recorded on his fitness app the times he spent on his daily training runs.

His times are listed in the table below.

Day	Time (minutes)	
Mon	68	
Tues	56	
Wed	70	
Thur	45	
Fri	62	

Calculate the standard deviation of Maurice's times over the five days.

You **must** show your working.

Answer _____ minutes [5]

[Turn over



3 Students in Year 13 were asked what subjects they study for AS level.

Of the 50 students asked

5 study Mathematics, Physics and Biology

11 study both Mathematics and Physics

8 study both Physics and Biology

12 study both Mathematics and Biology

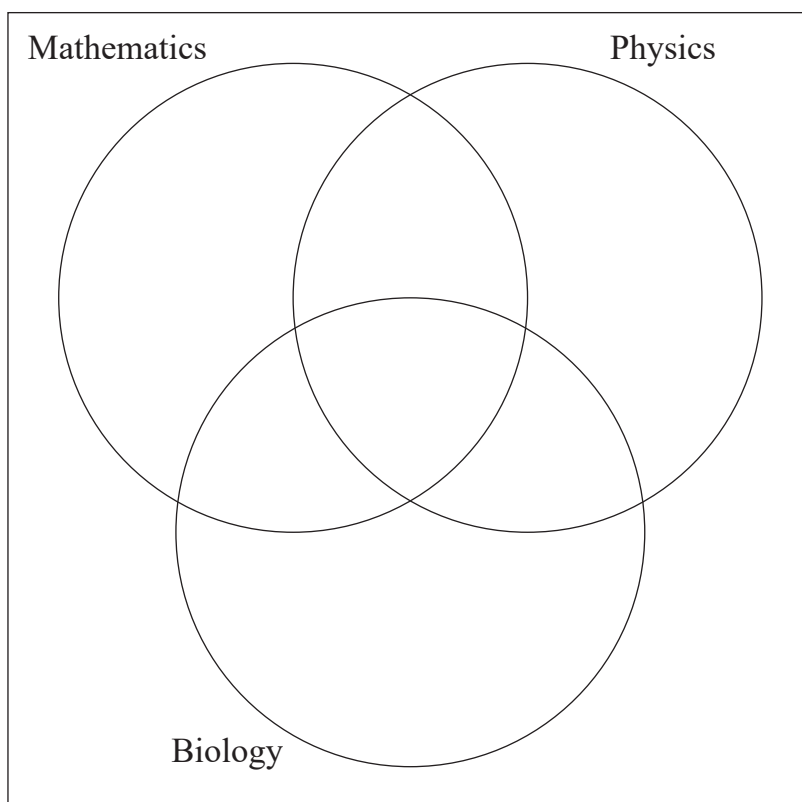
16 study Physics in total

23 study Biology in total

x **only** study Mathematics

9 study none of the three subjects.

(i) Illustrate this information on the Venn diagram below.



[2]



(ii) Calculate the value of x .

Answer _____ [2]

Calculate the probability that

(iii) a student chosen at random **does not** study Mathematics,

Answer _____ [2]

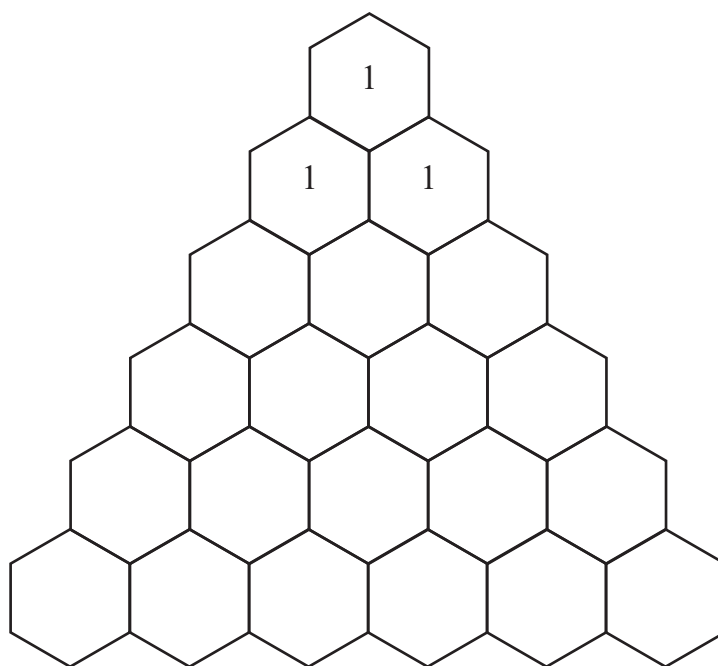
(iv) a student chosen at random studies Physics, given that this student does not study Mathematics.

Answer _____ [2]

[Turn over



4 (i) Complete Pascal's triangle in the grid below.



[1]

(ii) Hence write down the expansion of $(p + q)^5$

Answer _____
_____ [1]



The probability that Clara is absent from school on any day is 0.13

(iii) During a particular school week, what is the probability that Clara is absent on **exactly** two occasions?

Give your answer to 4 decimal places.

Answer _____ [3]

(iv) Calculate the probability that Clara is absent **at least** two times during a particular school week.

Give your answer to 4 decimal places.

Answer _____ [3]

[Turn over



- 5 At a ski jump event in Norway, the mean length of jump for the top fifteen competitors was recorded as 108.4 metres with a standard deviation of 17.2 metres.

One competitor's jump was incorrectly recorded as 113 metres when it was actually 131 metres.

- (i) Calculate the correct mean for these fifteen jumps.

Answer _____ metres [3]



(ii) Calculate the correct standard deviation for these fifteen jumps.

Answer _____ metres [4]



6 The length of time that a mobile phone battery will last before needing to be recharged is normally distributed with a mean of 28 hours and a standard deviation of 5 hours.

(i) Calculate the probability that a battery will last for more than 32 hours.

Give your answer to 4 decimal places.

Answer _____ [4]



(ii) Calculate the probability that a battery will last for more than 21 hours.

Give your answer to 4 decimal places.

Answer _____ [3]

[Turn over

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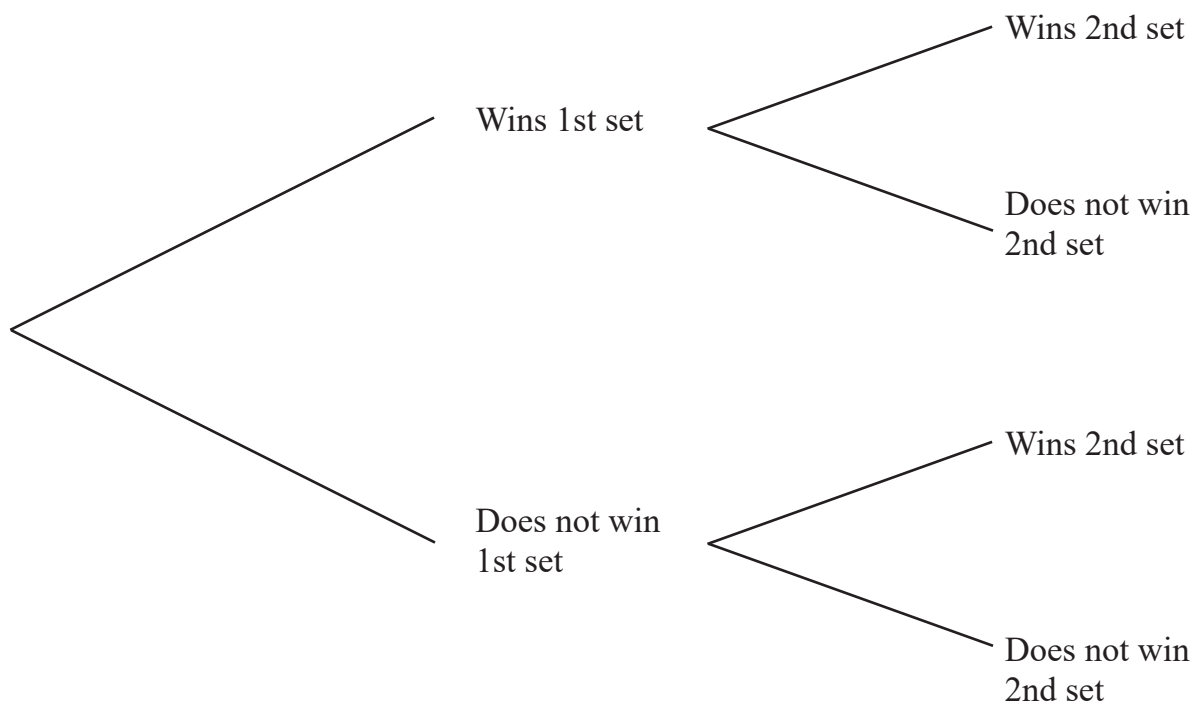
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7 Fred is going to play a tennis match.

- If he wins the first set, the probability that he wins the second set is 0.8
- If he does not win the first set, the probability that he wins the second set is 0.4

On average, Fred wins 70% of his first sets.

(i) Complete the tree diagram below.



[2]



(ii) Calculate the probability that Fred does not win the second set.

Answer _____ [3]

(iii) Given that Fred wins the second set, calculate the probability that he did not win the first set.

Answer _____ [3]

THIS IS THE END OF THE QUESTION PAPER



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Question Number	Marks
1	
2	
3	
4	
5	
6	
7	

Total Marks	
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