



Rewarding Learning

General Certificate of Secondary Education

Centre Number

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Candidate Number

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Further Mathematics

Unit 3 (With calculator)

Statistics



[GFM31]

GFM31

Assessment

Assessment Level of Control:

Tick the relevant box (✓)

TIME

1 hour.

Controlled Conditions	
Other	

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.

Complete in black ink only. **Do not write with a gel pen.**

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

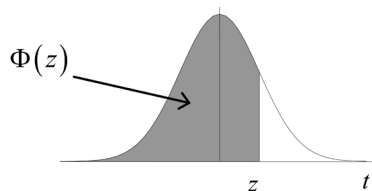
$$\text{then } x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$



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



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1 Three girls and nine boys sat a Physics examination.

The three girls' marks were 92%, 80% and 71%.

The mean of all 12 marks was 84%.

(i) Calculate the mean of the boys' marks.

Answer _____% [2]



The standard deviation of all 12 marks was 5%.

(ii) Calculate the standard deviation of the boys' marks.

Answer _____ % [4]

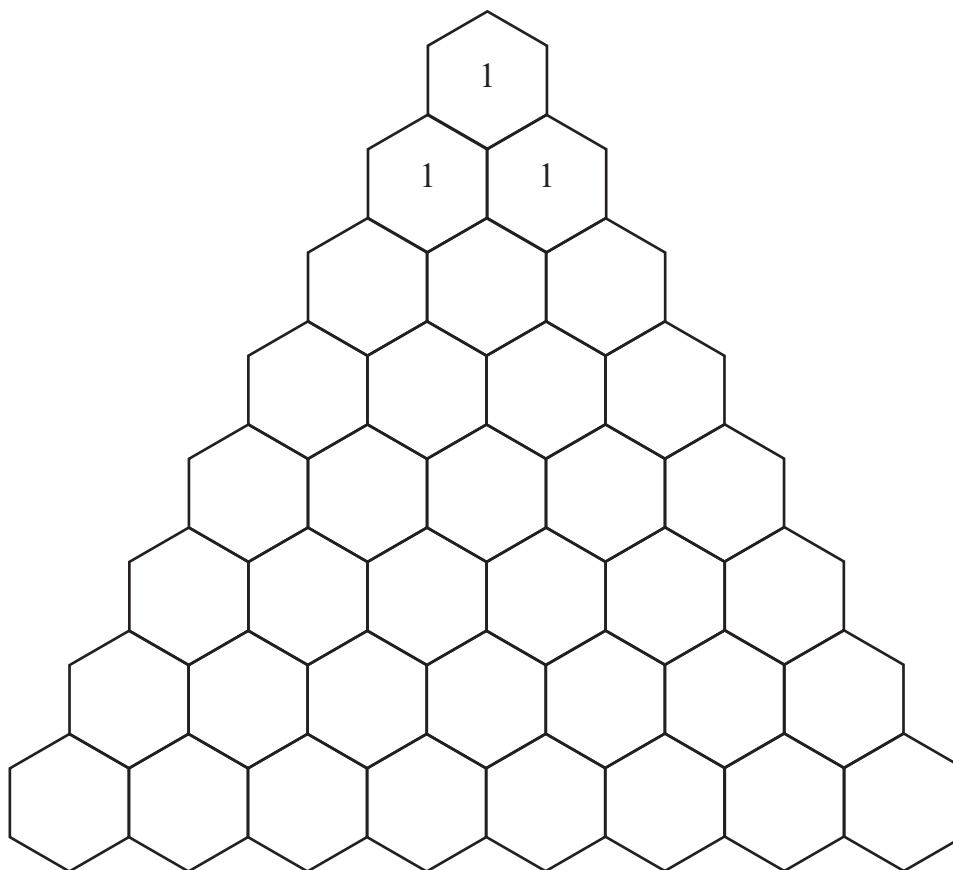
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2 (i) (a) Complete Pascal's triangle in the grid below.



[1]

(b) Hence write down the expansion of $(p + q)^7$

Answer _____

_____ [2]



(ii) A box contains a large number of green balls and white balls.

One tenth of the balls in the box are green.

Joan picks 7 balls, chosen at random, from the box.

Find the probability that

(a) exactly 2 of the balls are green,

Answer _____ [3]

(b) at most 2 of the balls are green.

Answer _____ [3]

[Turn over



3 Alan recorded the ages of a group of bowlers.

The results were normally distributed with mean 65 years and standard deviation 10 years.

All the bowlers aged 75 or over qualify for a free TV licence.

- (i) Find the probability that a bowler, chosen at random, qualifies for a free TV licence.

Answer _____ [4]



The bowlers aged 60 or over qualify for a free travel pass.

- (ii) Find the probability that a bowler, chosen at random, does **not** qualify for a free travel pass.

Answer _____ [4]

[Turn over



- 4 Jane recorded her percentage marks in her Winter and Summer examinations. The results are shown in the table below.

Subject	Maths	English	French	History	Geog	Science	Home Econ	ICT	RE
Winter	80	64	65	74	67	79	66	77	58
Summer	84	72	61	72	63	82	68	82	64
Ranks (Winter)									
Ranks (Summer)									

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

Answer _____ [4]



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

Answer _____ [1]

(iv) Calculate the mean Winter mark and the mean Summer mark.

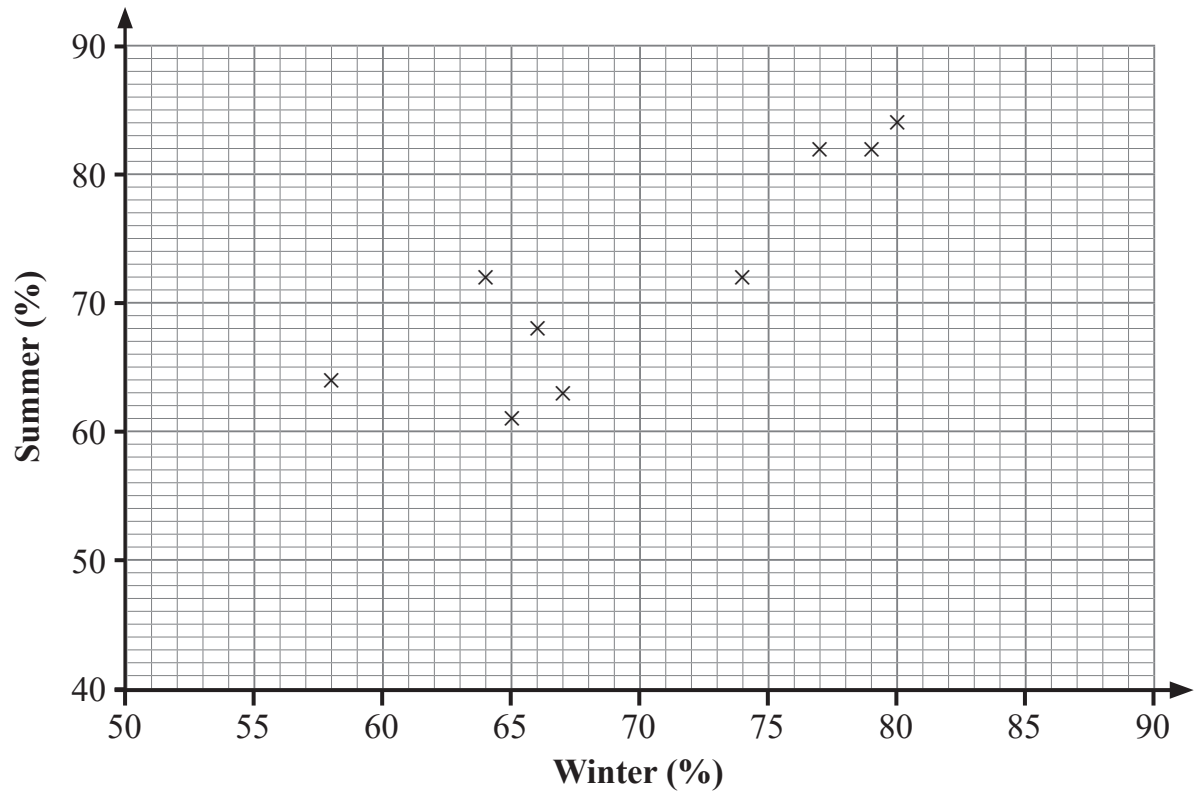
Answer Mean Winter mark _____ %

Mean Summer mark _____ % [1]

[Turn over



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



(v) Draw your line of best fit on the graph.

[2]



(vi) Determine the equation of the line of best fit which you have drawn.

Answer _____ [3]

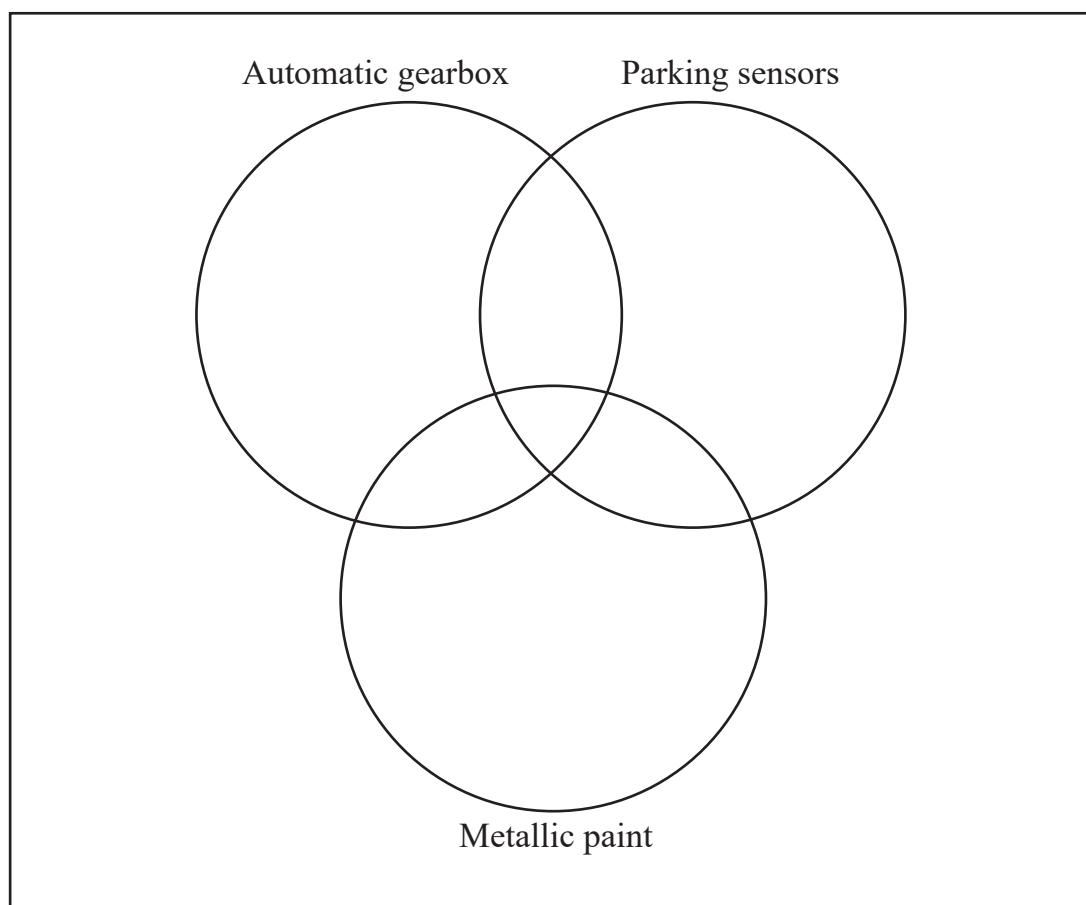


- 5 County Cars offered automatic gearbox, parking sensors and metallic paint as optional extras with their new cars.

Of the first 50 customers,

- 4 chose all three extras
- 6 chose an automatic gearbox and parking sensors
- 5 chose an automatic gearbox and metallic paint
- 19 chose parking sensors and metallic paint
- 10 chose an automatic gearbox
- 28 chose parking sensors
- 32 chose metallic paint.

- (i) Illustrate this information on the Venn Diagram below.



[3]



(ii) Calculate the probability that a customer, selected at random, chose **exactly** two extras.

Answer _____ [2]

A customer, selected at random, did **not** choose metallic paint.

(iii) What is the probability that this customer chose an automatic gearbox?

Answer _____ [3]

[Turn over



6 A box contains 5 black bats and x red bats.

Ben takes 2 bats, without replacement, from the box.

The probability that both bats chosen are red is $\frac{1}{6}$

By forming an equation in x , find how many red bats are in the box.

A solution by trial and improvement will not be accepted.

Answer _____ [6]



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For Examiner's use only	
Question Number	Marks
1	
2	
3	
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6	

Total Marks	
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Examiner Number

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