

Write your name here

Surname

Other names

Pearson
Edexcel Award

Centre Number

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Candidate Number

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Statistical Methods

Level 3

Calculator allowed

Monday 19 January 2015 – Morning

Time: 2 hours

Paper Reference

AST30/01

You must have:

Pen, HB pencil, eraser, calculator, ruler.

Total Marks



Instructions

- Use **black** ink or ball-point pen.
- **Fill in the boxes** at the top of this page with your name, centre number and candidate number.
- Answer **all** questions.
- Answer the questions in the spaces provided – *there may be more space than you need.*
- **Calculators may be used.**
- If your calculator does not have a π button, take the value of π to be 3.142 unless the question instructs otherwise.

Information

- The total mark for this paper is 90
- The marks for **each** question are shown in brackets – *use this as a guide as to how much time to spend on each question.*
- Normal distribution tables can be found on the inside of the front cover of this paper.

Advice

- Read each question carefully before you start to answer it.
- Keep an eye on the time.
- Try to answer every question.
- Check your answers if you have time at the end.

Turn over ►

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PEARSON

THE NORMAL DISTRIBUTION FUNCTION

The function tabulated below is $\Phi(z)$, defined as $\Phi(z) = \frac{1}{\sqrt{2\pi}} \int_{-\infty}^z e^{-\frac{1}{2}t^2} dt$.

z	$\Phi(z)$	z	$\Phi(z)$	z	$\Phi(z)$	z	$\Phi(z)$	z	$\Phi(z)$
0.00	0.5000	0.50	0.6915	1.00	0.8413	1.50	0.9332	2.00	0.9772
0.01	0.5040	0.51	0.6950	1.01	0.8438	1.51	0.9345	2.02	0.9783
0.02	0.5080	0.52	0.6985	1.02	0.8461	1.52	0.9357	2.04	0.9793
0.03	0.5120	0.53	0.7019	1.03	0.8485	1.53	0.9370	2.06	0.9803
0.04	0.5160	0.54	0.7054	1.04	0.8508	1.54	0.9382	2.08	0.9812
0.05	0.5199	0.55	0.7088	1.05	0.8531	1.55	0.9394	2.10	0.9821
0.06	0.5239	0.56	0.7123	1.06	0.8554	1.56	0.9406	2.12	0.9830
0.07	0.5279	0.57	0.7157	1.07	0.8577	1.57	0.9418	2.14	0.9838
0.08	0.5319	0.58	0.7190	1.08	0.8599	1.58	0.9429	2.16	0.9846
0.09	0.5359	0.59	0.7224	1.09	0.8621	1.59	0.9441	2.18	0.9854
0.10	0.5398	0.60	0.7257	1.10	0.8643	1.60	0.9452	2.20	0.9861
0.11	0.5438	0.61	0.7291	1.11	0.8665	1.61	0.9463	2.22	0.9868
0.12	0.5478	0.62	0.7324	1.12	0.8686	1.62	0.9474	2.24	0.9875
0.13	0.5517	0.63	0.7357	1.13	0.8708	1.63	0.9484	2.26	0.9881
0.14	0.5557	0.64	0.7389	1.14	0.8729	1.64	0.9495	2.28	0.9887
0.15	0.5596	0.65	0.7422	1.15	0.8749	1.65	0.9505	2.30	0.9893
0.16	0.5636	0.66	0.7454	1.16	0.8770	1.66	0.9515	2.32	0.9898
0.17	0.5675	0.67	0.7486	1.17	0.8790	1.67	0.9525	2.34	0.9904
0.18	0.5714	0.68	0.7517	1.18	0.8810	1.68	0.9535	2.36	0.9909
0.19	0.5753	0.69	0.7549	1.19	0.8830	1.69	0.9545	2.38	0.9913
0.20	0.5793	0.70	0.7580	1.20	0.8849	1.70	0.9554	2.40	0.9918
0.21	0.5832	0.71	0.7611	1.21	0.8869	1.71	0.9564	2.42	0.9922
0.22	0.5871	0.72	0.7642	1.22	0.8888	1.72	0.9573	2.44	0.9927
0.23	0.5910	0.73	0.7673	1.23	0.8907	1.73	0.9582	2.46	0.9931
0.24	0.5948	0.74	0.7704	1.24	0.8925	1.74	0.9591	2.48	0.9934
0.25	0.5987	0.75	0.7734	1.25	0.8944	1.75	0.9599	2.50	0.9938
0.26	0.6026	0.76	0.7764	1.26	0.8962	1.76	0.9608	2.55	0.9946
0.27	0.6064	0.77	0.7794	1.27	0.8980	1.77	0.9616	2.60	0.9953
0.28	0.6103	0.78	0.7823	1.28	0.8997	1.78	0.9625	2.65	0.9960
0.29	0.6141	0.79	0.7852	1.29	0.9015	1.79	0.9633	2.70	0.9965
0.30	0.6179	0.80	0.7881	1.30	0.9032	1.80	0.9641	2.75	0.9970
0.31	0.6217	0.81	0.7910	1.31	0.9049	1.81	0.9649	2.80	0.9974
0.32	0.6255	0.82	0.7939	1.32	0.9066	1.82	0.9656	2.85	0.9978
0.33	0.6293	0.83	0.7967	1.33	0.9082	1.83	0.9664	2.90	0.9981
0.34	0.6331	0.84	0.7995	1.34	0.9099	1.84	0.9671	2.95	0.9984
0.35	0.6368	0.85	0.8023	1.35	0.9115	1.85	0.9678	3.00	0.9987
0.36	0.6406	0.86	0.8051	1.36	0.9131	1.86	0.9686	3.05	0.9989
0.37	0.6443	0.87	0.8078	1.37	0.9147	1.87	0.9693	3.10	0.9990
0.38	0.6480	0.88	0.8106	1.38	0.9162	1.88	0.9699	3.15	0.9992
0.39	0.6517	0.89	0.8133	1.39	0.9177	1.89	0.9706	3.20	0.9993
0.40	0.6554	0.90	0.8159	1.40	0.9192	1.90	0.9713	3.25	0.9994
0.41	0.6591	0.91	0.8186	1.41	0.9207	1.91	0.9719	3.30	0.9995
0.42	0.6628	0.92	0.8212	1.42	0.9222	1.92	0.9726	3.35	0.9996
0.43	0.6664	0.93	0.8238	1.43	0.9236	1.93	0.9732	3.40	0.9997
0.44	0.6700	0.94	0.8264	1.44	0.9251	1.94	0.9738	3.50	0.9998
0.45	0.6736	0.95	0.8289	1.45	0.9265	1.95	0.9744	3.60	0.9998
0.46	0.6772	0.96	0.8315	1.46	0.9279	1.96	0.9750	3.70	0.9999
0.47	0.6808	0.97	0.8340	1.47	0.9292	1.97	0.9756	3.80	0.9999
0.48	0.6844	0.98	0.8365	1.48	0.9306	1.98	0.9761	3.90	1.0000
0.49	0.6879	0.99	0.8389	1.49	0.9319	1.99	0.9767	4.00	1.0000
0.50	0.6915	1.00	0.8413	1.50	0.9332	2.00	0.9772		



Answer ALL questions.

Write your answers in the spaces provided.

You must write down all stages in your working.

- 1 The two-way table gives some information about 180 people.

	Age (in years)				Total
	under 10	10–30	31–50	over 50	
can swim	27	30	24	15	96
cannot swim	15	16	20	33	84
Total	42	46	44	48	180

Blake is going to do a survey of these people.

- (a) Write down a suitable sampling frame he could use.

.....
(1)

Blake is going to pick at random one of these people.

- (b) Find the probability that this person will be under 31 years of age and **cannot** swim.

.....
(2)

Blake is going to take a sample of 25 of these people stratified by age and by whether they can swim or cannot swim.

- (c) Work out the number of people aged over 50 who **can** swim that are in his sample.

.....
(2)

(Total for Question 1 is 5 marks)



2 Terri recorded the numbers of lessons needed by some people to pass their driving tests.

Here are her results.

Males

19 25 23 18 37 18 30 27
16 27 22 35 19 18 25

Females

17 21 34 19 25 27 30 15
20 36 18 42 21 28 19

(a) The number of lessons needed to pass a driving test is an example of which type of data?

..... data
(1)

(b) Draw an ordered back-to-back stem and leaf diagram to represent Terri's results.

Males		Females
	1	
	2	
	3	
	4	

(3)



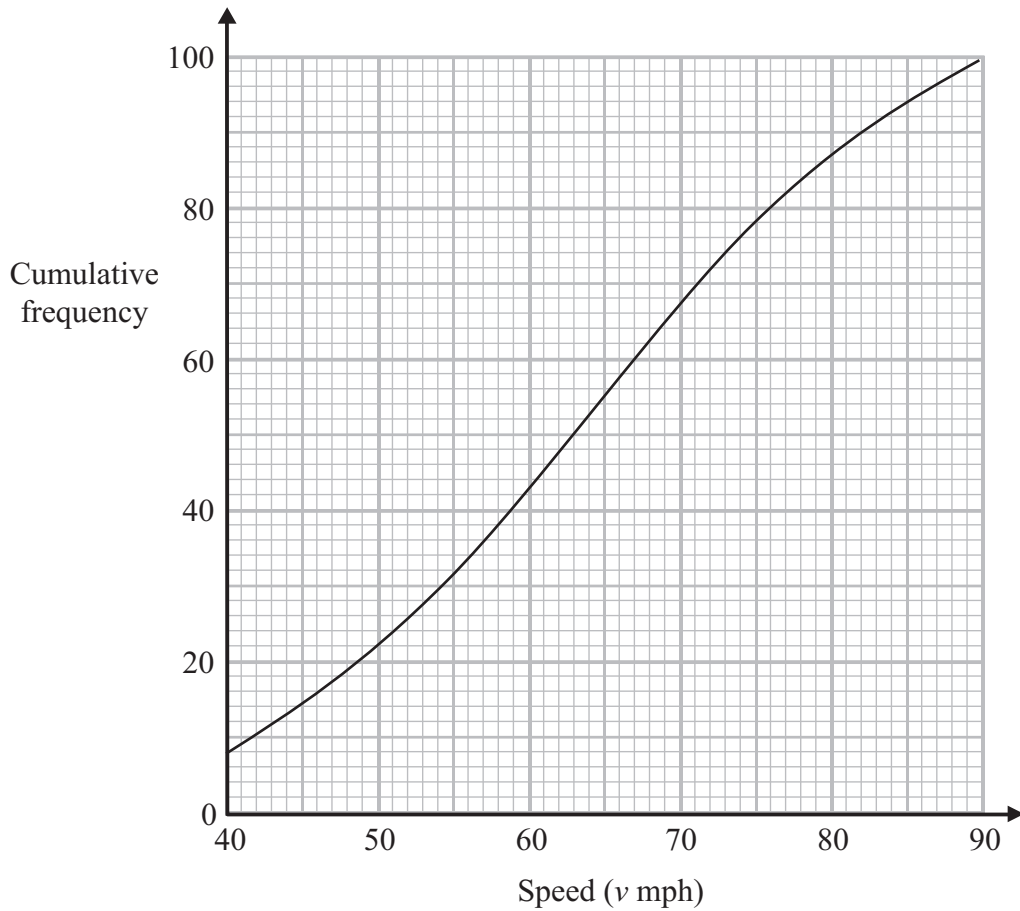
(c) Compare the interquartile range of the numbers of lessons needed by males with the interquartile range of the numbers of lessons needed by females.

(2)

(Total for Question 2 is 6 marks)

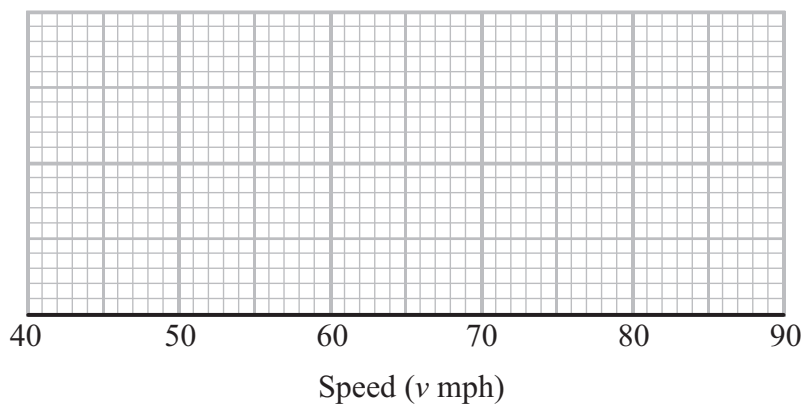


- 3 The cumulative frequency graph gives information about the recorded speeds of 100 cars travelling along a road.



The least recorded speed was 40 mph.
The greatest recorded speed was 87 mph.

On the grid, draw a box plot for the speeds of these cars.

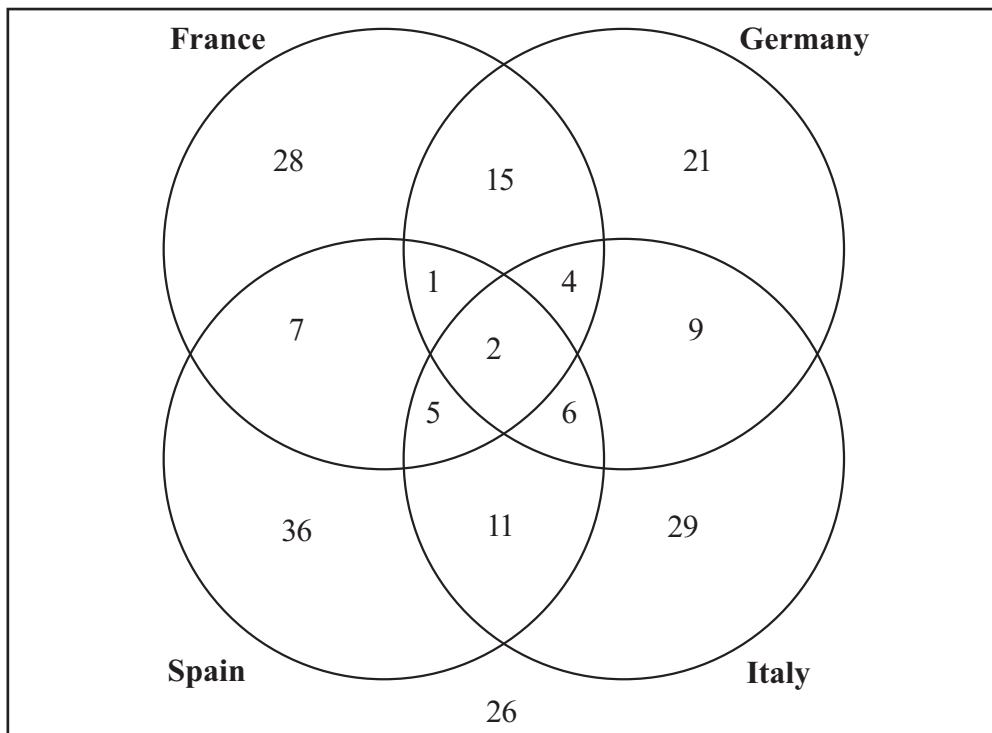


(Total for Question 3 is 3 marks)



- 4 James asked 200 people which of the countries France, Germany, Spain and Italy they had visited.

The Venn diagram gives information about his results.



- (a) Write down the number of people who had visited all four of these countries.

.....
(1)

- (b) Work out the number of people who had visited only **two** of these countries.

.....
(2)

One of the people James asked is picked at random.

- (c) Given that this person had visited Italy, work out the probability that this person had also visited Spain.

.....
(2)

(Total for Question 4 is 5 marks)

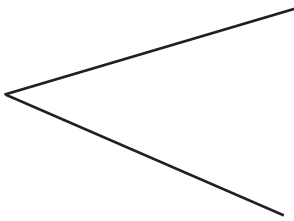


- 5 Felipe is going to roll a red 6-sided dice and a blue 6-sided dice.
Both dice are biased.

The probability that the red dice will land on 6 is 0.25

The probability that the blue dice will land on 6 is 0.3

- (a) Complete the probability tree diagram for this information.
The probability tree diagram has been started for you.



(3)

Felipe rolls the red dice and the blue dice.

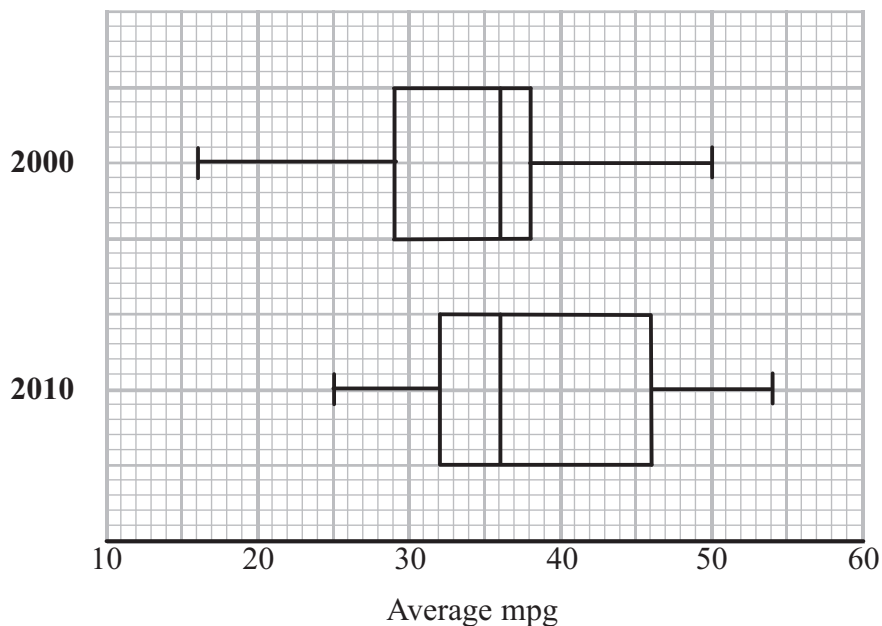
- (b) Work out the probability that he will get exactly one 6

.....
(3)

(Total for Question 5 is 6 marks)



6 The box plots show information about the average number of miles per gallon (mpg) achieved by a sample of cars in 2000 and in 2010.



Compare the distribution for 2000 with the distribution for 2010.
Write down three comparisons.

- 1
-
- 2
-
- 3
-

(Total for Question 6 is 3 marks)



- 7 The table gives information about the times spent, in minutes, by 50 people listening to the radio last Thursday.

Time spent (x minutes)	Frequency
$0 < x \leq 30$	12
$30 < x \leq 40$	25
$40 < x \leq 60$	8
$60 < x \leq 100$	5

- (a) Calculate an estimate for the mean time.

You may use $\sum fx = 1855$

..... minutes

(2)

- (b) Calculate an estimate for the standard deviation of the distribution.

Give your answer correct to 1 decimal place.

..... minutes

(3)

(Total for Question 7 is 5 marks)



- 8 The table gives information about the cost of stationery for a company each year from 2012 to 2014.

Year	2011	2012	2013	2014
Chain base index number		104.1	105.2	103.9

The cost of stationery in 2011 was £670

- (a) Work out the cost of stationery

(i) in 2012,

£.....

(ii) in 2013.

£.....

(3)

- (b) (i) Calculate the geometric mean of the chain base index numbers for 2012, 2013 and 2014.
Give your answer correct to 1 decimal place.

.....

(ii) Write down the average percentage increase each year in the cost of stationery for this period.

.....%

(3)

(Total for Question 8 is 6 marks)



9 Hoeg wants to find out information about the body temperature of people.

He will take a sample of people and not a census.

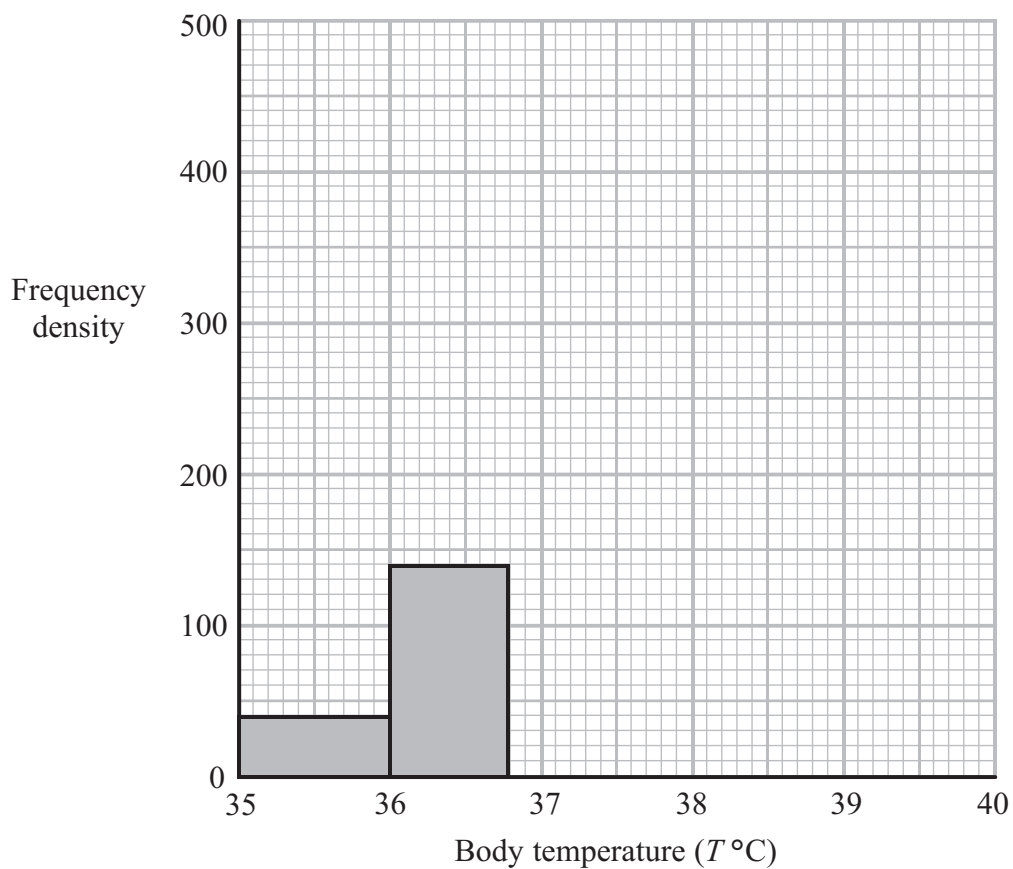
(a) Explain why.

(1)

The table gives information about the body temperatures of some adults.

Body temperature (T °C)	Frequency
$35 < T \leq 36$	40
$36 < T \leq 36.8$	112
$36.8 < T \leq 37.3$	140
$37.3 < T \leq 38.2$	351
$38.2 < T \leq 39.5$	156

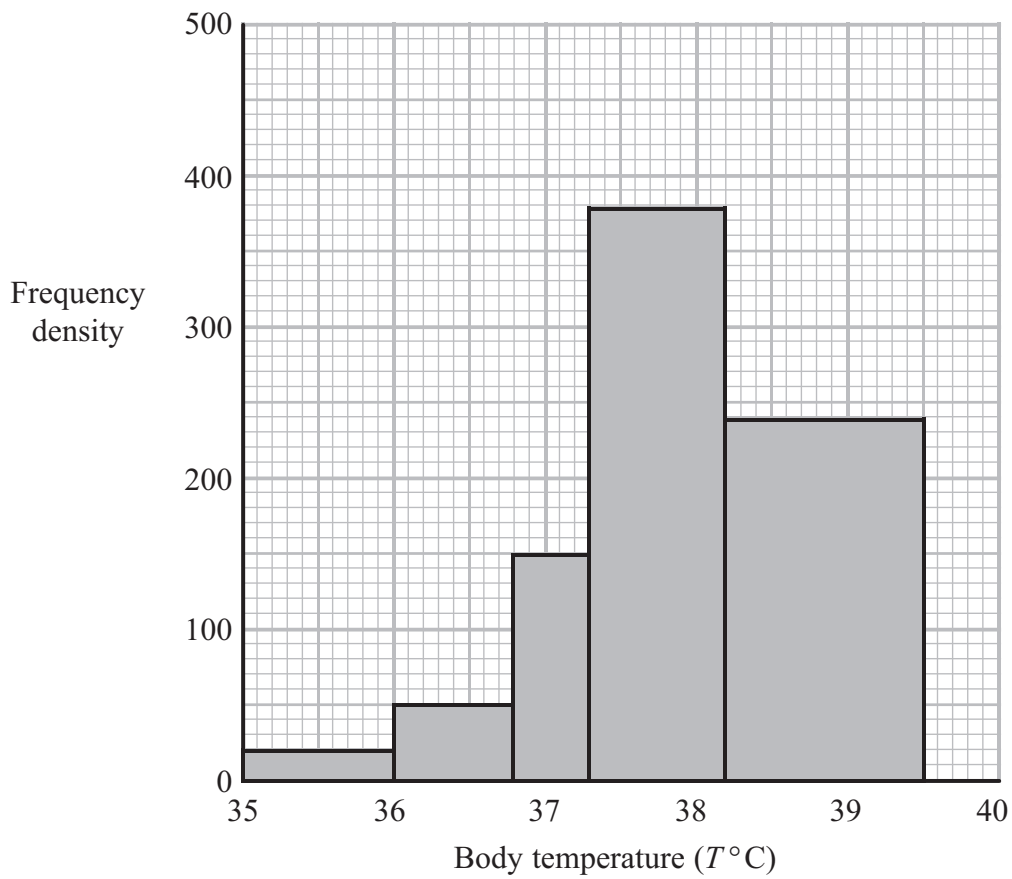
(b) Complete the histogram for this information.



(3)



The histogram below gives information about the body temperatures of some children.



- (c) Compare the total number of adults with a body temperature of at most 36.8°C with the total number of children with a body temperature of at most 36.8°C . You must show your working.

.....

.....

.....

(2)

(Total for Question 9 is 6 marks)



10 Jim wants to find out information about the lengths of films.

He is going to collect secondary data.

(a) Write down one advantage of collecting secondary data.

(1)

The table gives information about the lengths, in minutes, of some films.

	Length (in minutes)
Shortest film	75
Lower quartile	83
Median	107
Upper quartile	119
Longest film	178

(b) Show that 178 is an outlier for this distribution.

(3)

(Total for Question 10 is 4 marks)



11 The weights of the fish in a lake are normally distributed with mean 480 g and standard deviation 50 g.

Mary caught a fish from the lake.
The weight of the fish was 450 g.

(a) Calculate the standardised weight of Mary's fish.

.....g
(2)

Julie and Pam each caught a fish from the lake.

The standardised weight of Julie's fish is -1.5
The standardised weight of Pam's fish is 0.65

(b) Compare the weights of these two fish.

.....
.....
(1)

(Total for Question 11 is 3 marks)



12 Carlos has a large number of coins in a box.
All the coins are 5p coins.

He wants to find an estimate for the total amount of money in the box.

Carlos takes a sample of 45 coins from the box and marks each one with paint.
He then returns the coins to the box.

Carlos shakes the box.

He now takes a sample of 20 coins from the box.
3 of these coins are marked with paint.

(a) Work out an estimate for the total amount of money in the box.

.....
(3)

This is unlikely to be a good estimate for the total amount of money in the box.

(b) Explain why.

.....
.....
.....
(1)

(Total for Question 12 is 4 marks)



13 A and B are mutually exclusive events.

$$P(A) = 0.2$$

$$P(B) = 0.7$$

(a) Work out $P(A \text{ or } B)$

.....
(1)

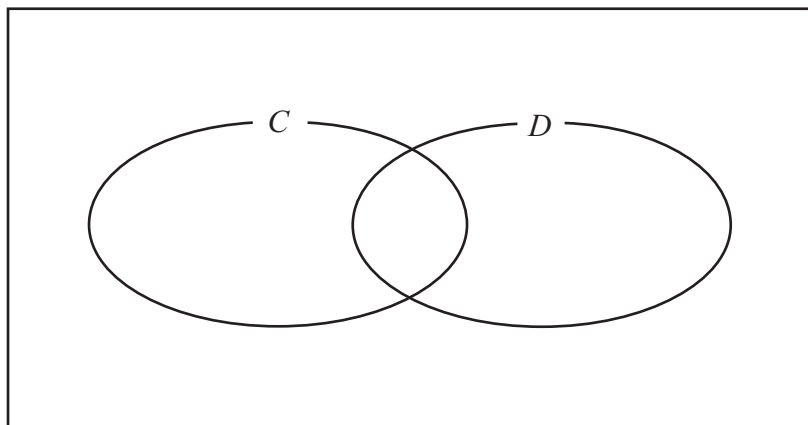
C and D are two events.

$$P(C) = 0.3$$

$$P(D) = 0.5$$

$$P(C \cap D) = 0.1$$

(b) (i) Complete the Venn diagram for this information.



(3)

The events C and D are **not** independent.

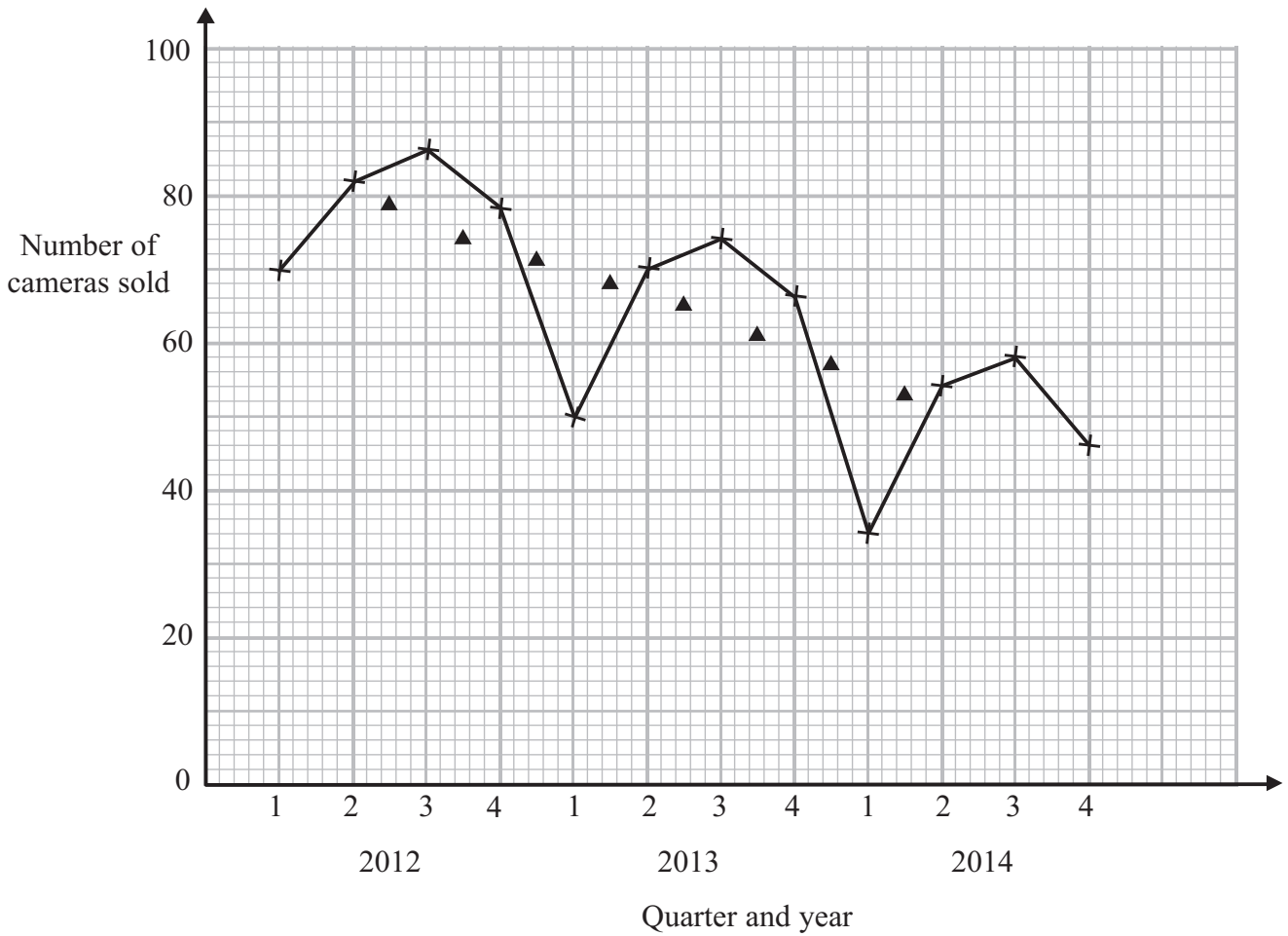
(ii) Explain why.

.....
.....
(1)

(Total for Question 13 is 5 marks)



14 The time-series graph shows information about the number of cameras sold by a shop each quarter from 2012 to 2014.



Key: ▲ 4-point moving average

The graph also shows the first eight 4-point moving averages for this information.

(a) Work out the last 4-point moving average for this information and plot it on the grid.

(3)



(b) Describe the trend shown by the moving averages.

.....
(1)

(c) (i) Find an estimate for the mean seasonal variation for quarter 1

.....
(ii) Work out an estimate for the number of cameras sold in quarter 1 of 2015.

.....
(4)

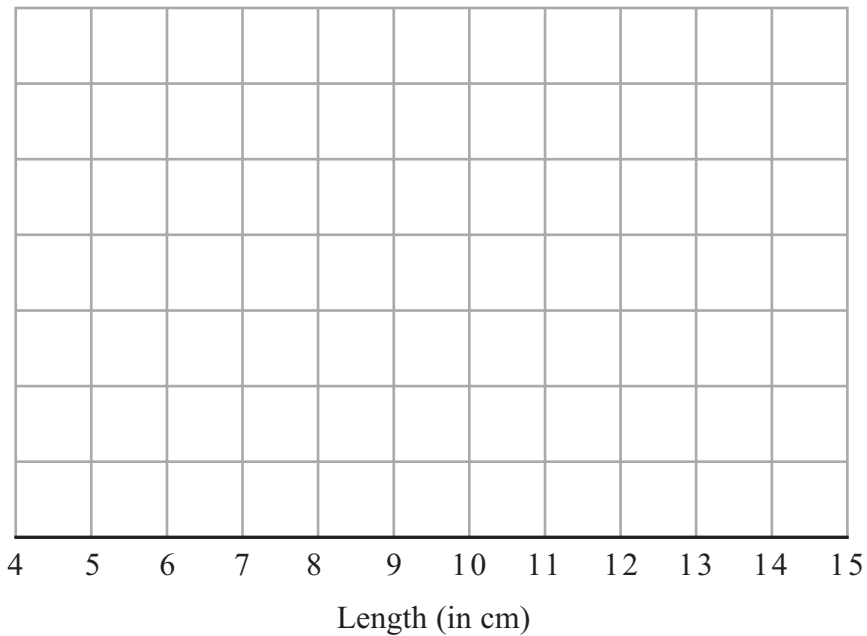
(Total for Question 14 is 8 marks)



15 The lengths of leaves on a tree were measured.

The lengths are found to be normally distributed with mean 9 cm and standard deviation 1 cm.

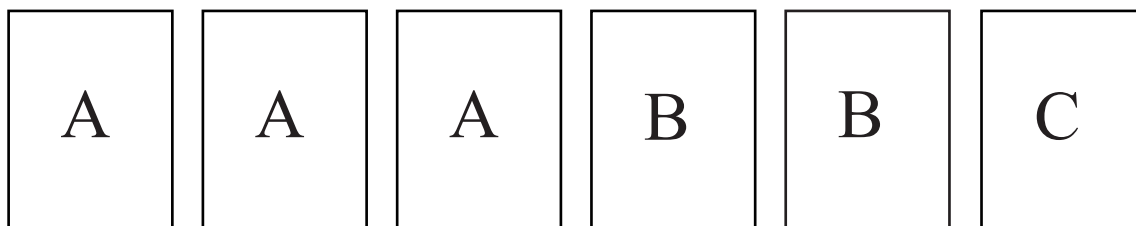
On the grid, draw a sketch of the distribution.



(Total for Question 15 is 2 marks)



16 The diagram shows 6 cards.



Each card is printed with an A or a B or a C.

Myra is going to take at random two of these cards.

Work out the probability that the letters on the cards will **not** be the same.

.....
(Total for Question 16 is 4 marks)



17 The variables x and y are thought to be related.

In an experiment, Karen recorded the value of y for each of eight values of x .

Her results are given in this table.

x	y	
0.5	2.5	
1.0	3.6	
1.5	1.8	
2.0	5.3	
2.5	4.2	
3.0	4.8	
3.5	5.3	
4.0	2.1	

(a) Show that $S_{yy} = 14.2$

You must show your working.

You may use $S_{yy} = \sum y^2 - \frac{(\sum y)^2}{n}$

(2)



It is given that $S_{xx} = 10.5$ and $S_{xy} = 3.4$

- (b) (i) Calculate the product-moment correlation coefficient for the data.
Give your answer correct to 3 decimal places.

Karen says

“There is a linear correlation between x and y .”

Karen may be **wrong**.

- (ii) Explain why.

(3)

(Total for Question 17 is 5 marks)



18 Jamie is going to test 10 computers.

The probability that any one of these computers will fail the test is $\frac{1}{40}$

- (a) Work out the probability that none of these computers will fail the test.
Give your answer correct to 3 decimal places.

.....
(2)

- (b) Work out the probability that exactly two of these computers will fail the test.
Give your answer correct to 3 decimal places.

.....
(2)

(Total for Question 18 is 4 marks)



19 A machine delivers coffee in cups.

The amount of coffee delivered by the machine in each cup is normally distributed with mean 225 ml and standard deviation 20 ml.

Kalim is going to get a cup of coffee from the machine.

- (a) Find the probability that the amount of coffee delivered by the machine is less than 200 ml.

.....
(3)

On Monday, the machine delivered 400 cups of coffee.

- (b) Work out an estimate for the number of times the machine delivered less than 235 ml.

.....
(3)

(Total for Question 19 is 6 marks)

TOTAL FOR PAPER IS 90 MARKS



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