

Write your name here

Surname

Other names

Centre Number

Candidate Number

Edexcel Award

Statistical Methods

Level 3

Calculator allowed

Wednesday 15 May 2013 – 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 ►

P43621A

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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. Victoria plays darts.

Last year Victoria won 27 of the 39 games of darts she played.

This year Victoria is going to play 50 games of darts.

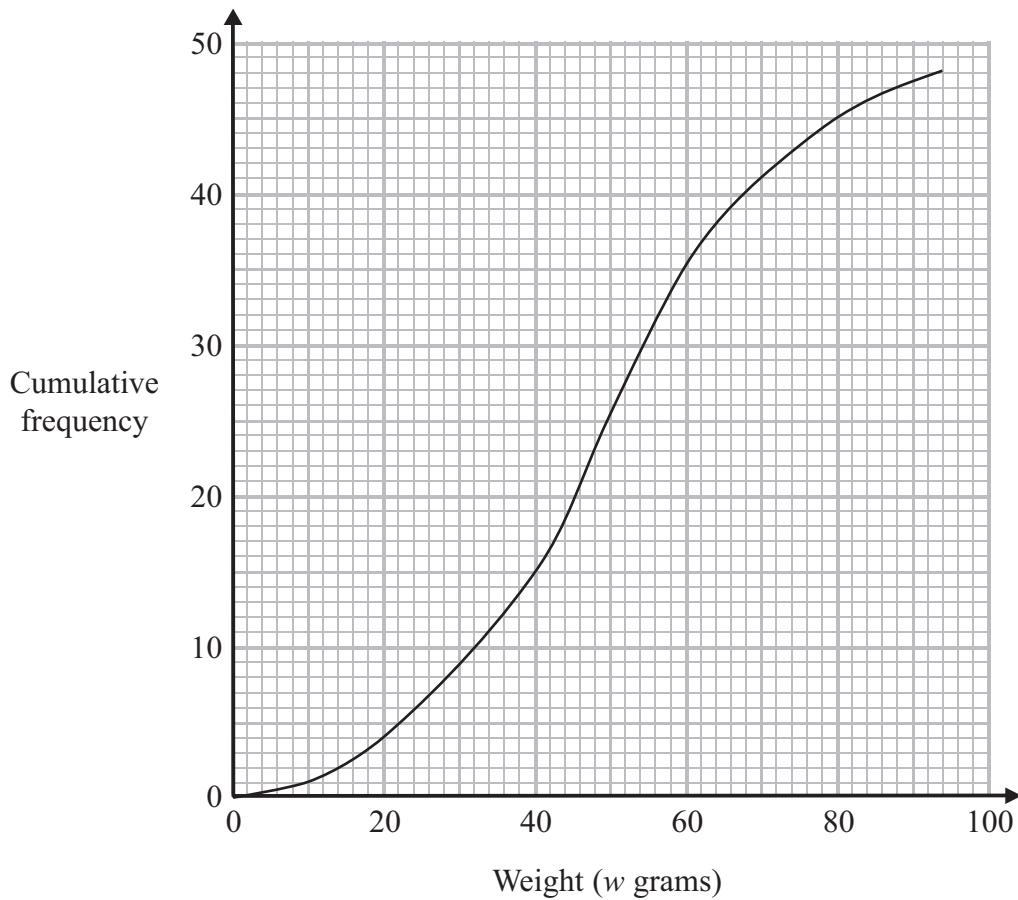
Work out an estimate for the number of games of darts she will win.

.....
(Total for Question 1 is 2 marks)



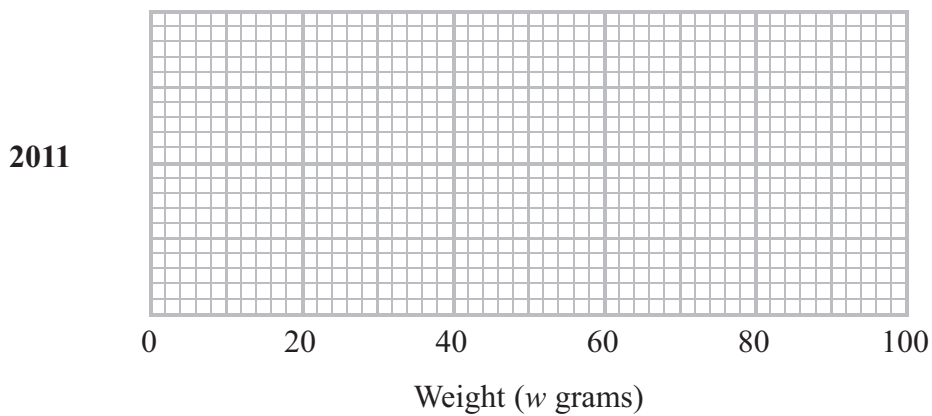
2. Bob grows tomatoes.

The cumulative frequency diagram gives information about the weights of the tomatoes he grew in 2011



The lightest tomato had a weight of 10 grams.
The heaviest tomato had a weight of 94 grams.

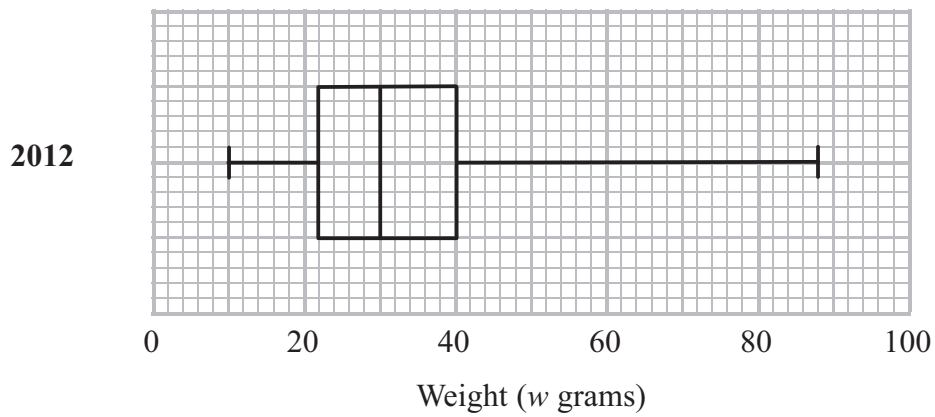
(a) On the grid below, draw a box plot for the weights of these tomatoes.



(3)



The box plot below gives information about the weights of the tomatoes he grew in 2012



(b) Compare the distribution of the weights of the tomatoes in 2011 with the distribution of the weights of the tomatoes in 2012

.....

.....

.....

.....

.....

(3)

In 2012, the weight of the heaviest tomato was 88 grams.
This value is an outlier.

(c) Show that 88 is an outlier for this distribution.

(3)

(Total for Question 2 is 9 marks)



3. Jasmine drives to work.

There are two sets of traffic lights on her journey.

The probability that Jasmine will have to stop at the first set of traffic lights is 0.4

The probability that Jasmine will have to stop at the second set of traffic lights is 0.35

(a) Draw a probability tree diagram for this information.

(3)

Jasmine is going to drive to work.

(b) Work out the probability that she will have to stop at only one set of these traffic lights.

.....
(3)

(Total for Question 3 is 6 marks)



4. Charles asked 100 people which of the films Ghost, Titanic and Shrek they have watched.

Here is some information about his results.

55 had watched Ghost.

58 had watched Titanic.

60 had watched Shrek.

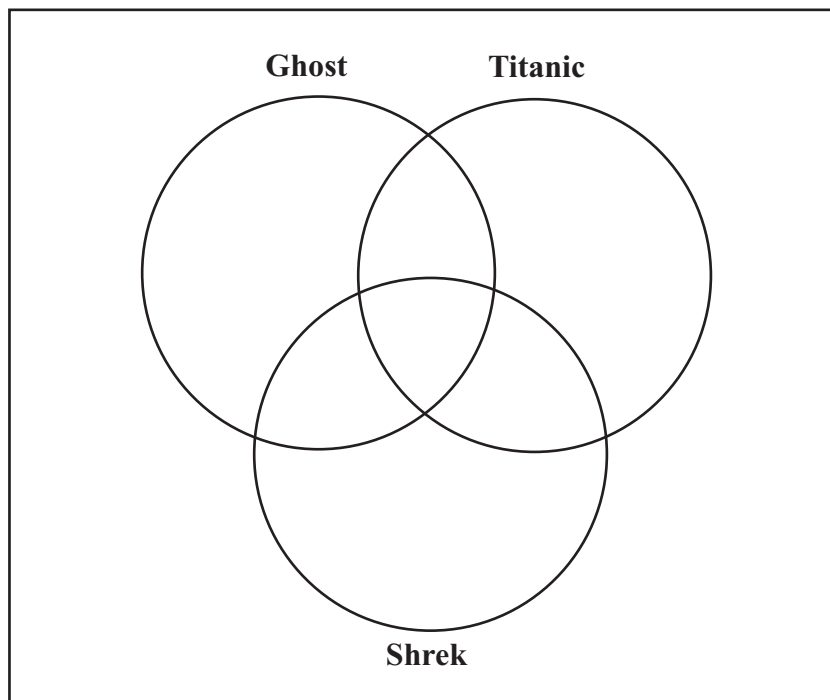
36 had watched Ghost and Shrek.

35 had watched Ghost and Titanic.

37 had watched Titanic and Shrek.

20 had watched all three films.

(a) Complete the Venn diagram for this information.



(4)

Charles is going to pick at random one of these 100 people.

Given that the person had watched Titanic,

(b) work out the probability that the person had also watched Ghost.

.....
(2)

(Total for Question 4 is 6 marks)



5. Ted throws the javelin.

The table gives information about the distances he threw the javelin last year.

| Distance (d metres) | Frequency |
|------------------------|-----------|
| $0 < d \leq 40$ | 25 |
| $40 < d \leq 60$ | 36 |
| $60 < d \leq 80$ | 14 |
| $80 < d \leq 90$ | 5 |

(a) Calculate an estimate for the mean distance.

.....metres
(3)

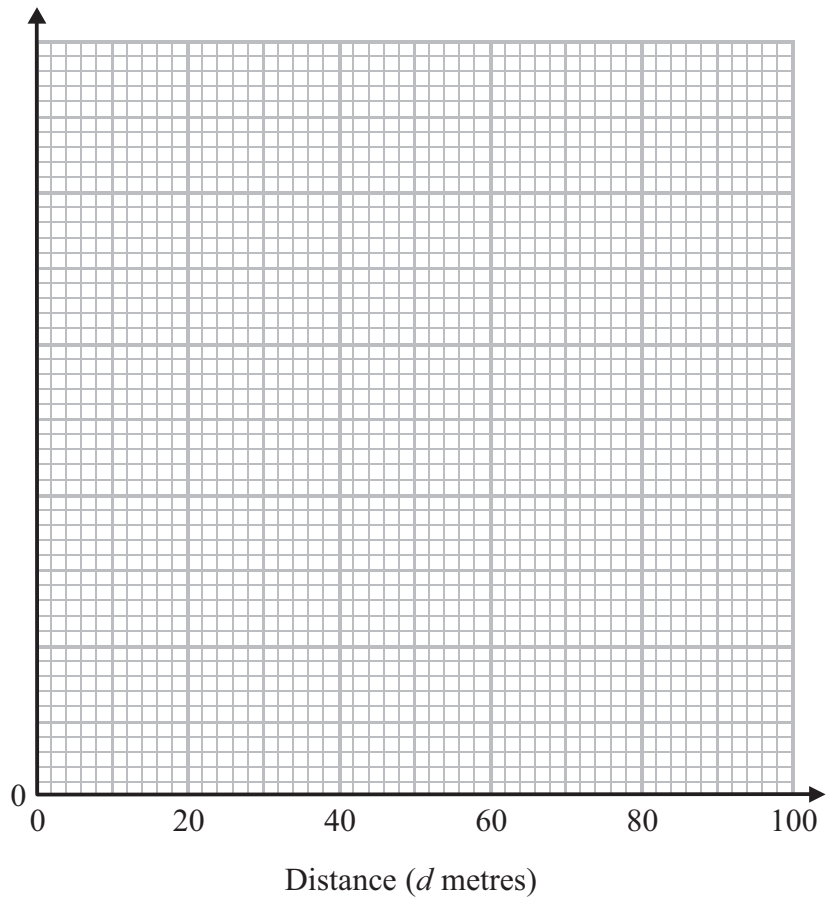
(b) Calculate an estimate for the standard deviation of the distribution.
Give your answer correct to 1 decimal place.

You may use $\sum fd^2 = 204\,725$

.....metres
(2)



(c) Draw a histogram to represent the information in the table.



(4)

(Total for Question 5 is 9 marks)



6. The table gives information about the selling price and the mileages of 8 used cars.

| Selling price (to the nearest £500) | Mileage (to the nearest 1000 miles) | | |
|--|--|--|--|
| 11 000 | 78 000 | | |
| 8500 | 65 000 | | |
| 9500 | 39 000 | | |
| 7000 | 34 000 | | |
| 12 500 | 23 000 | | |
| 5000 | 105 000 | | |
| 9000 | 48 000 | | |
| 14 000 | 20 000 | | |

(a) Calculate Spearman's coefficient of rank correlation for this information.

.....
(4)

(b) (i) Interpret the correlation between the selling price and the mileage of these used cars.

.....
(ii) Comment on the strength of the correlation.
.....
.....

.....
(2)

(Total for Question 6 is 6 marks)



7. Bhavna has a bag containing a large number of beads.
She wants to find an estimate for the number of beads in the bag.

Bhavna takes a sample of 30 beads from the bag.
She marks each bead with a black cross.
She then puts the beads back in the bag.

Bhavna shakes the bag.
She now takes another sample of 30 beads from the bag.

4 of these beads have been marked with a black cross.

- (a) Work out an estimate for the total number of beads in the bag.

.....beads
(2)

- (b) Write down any assumptions you have made.

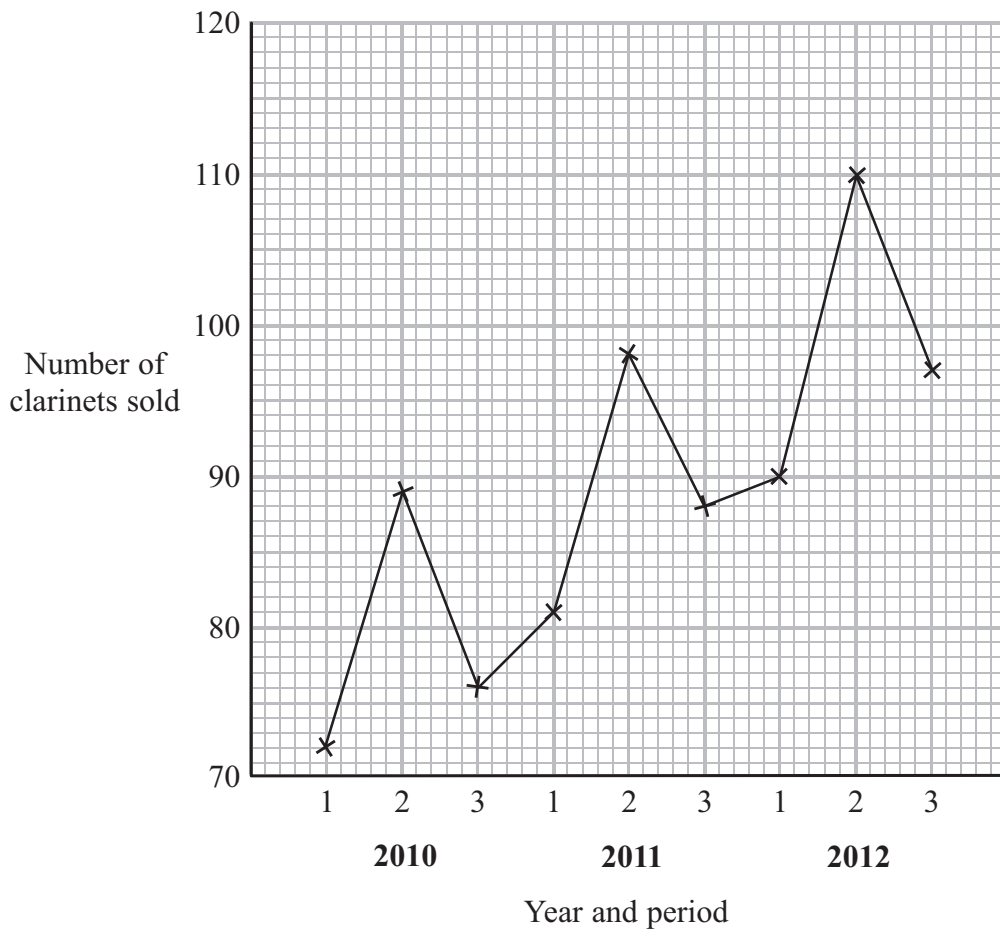
.....
.....
(1)

(Total for Question 7 is 3 marks)



8. Jarvis sells clarinets on the Internet.

The time series graph gives information about the number of clarinets Jarvis sold each period from 2010 to 2012



(a) On the grid, plot the 3-point moving averages for this information.

(4)



(b) What do the moving averages show about the trend in the number of clarinets sold?

.....
(1)

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

.....
(ii) Calculate an estimate for the number of clarinets sold in period 1 of 2013

.....
(4)

(Total for Question 8 is 9 marks)



9. The table gives information about the cost of the same basket of groceries in 2010, in 2011 and in 2012

| Year | 2010 | 2011 | 2012 |
|-------------------------------|-------|-------|-------|
| Index number (base year 2009) | 102.1 | 103.5 | 105.8 |

In 2009, the cost of the basket of groceries was £25.99

- (a) Work out the cost of the basket of groceries in 2012

£.....
(2)

- (b) (i) Calculate the geometric mean of the index numbers for 2010, 2011 and 2012
Give your answer to 1 decimal place.

.....
(2)

- (ii) Explain what the geometric mean shows about the cost of the basket of groceries over this period.

.....
(2)

(Total for Question 9 is 6 marks)



10. 141 children went on a school trip.

Each child went to the museum, or the art gallery or the theatre.

The table gives information about these children and where they went.

| Gender | Trip | | | Total |
|--------|--------|-------------|---------|-------|
| | Museum | Art gallery | Theatre | |
| Boys | 23 | 18 | 25 | 66 |
| Girls | 19 | 26 | 30 | 75 |
| Total | 42 | 44 | 55 | 141 |

Kyle is going to do a survey.

He will take a sample of these children rather than a census.

(a) Write down one advantage of taking a sample.

.....
(1)

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

.....
(1)

Kyle is going to take a sample of 30 of these children stratified by trip and by gender.

(c) Work out the number of boys who went to the theatre in his sample.

.....
(2)

(Total for Question 10 is 4 marks)



11. A and B are two events.

$$P(A) = 0.7$$

$$P(B) = 0.6$$

$$P(A \cap B) = 0.4$$

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

.....
(2)

(b) Work out $P(A | B)$

.....
(2)

C and D are two events.

Given that $P(C \text{ or } D) = P(C) + P(D)$

(c) explain what this result tells you about events C and D .

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

(Total for Question 11 is 5 marks)



12. Barry recorded the times, in seconds, taken by some students to run a race.

The times taken by the students are normally distributed with mean 52.6 seconds and standard deviation 2.7 seconds.

Jenny's time for the race is 49.2 seconds.

- (a) Calculate Jenny's standardised time.
Give your answer to 2 decimal places

.....
(2)

Toby's standardised time is -1.20

- (b) Who did better in the race, Jenny or Toby?
You must explain your answer.

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

(Total for Question 12 is 3 marks)



13. In a drawer there are

4 white socks,
6 black socks,
8 grey socks.

Jim wants to wear two socks of the same colour.
He is going to take at random two socks from the drawer.

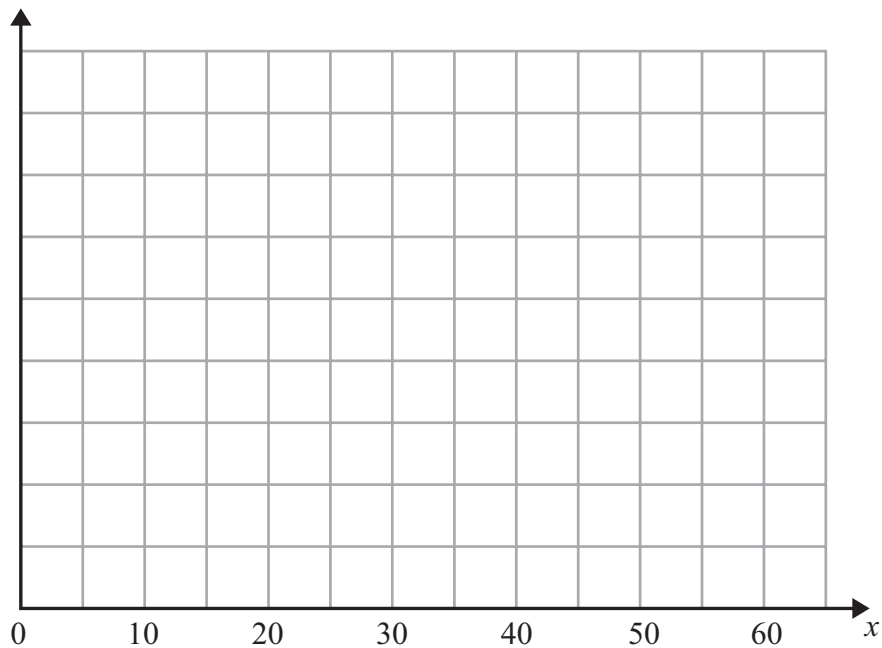
Work out the probability that the two socks will be the same colour.

.....
(Total for Question 13 is 4 marks)



14. A continuous random variable, X , is normally distributed with mean 24.5 and standard deviation 4.9

(a) On the grid, draw a sketch of the distribution.



(3)

(b) Using the standard normal distribution tables, find the probability that $X > 28$
Give your answer to 3 decimal places.
You must show your working.

.....
(3)

(Total for Question 14 is 6 marks)



15. $n = 10$ $\sum x = 56$ $\sum x^2 = 393.7$

(a) Show that $S_{xx} = 80.1$

You may use $S_{xx} = \sum x^2 - \frac{1}{n} (\sum x)^2$

(2)

It is given that $S_{yy} = 65.58$ $S_{xy} = -71.56$

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

(ii) Interpret your answer.

(3)

(Total for Question 15 is 5 marks)



16. Hiki has a biased dice.

The probability that the dice will land on a 6 is 0.2

Hiki is going to roll the dice 10 times.

- (a) Work out the probability that the dice will land on a 6 exactly 3 times.
Give your answer correct to 3 decimal places.

.....
(3)

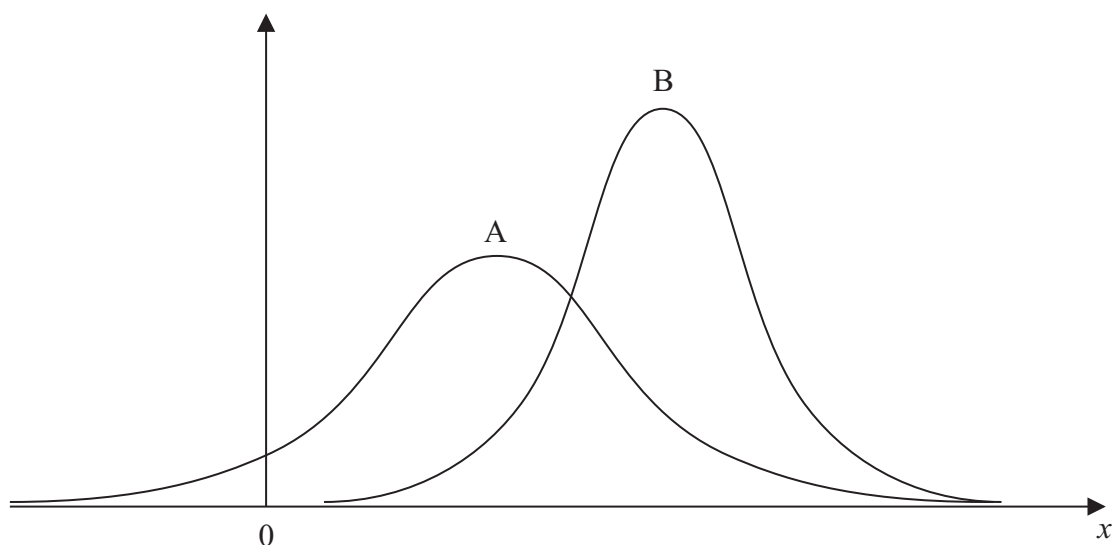
- (b) Work out the probability that the dice will land on a 6 at least once.
Give your answer correct to 3 decimal places.

.....
(2)

(Total for Question 16 is 5 marks)



17. The diagram shows two normal distributions, A and B.



Compare these two distributions.
Write down **two** comparisons.

1.....
.....

2.....
.....

(Total for Question 17 is 2 marks)

TOTAL FOR PAPER: 90 MARKS



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