

Write your name here

Surname

Other names

Pearson
Edexcel Award

Centre Number

--	--	--	--	--

Candidate Number

--	--	--	--

Statistical Methods

Level 3

Calculator allowed

Thursday 12 May 2016 – 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 ►

P46462A

©2016 Pearson Education Ltd.

6/6/6/



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		

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA



Answer ALL questions.

Write your answers in the spaces provided.

You must write down all stages in your working.

- 1** Tony has a dice.
The dice is biased.

The probability that the dice will land on 6 is 0.35

Tony is going to roll the dice 200 times.

Work out an estimate for the number of times the dice will land on 6

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

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA



2 The table gives information about the people working in a school.

		Gender	
		Male	Female
Type of staff	Office staff	4	5
	Teaching staff	21	35
	Support staff	12	18

Cullum is going to take a sample of these people.

(a) Write down one **disadvantage** of taking a sample.

(1)

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

(1)

Cullum is going to take a sample of 30 of these people stratified by type of staff and by gender.

(c) Work out the number of male teaching staff that should be in his sample.

(2)

(Total for Question 2 is 4 marks)



DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

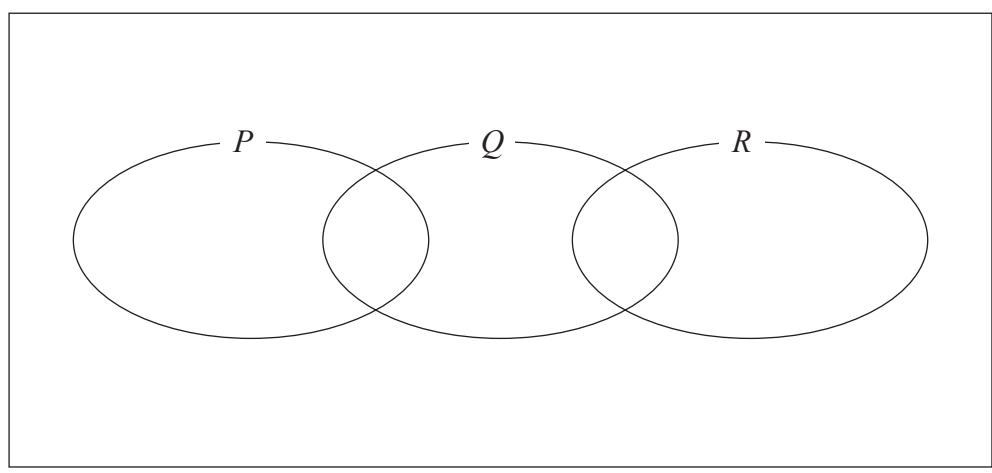
DO NOT WRITE IN THIS AREA

3 Giles asks some people which, if any, of three TV soaps they watch. They can choose from soap P , soap Q and soap R . Here are his results.

- 12 people watch soap P
- 11 people watch soap Q
- 9 people watch soap R
- 4 people watch soap P and soap Q
- 2 people watch soap Q and soap R
- 6 people do **not** watch any of the soaps

Nobody watches soap P and soap R
 Nobody watches all three soaps

(a) Complete the Venn diagram to show this information.



(3)

(b) Work out the total number of people Giles asks.

.....
 (1)

Giles picks at random one of these people.

(c) Given that this person watches soap Q , write down the probability that this person also watches soap P .

.....
 (2)

(Total for Question 3 is 6 marks)



- 4 Josh and Freda each played 15 rounds of golf.
Here are their scores for each round.

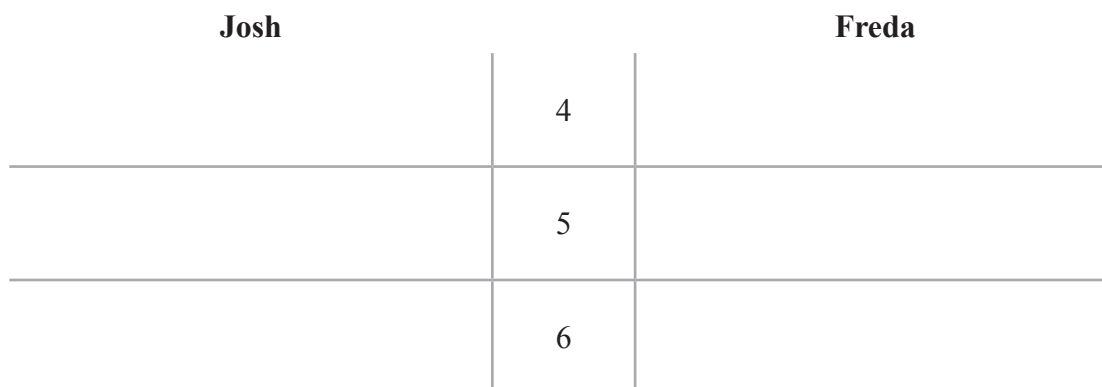
Josh

43 61 57 45 63 48 59 55
56 48 54 49 65 57 53

Freda

42 48 53 45 69 51 45 52
50 45 49 61 51 49 55

- (a) Draw an ordered back-to-back stem and leaf diagram for this information.



Key:

(3)



(b) Write down and compare Josh's median score and Freda's median score.

(2)

(c) Show that 69 is an outlier for Freda's scores.

(3)

(Total for Question 4 is 8 marks)

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

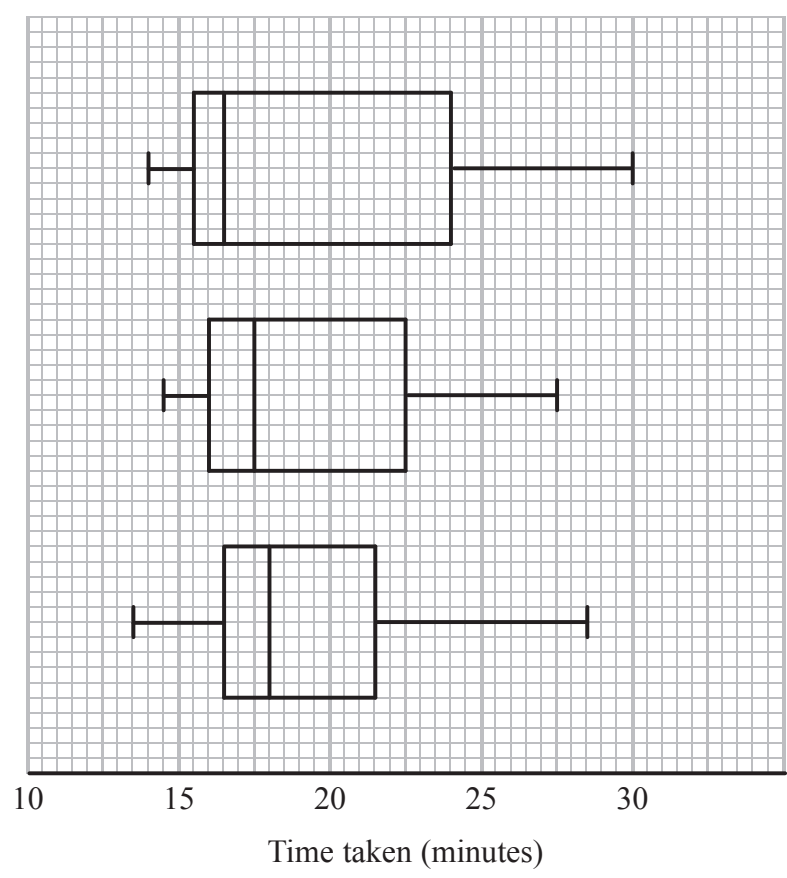


5 The box plots show information about the times taken, in minutes, for some people of different ages to complete a number puzzle.

People aged 20–39 years

People aged 40–59 years

People aged 60 years and over



(a) The times taken to complete the number puzzle are examples of which type of data?

..... data
(1)

(b) Compare the distributions of the times taken.
Write down **three** comparisons.

.....

.....

.....

.....

.....

.....

(3)

(Total for Question 5 is 4 marks)



DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

6 Shane takes a sample of 50 geese from a bird reserve and marks each one with a tag.

The next day, Shane takes a random sample of 20 geese from the bird reserve.
7 of these geese are marked with a tag.

Find an estimate for the number of geese at the bird reserve.

.....
(Total for Question 6 is 2 marks)



7 Preena has a bag of beads and a box of beads.
She is going to take at random a bead from the bag and a bead from the box.

The probability that she will take a red bead from the bag is 0.65
The probability that she will take a red bead from the box is 0.15

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

(3)

(b) Work out the probability that both beads will be red.

.....
(2)

(c) Work out the probability that at least one of the two beads will be red.

.....
(2)

(Total for Question 7 is 7 marks)



DO NOT WRITE IN THIS AREA

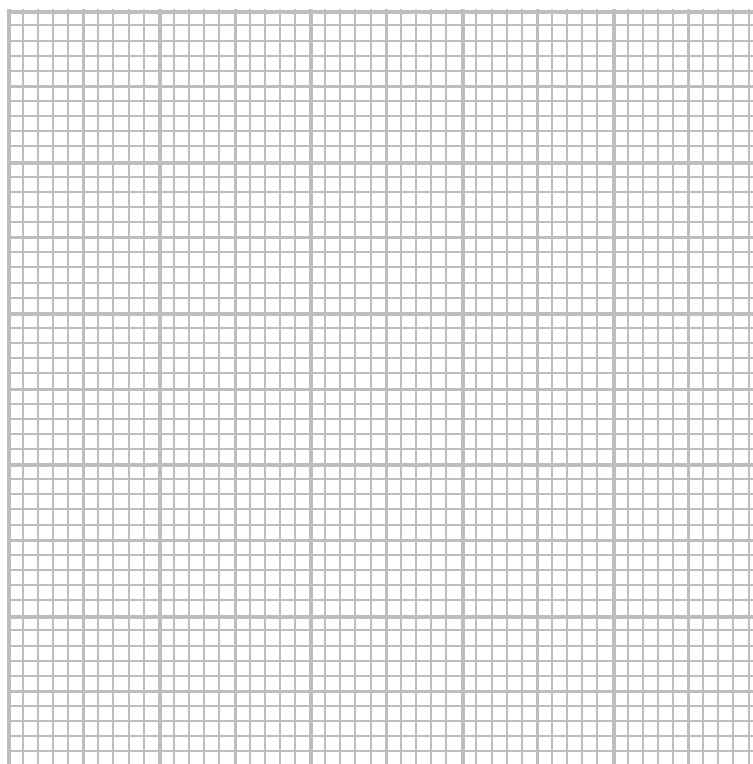
DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

8 The heights of 100 trees in a forest were recorded.
The frequency table gives information about these heights.

Height (h metres)	$0 < h \leq 4$	$4 < h \leq 8$	$8 < h \leq 12$	$12 < h \leq 16$	$16 < h \leq 20$
Frequency	3	12	32	48	5

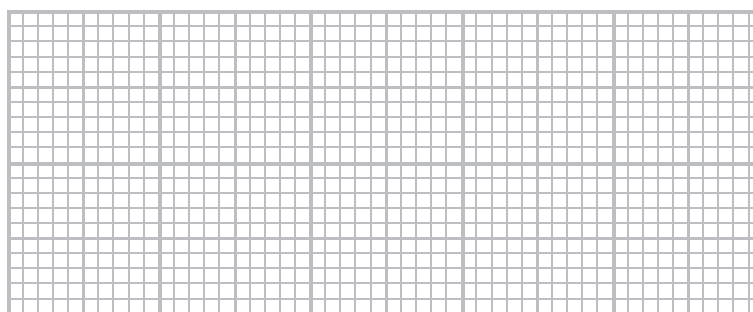
(a) On the grid, draw a cumulative frequency graph for this information.



(3)

The height of the shortest tree is 2 metres.
The height of the tallest tree is 17 metres.

(b) On the grid, draw a box plot for the heights of the 100 trees.



(3)

(Total for Question 8 is 6 marks)



9 Hilary and Martin each ranked 8 cakes at a village fete.

Here are their ranks.

Cake	A	B	C	D	E	F	G	H
Hilary's ranks	6	5	1	3	4	2	7	8
Martin's ranks	6	4	3	1	2	5	8	7

- (i) Calculate Spearman's coefficient of rank correlation for this information. Give your answer correct to 3 decimal places.

- (ii) Interpret your answer.

(Total for Question 9 is 4 marks)



DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

10 The distances jumped in a ski jumping competition are normally distributed with a mean of 115 m and a standard deviation of 4 m.

Carl jumped a distance of 118 m in this competition.

(a) Calculate the standardised score for Carl's jump.

.....
(2)

Pierre and Ito each jumped in this competition.

The standardised score for Pierre's jump is 1.2

The standardised score for Ito's jump is -1.35

(b) Who jumped further in the competition, Pierre or Ito?
Give a reason for your answer.

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

(c) Work out the distance jumped by Pierre.

..... m
(2)

(Total for Question 10 is 5 marks)



11 The table gives information about the weights of 1400 chickens.

Weight (w kg)	Frequency
$0.5 < w \leq 1.5$	280
$1.5 < w \leq 1.75$	400
$1.75 < w \leq 2.25$	480
$2.25 < w \leq 2.75$	240

- (a) Calculate an estimate for the mean weight.
Give your answer correct to 3 decimal places.

..... kg
(3)

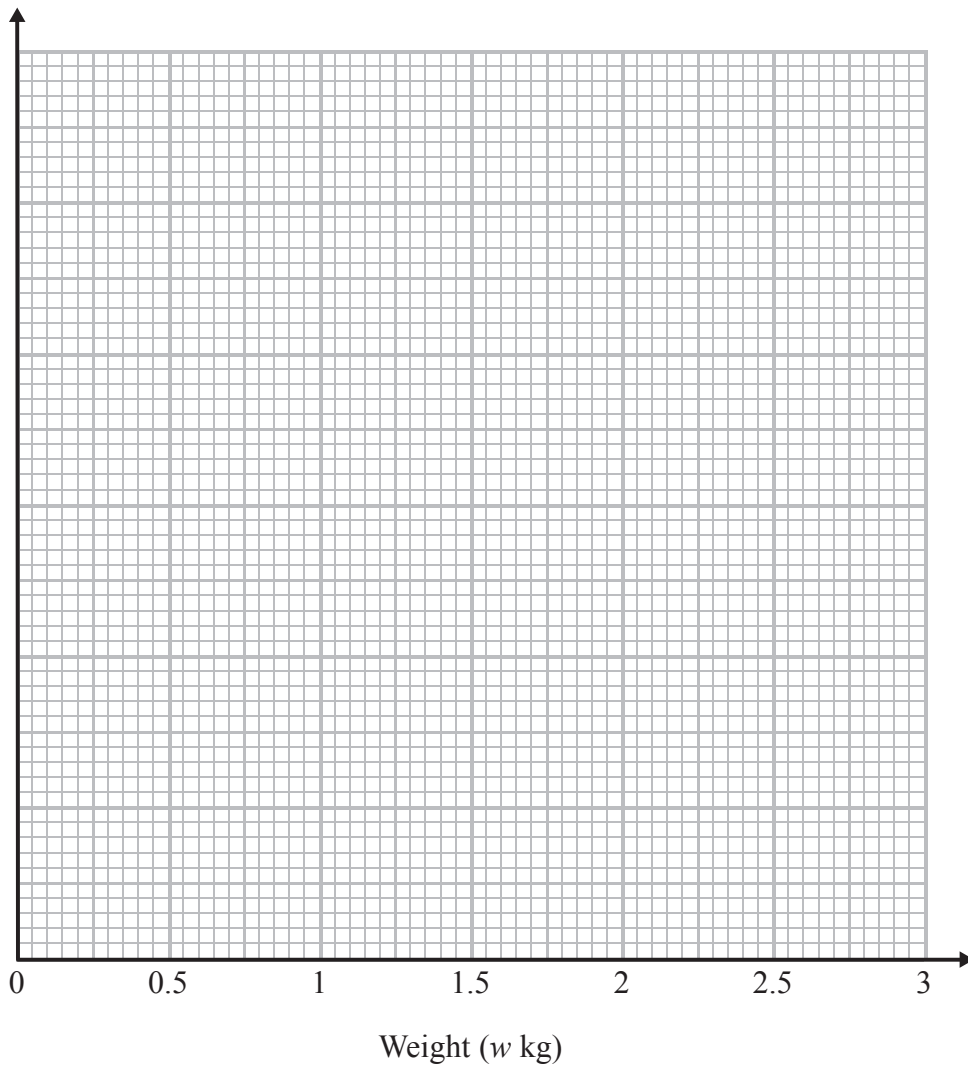
- (b) Calculate an estimate for the standard deviation of the weights.
Give your answer correct to 2 decimal places.

You may use $\sum fw^2 = 4756.25$

..... kg
(2)



(c) On the grid, draw a histogram for the information in the table.



(4)

(Total for Question 11 is 9 marks)

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA



12 The table gives information about the cost of heating a house each year from 2012 to 2015.

It shows the chain base index numbers for these four years.

Year	2011	2012	2013	2014	2015
Chain base index number		98.5	101.5	102.1	99.2

The cost of heating the house in 2011 was £1250

(a) Work out the cost of heating the house in 2012.

£.....
(2)

(b) Calculate the geometric mean of the chain base index numbers for 2012, 2013, 2014 and 2015.

Give your answer correct to 2 decimal places.

.....
(2)

(c) Describe what the geometric mean shows about the cost of heating the house over this period.

.....
(2)

(Total for Question 12 is 6 marks)

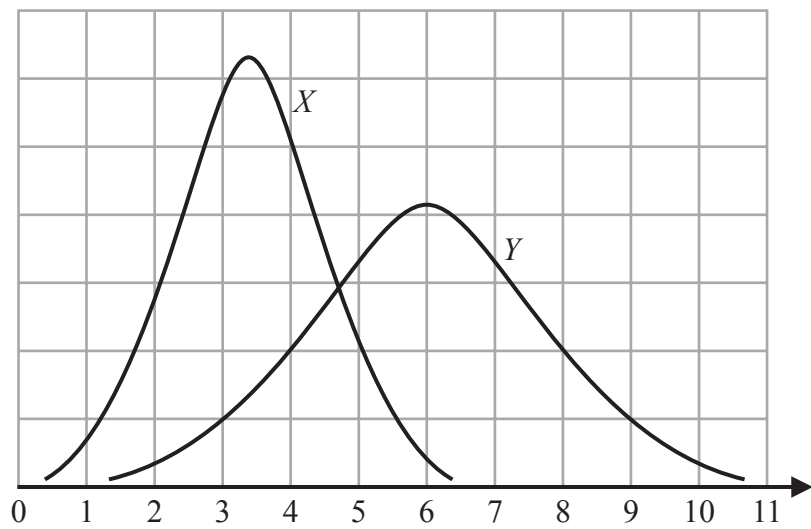


DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

13 X and Y are normally distributed and their curves are drawn on the grid.



(a) Find an estimate for the mean of X .

.....
(1)

(b) Compare the two distributions.
Write down **two** comparisons.

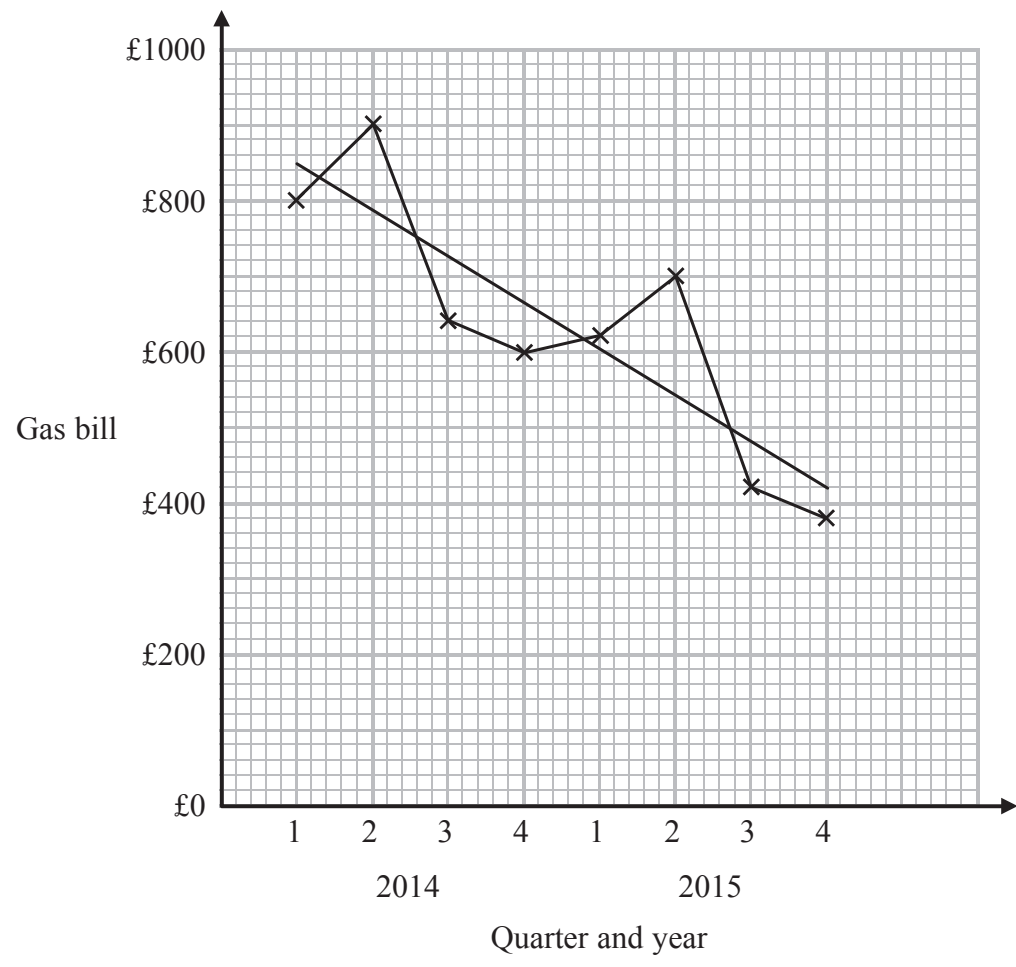
.....
.....
.....
(2)

(Total for Question 13 is 3 marks)



14 This time-series graph gives information about the quarterly gas bills for a restaurant for 2014 and 2015.

A trend line has also been drawn on the grid.



(a) Describe the trend.

..... (1)

(b) Work out an estimate for the mean seasonal variation for quarter 2

£..... (2)



(c) Find an estimate of the gas bill for the restaurant for quarter 2 of 2016.

£.....
(2)

(Total for Question 14 is 5 marks)

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA



15 A and B are mutually exclusive events.

$$P(A) = 0.35$$

$$P(B) = 0.4$$

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

.....
(1)

X and Y are two events.

$$P(X) = 0.6$$

$$P(Y) = 0.8$$

$$P(X \cup Y) = 0.92$$

Tammy says

“ X and Y are independent events”.

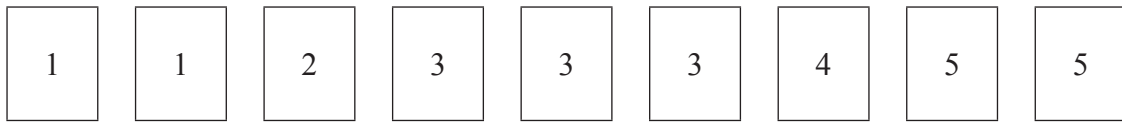
(b) Is she right?
Explain why.

.....
.....
(3)

(Total for Question 15 is 4 marks)



- 16 Here are 9 cards.
There is a number on each card.



Jane takes at random 2 of the cards.
She adds together the numbers on the two cards to get a total T .
Work out the probability that T is an even number.

(Total for Question 16 is 3 marks)



17 The weights of bags checked in at an airport are normally distributed with mean 13.4kg and standard deviation 4kg.

(a) Jerez picks at random one of these bags.

(i) Find the probability that this bag has a weight less than 16kg.

.....

(ii) Find the probability that this bag has a weight greater than 12kg.

.....

(4)

Kim picks at random three of the bags checked in at the airport.

(b) Find the probability that exactly 2 of these bags have a weight less than 16kg. Give your answer correct to 3 decimal places.

.....

(3)

(Total for Question 17 is 7 marks)



DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

18 The table shows information about the body mass, x grams, and the heart mass, y milligrams, of each of 10 mice.

x	26	35	30	36	38	36	33	38	30	38
y	117	157	139	157	144	149	131	160	136	150

For the data $\sum xy = 49378$ $S_{xx} = 154$ $S_{yy} = 1642$

- (a) Calculate the product-moment correlation coefficient.
Give your answer correct to 3 decimal places.

You may use $S_{xy} = \sum xy - \frac{1}{n}(\sum x)(\sum y)$

.....
(4)

- (b) Describe the relationship between the body mass and the heart mass of these mice.

.....
(1)

(Total for Question 18 is 5 marks)

TOTAL FOR PAPER IS 90 MARKS



DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

BLANK PAGE

