

Write your name here	
Surname	Other names
Pearson Edexcel	Centre Number
Level 3 Certificate	Candidate Number
Mathematics in Context	
Paper 2: Applications	
Wednesday 24 May 2017 – Morning	Paper Reference
Time: 1 hour 40 minutes	7MC0/02
You must have: Ruler graduated in centimetres and millimetres, protractor, pair of compasses, pen, HB pencil, eraser, calculator. Source booklet.	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.**



Information

- The total mark for this paper is 80
- The marks for **each** question are shown in brackets
– *use this as a guide as to how much time to spend on each question.*

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.

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SECTION A

Answer ALL questions. Write your answers in the spaces provided.

ENERGY

Refer to **Table 1** in the source booklet for Questions 1 and 2

- 1 Payment for electricity can be made by standard credit, by direct debit or by prepayment. The payment rate depends on the payment method.

The table shows some information about the average annual domestic electricity bill for all consumers in 1999 and 2014.

Year	Payment method (all consumers)		
	Standard credit (£)	Direct debit (£)	Prepayment (£)
1999	299	287	318
2014	619	570	

- (a) Use the information in **data source A** to complete the table above.

(1)

The percentage increase for direct debit payments from 1999 to 2014 is 98.6%.

- (b) Compare the percentage increases from 1999 to 2014 for each payment method.

(5)

(Total for Question 1 is 6 marks)



2 Use the standard credit information in Table 1 from the source booklet.

For standard credit home suppliers the mean of the average annual domestic electricity bills is £430.56 and the standard deviation is £129.08

For standard credit non-home suppliers let f_y represent the average annual domestic electricity bill.

Given $\Sigma y = 6389$ and $\Sigma y^2 = 2788051$

compare the distribution of average bills for the period from 1999 to 2014 for standard credit home suppliers and standard credit non-home suppliers.

(Total for Question 2 is 6 marks)



3 An electricity company buys electricity from customers with solar panels on their houses. The company pays 4.85p per kWh of electricity.

Mr Fernandes was paid £95 for electricity by the company.

Mr Gordon was paid £75 for electricity by the company.

(a) How much more electricity, in kWh, did the company buy from Mr Fernandes than from Mr Gordon?

(4)

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Mr Dawson used 4000 kWh of electricity during 2014.
Solar panels were then fitted to his house.

During 2015 he used 3200 kWh of electricity.

At the end of 2015, Mr Dawson was paid £85 for electricity by the company.

The total percentage export of electricity, T , for any house is

$$T = 100 - \frac{100(c_0 - c_1)}{G} \quad G = \frac{P}{0.0485}$$

where

P is the payment, in pounds, made by the electricity company

c_0 is the electricity, in kWh, used during the year before solar panels are fitted

c_1 is the electricity, in kWh, used during the first year after solar panels are fitted.

(b) Work out the value of T for Mr Dawson's house.

(4)

(Total for Question 3 is 8 marks)

TOTAL FOR SECTION A IS 20 MARKS



P 5 1 5 7 7 A 0 5 2 0

SECTION B

Answer ALL questions. Write your answers in the spaces provided.

TASK 1: FARMING

- 4 A farmer has two types of field, low fields and valley fields.
He grows pumpkins in his fields.

The yield, in tons per acre, in each type of field depends on the weather.

The table below gives the yields, in tons per acre, for the different fields in different weather conditions.

	Wet weather	Dry weather
Low fields	31	8
Valley fields	6	50

The farmer considers growing half the pumpkins in the low fields and half the pumpkins in the valley fields.

- (a) Compare the yields this would give in wet weather conditions and in dry weather conditions.

(4)

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Let x be the fraction of pumpkins grown in the low fields and y be the fraction of pumpkins grown in the valley fields.

(b) (i) Explain why $x + y = 1$

(1)

The farmer needs to ensure a total yield of 24 tons per acre in wet weather conditions.

(ii) Use this information to write down another equation in x and y .

(1)

(iii) Hence, or otherwise, find the value of x and the value of y .

(4)

(Total for Question 4 is 10 marks)



P 5 1 5 7 7 A 0 7 2 0

- 5 Kezia is a farmer.
She writes on her blog.

“This season we got 151 pumpkins per half acre of land but only 60 of these were fit to sell.”

- (a) Write down the probability that a pumpkin grown this season is fit to sell.

(1)

Kezia records the costs **per acre** of growing pumpkins this season.

Tractor \$15

8 gallons of fuel at \$0.93 per gallon

19 hours of labour at \$24.60 per hour

Pumpkin seed \$110

Kezia assumes she will sell all the pumpkins that are fit to sell. She does not want to make a loss on this pumpkin crop.

- (b) Work out the minimum amount Kezia should charge for each pumpkin this season.

(3)

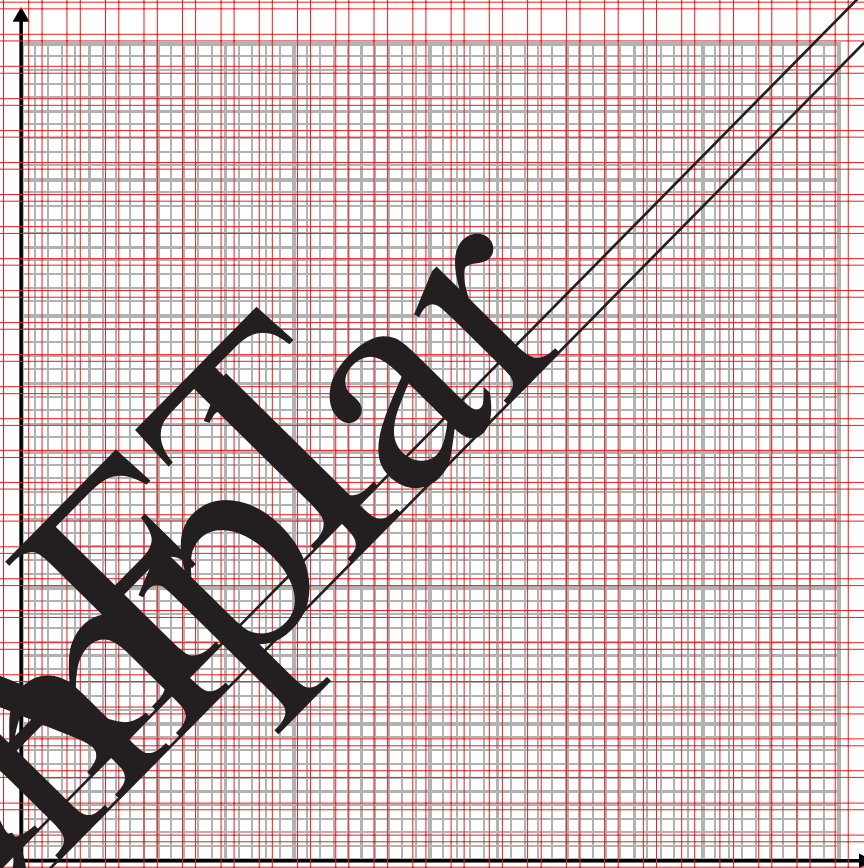
(Total for Question 5 is 4 marks)



6 Information about the weights of some of the pumpkins that were sold is shown in the table.

Pumpkin weight (w pounds)	Frequency
$0 < w \leq 5$	15
$5 < w \leq 10$	8
$10 < w \leq 15$	25
$15 < w \leq 20$	9
$20 < w \leq 25$	3

(a) Draw a cumulative frequency graph for this information.



Use your graph to find an estimate for the median weight.

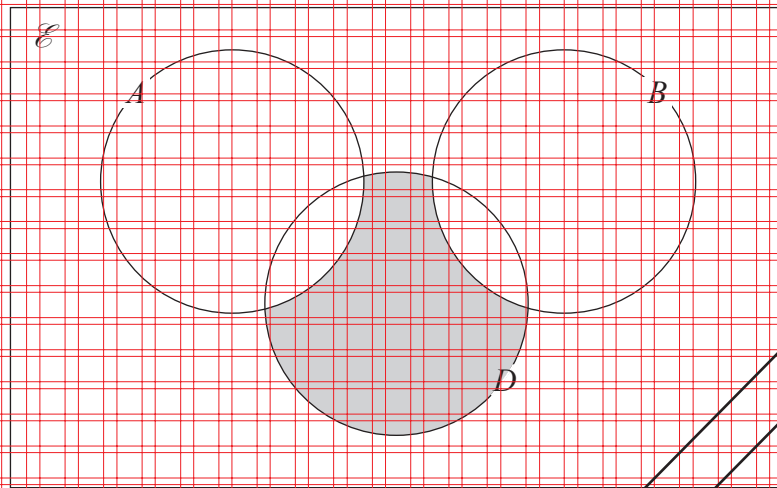
(Total for Question 6 is 6 marks)



TASK 2: PRODUCTION

- 7 In a factory, machines A, B and C make identical belts.
Some of the belts are defective.

The Venn diagram shows information about the belts.



$E = \{\text{all belts made by machines A, B and C}\}$
 $A = \{\text{belts made by machine A}\}$
 $B = \{\text{belts made by machine B}\}$
 $D = \{\text{defective belts}\}$

- (i) Describe, in context, $A \cap D$.

- (ii) Explain why $P(A \cap D) < P(A)$.

- (iii) In context, what the shaded region represents.

(Total for Question 7 is 3 marks)



8 The numbers of belts made by machines A, B and C are in the ratio 2:1:3

The proportion of defective belts made by machines A, B and C is 0.02, 0.03 and 0.025 respectively.

All the belts made are put in a storeroom.

(a) Work out the probability that a belt selected at random from the storeroom is defective.

(4)

A batch of 115 belts is made by machine A.
The probability that a belt made by machine A is defective is 0.02

(b) Show that the probability that this batch contains at least one defective belt is greater than 0.9

(3)

(Total for Question 8 is 7 marks)



P 5 1 5 7 7 A 0 1 1 2 0

9 Machine D and machine E each make bags.

Machine D makes between 70 and 150 bags each day.

Machine E makes at least twice as many bags as machine D each day.

The total number of bags made each day cannot exceed 390

Let x be the number of bags made by machine D.

Let y be the number of bags made by machine E.

(a) Write down all the constraints this information gives in addition to $x \geq 0$ and $y \geq 0$

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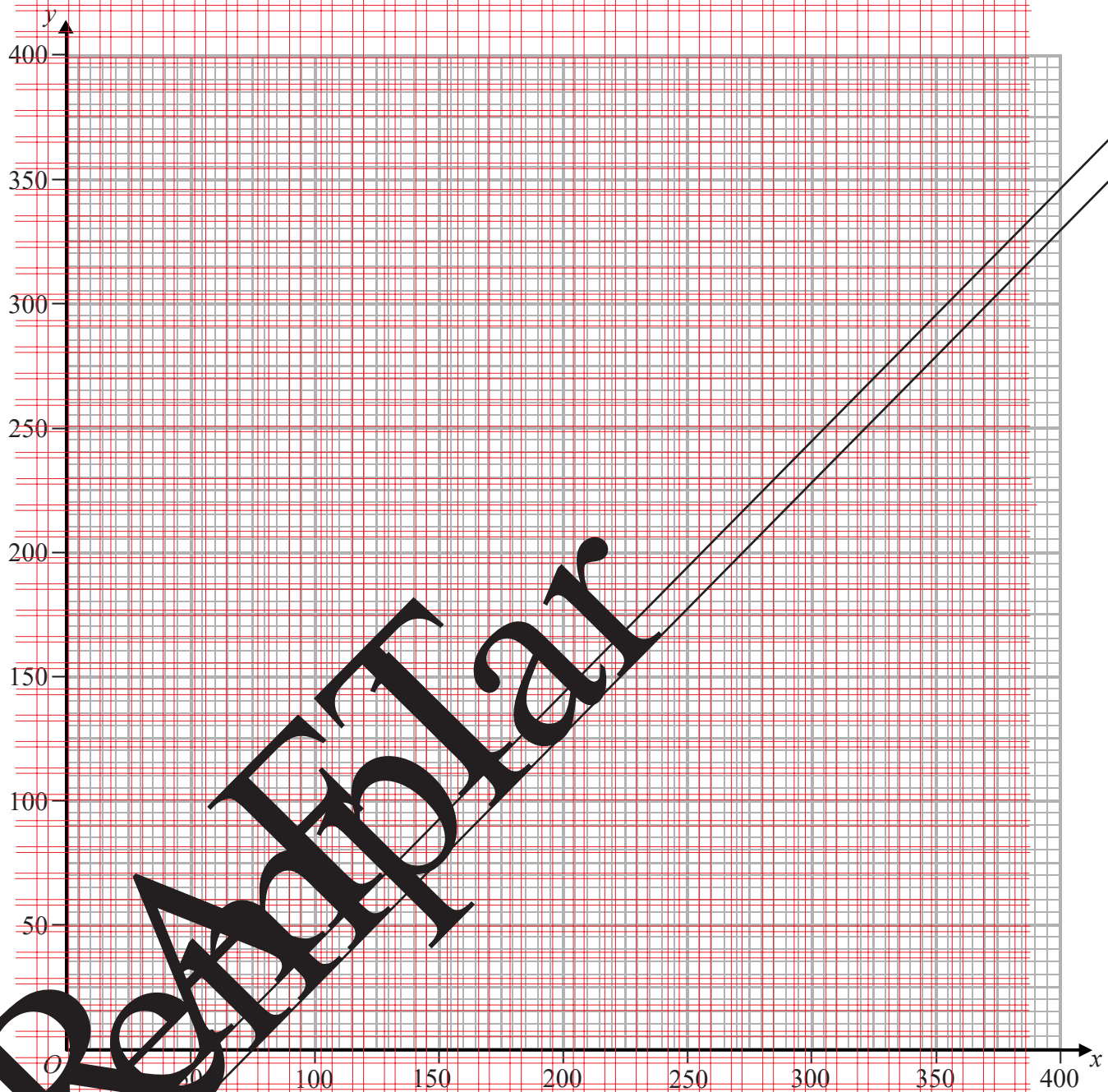
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(b) On the grid, show all the constraints.
Label the feasible region with the letter R.



The factory needs to maximise profits.

Machine D gives £4 profit per bag.

Machine E gives £3.50 profit per bag.

(c) Find the maximum profit.

You should state the number of bags made by each machine.

(3)

(Total for Question 9 is 10 marks)

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TASK 3: EARNINGS

10 Information about wages paid by a company last month is shown in the table.

Wage (£ w)	Frequency
$0 < w \leq 1250$	5
$1250 < w \leq 2000$	15
$2000 < w \leq 2500$	18
$2500 < w \leq 3500$	23
$3500 < w \leq 5000$	9

Calculate an estimate for the mean wage.

(Total for Question 10 is 4 marks)



11 Here is a table with some information about earnings.

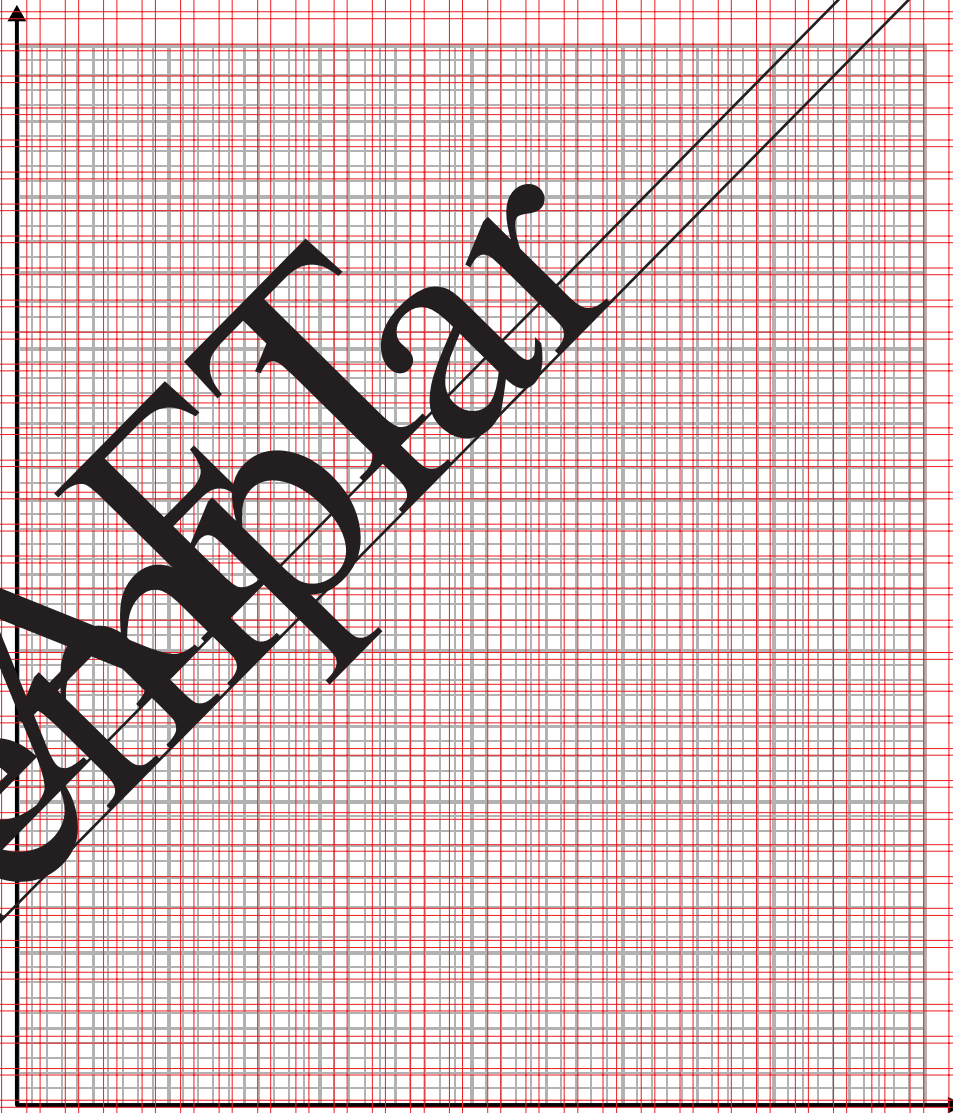
The table shows the median full-time gross weekly earnings by gender and age in the UK.

Median full-time gross earnings (£ per week)						
Age (years)	17	20	25	35	45	55
Men	170	300	430	580	640	610
Women	130	280	400	530	490	460

Source: Annual Survey of Hours and Earnings – Office of National Statistics

- (a) On the graph paper, draw a diagram that could be used to determine the nature of the correlation between age in years (x) and weekly earnings in pounds (y) for **men**.

(4)



(b) Explain why age is the explanatory (independent) variable.

(1)

The regression coefficient of y on x for men is 11.29 (2 dp).

(c) Find the equation of the regression line of y on x for men.

(5)

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The equation of the regression line of y on x for women is $y = 7.60x + 132.04$

Mrs Bradshaw and Mr Gould are both 30 years old.

(d) Work out their expected weekly earnings.

Comment on the reliability of your values.

(4)

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(e) Interpret and compare, in context, the gradients of the regression lines.

(2)

(Total for Question 11 is 16 marks)

TOTAL FOR SECTION B IS 60 MARKS

TOTAL FOR PAPER IS 80 MARKS

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Preparation



References for farming and earnings

<https://books.google.co.uk/books?id=qrS8jEGOp9kC&pg=PA27&lpg=PA27&dq=simultaneous+equations+geography&source=bl&ots=Zz4mwnY3VJ&sig=sAXpyXOBt1wFZkRO2F3Ww7clMA0&hl=en&sa=X&ved=0CCEQ6AEwAGoVChMlmNqs6pf0xwIVA28UCh3XJwWE#v=onepage&q=simultaneous%20equations%20geography&f=false>

<http://www.pumpkinpatchesandmore.org/pumpkincrops/pumpkin.pdf>

<http://www.blogger.com/price-pumpkins>

Source Annual Survey of Hours and Earnings – Office of National Statistics

<http://www.neighbourhood.statistics.gov.uk/HTMLDocs/dvc126/index.html>

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Pearson Edexcel Level 3 Certificate

Mathematics in Context

Paper 2: Applications

Wednesday 24 May 2017 – Morning

Source booklet

Paper Reference

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Formulae sheet

~~There will be no credit for anything you write on this formulae sheet.~~

Mean of a frequency distribution $= \frac{\sum fx}{\sum f}$

Mean of a grouped frequency distribution $= \frac{\sum fx}{\sum f}$, where x is the mid-interval value

Variance $= \frac{\sum (x - \bar{x})^2}{n}$

Standard deviation (set of numbers) $= \sqrt{\frac{\sum x^2}{n} - \left(\frac{\sum x}{n}\right)^2}$

or

$$\sqrt{\frac{\sum (x - \bar{x})^2}{n}}$$

where \bar{x} is the mean of the set of values

Standard deviation (discrete frequency distribution) $= \sqrt{\left[\frac{\sum fx^2}{\sum f} - \left(\frac{\sum fx}{\sum f}\right)^2 \right]}$

or

$$\sqrt{\left[\frac{\sum f(x - \bar{x})^2}{\sum f} \right]}$$

Spearman's rank correlation coefficient $= 1 - \frac{6\sum d^2}{n(n^2 - 1)}$

The product moment correlation coefficient is

$$r = \frac{S_{xy}}{\sqrt{S_{xx}S_{yy}}} = \frac{\sum x_i y_i - \frac{(\sum x_i)(\sum y_i)}{n}}{\sqrt{\left(\sum x_i^2 - \frac{(\sum x_i)^2}{n}\right)\left(\sum y_i^2 - \frac{(\sum y_i)^2}{n}\right)}}$$

The regression coefficient of y on x is $b = \frac{S_{xy}}{S_{xx}}$

Least squares regression line of y on x is $y = a + bx$ where $a = \bar{y} - b\bar{x}$

Arithmetic series

$$u_n = a + (n-1)d$$

$$S_n = \frac{1}{2}n(a + l) = \frac{1}{2}n[2a + (n-1)d]$$

Geometric series

$$u_n = ar^{n-1}$$

$$S_n = \frac{a(1-r^n)}{1-r}$$

$$= \frac{a}{1-r} \text{ for } |r| < 1$$

There will be no credit for anything you write in this source booklet.

SECTION A: Energy Costs

There are three ways to pay for electricity

- standard credit
- direct debit
- prepayment

People pay different rates depending on their payment method.

Electricity is supplied to users by either

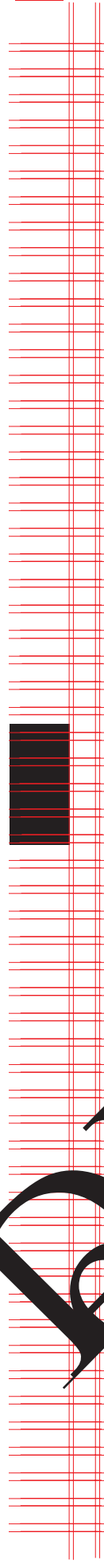
- home suppliers – the electricity company that originally supplied to all homes in the area
- or
- non-home suppliers – a different electricity company other than the original supplier.

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Data Source A

Table 1 Average annual domestic standard electricity bills: (£), by home and non-home supplier based on consumption of 3,800 kWh/year for the United Kingdom

Cash terms	Pounds											
	Direct credit				Direct debit				Prepayment			
	Home suppliers	Non-home suppliers	All consumers	Home suppliers	Non-home suppliers	All consumers	Home suppliers	Non-home suppliers	All consumers			
1996	-	-	330	-	-	330	-	-	359			
1997	-	-	315	-	-	315	-	-	342			
1998	-	-	293	-	-	293	-	-	323			
1999	301	277	290	265	287	287	318	306	318			
2000	294	273	291	262	278	278	312	309	311			
2001	288	268	283	258	271	271	304	297	303			
2002	290	264	282	253	269	269	306	290	300			
2003	292	268	283	257	270	270	304	296	301			
2004	300	275	291	262	277	277	318	299	311			
2005	334	308	322	291	305	305	350	337	345			
2006	388	376	382	371	343	355	402	414	407			
2007	442	408	428	420	378	395	450	441	446			
2008	511	468	492	489	430	454	521	507	514			
2009	532	481	507	501	446	466	535	501	519			
2010	517	469	493	484	436	453	522	489	505			
2011	554	515	533	516	481	493	558	529	542			
2012	584	549	565	543	511	521	588	552	568			
2013	621	588	602	579	548	557	625	594	605			
2014	641	602	619	590	560	570	646	608	623			
% Change												
2013-2014	+3.2	+2.4	+2.8	+1.9	+2.2	+2.3	+3.4	+2.4	+3.0			



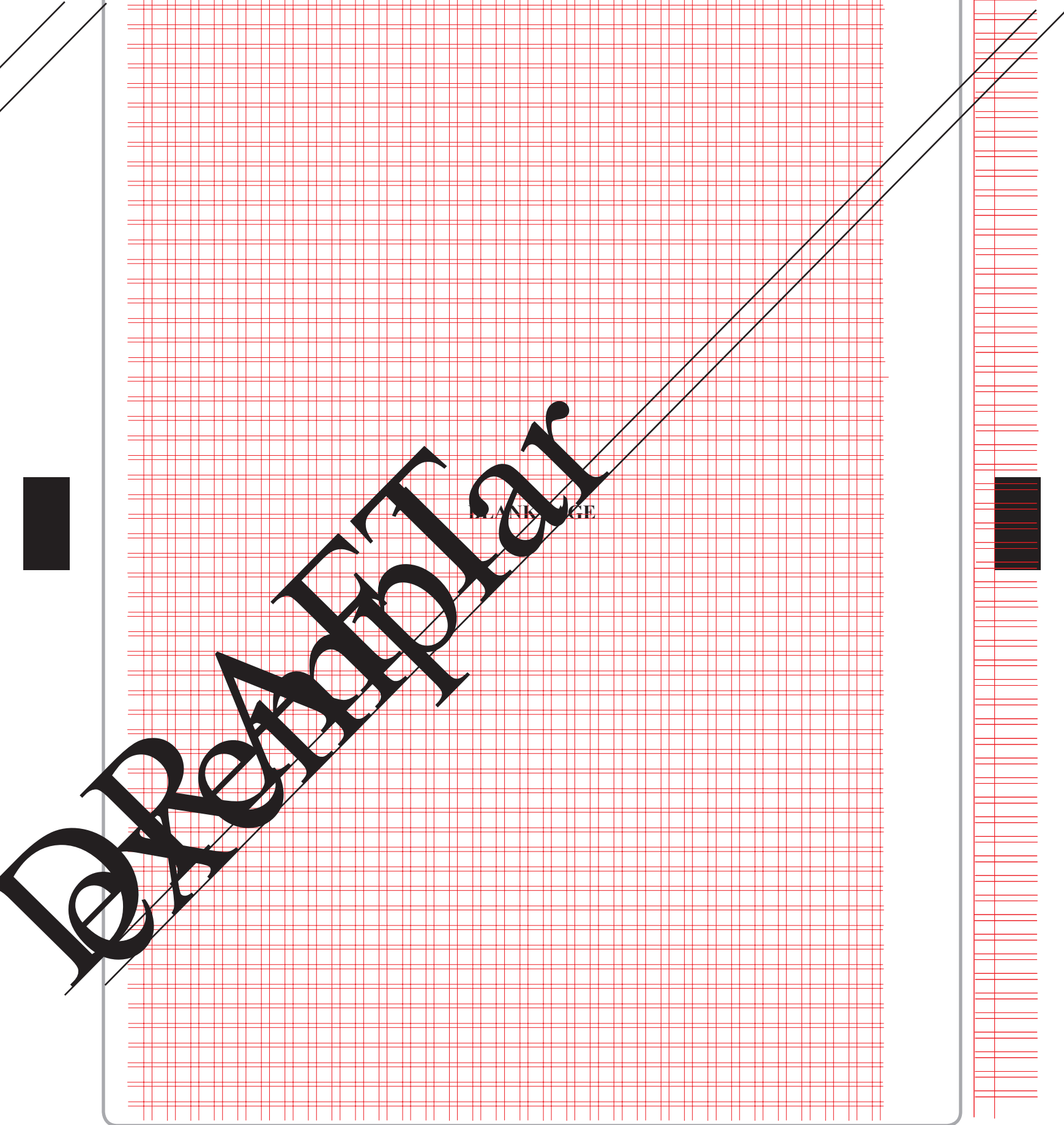
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