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Candidate surname

Other names

**Pearson Edexcel  
Level 3 GCE**

Centre Number

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Candidate Number

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**Thursday 20 June 2019**

Morning (Time: 1 hour 30 minutes)

Paper Reference **8ST0/02**

**Statistics**

**Advanced Subsidiary  
Paper 2**

**You must have:**

Statistical Formulae and Tables booklet  
Calculator

Total Marks

**Candidates may use any calculator allowed by Pearson regulations.  
Calculators must not have retrievable mathematical formulae stored in them.**

### Instructions

- Use **black** ink or ball-point pen.
- If pencil is used for diagrams/sketches/graphs it must be dark (HB or B).
- **Fill in the boxes** at the top of this page with your name, centre number and candidate number.
- Answer **all** questions and ensure that your answers to parts of questions are clearly labelled.
- Answer the questions in the spaces provided  
– *there may be more space than you need.*
- You should show sufficient working to make your methods clear.  
Answers without working may not gain full credit.
- Unless otherwise stated, statistical tests should be carried out at the 5% significance level.
- When a calculator is used, the answer should be given to three significant figures unless otherwise stated.

### Information

- A booklet 'Statistical Formulae and Tables' is provided.
- There are 8 questions in this question paper. The total mark for this paper is 60.
- 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.
- Try to answer every question.
- Check your answers if you have time at the end.
- If you change your mind about an answer, cross it out and put your new answer and any working underneath.

Turn over ►

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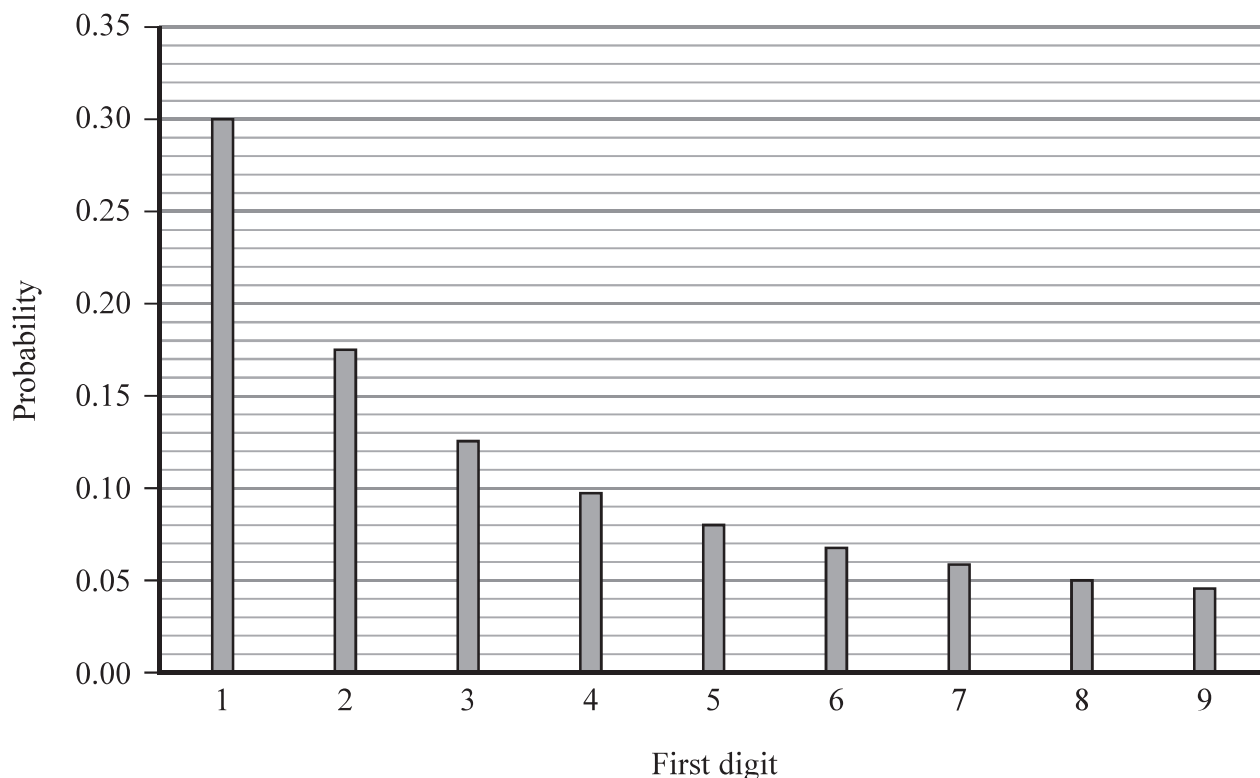


- 3 Benford's law is a statistical observation about the **first digits** of numbers in many real-life datasets.

One such dataset that obeys Benford's law is the set of Surface Areas of British Lakes (in hectares).

If  $X$  represents the **first digit** of the surface area of a randomly selected British lake, then Benford's law states that  $X$  will have the probability distribution given in **Figure 1**.

So, for example, the probability that a randomly chosen British lake has a surface area with first digit 8 (such as 81 hectares or 824.5 hectares) is approximately 0.05



**Figure 1: Probability mass function for Benford's law**

- (a) If a British lake is chosen at random, **estimate** the probability that the first digit of its surface area is greater than 7.

(1)

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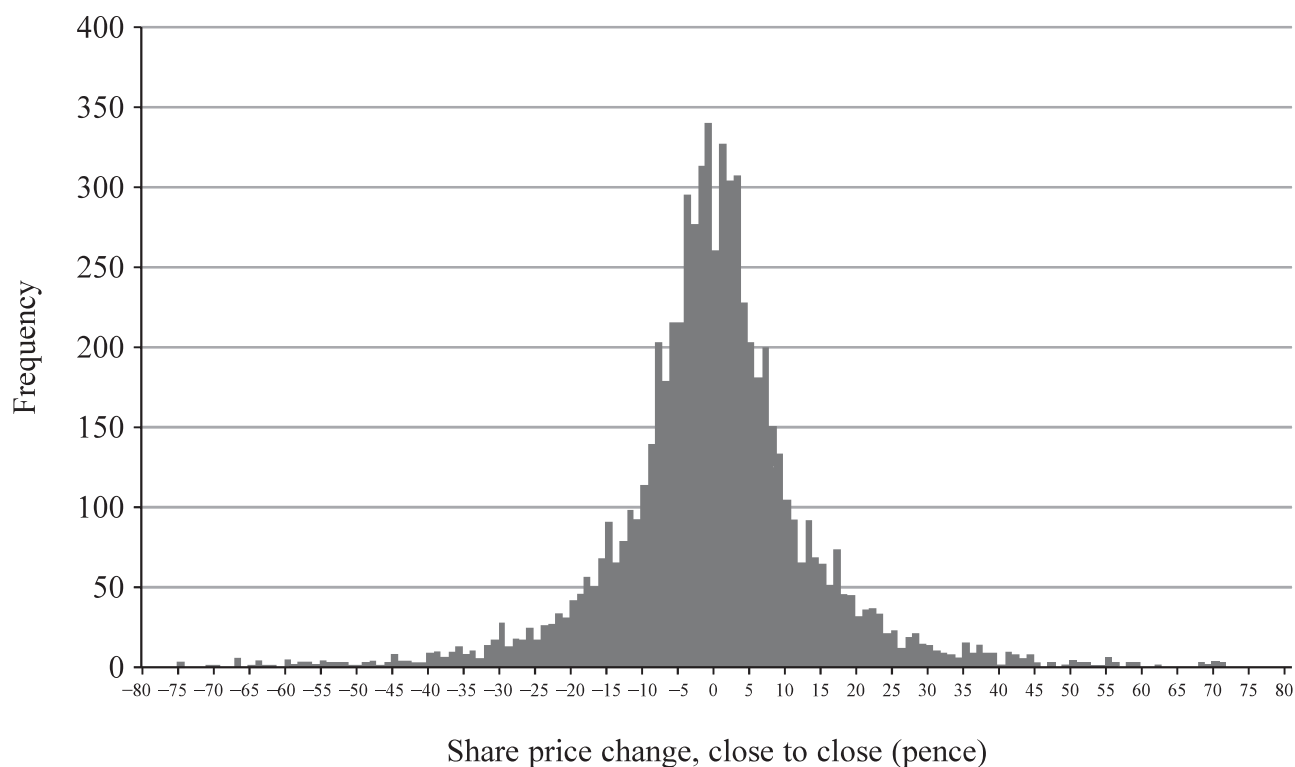






- 5 Borghild is studying the changes in Pearson PLC's share price on the London Stock Exchange.

She has calculated the daily **change** in its share price for each weekday from 1st July 1988 to 30th September 2017, and produced the histogram given in **Figure 2**.



Source from: <https://uk.finance.yahoo.com/>

**Figure 2: Histogram of daily changes to Pearson PLC's share price**

Borghild models this data as a normal distribution with the following parameters:

$$\mu = 0.03$$

$$\sigma = 8.73$$







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6 Rebecca works in the Maths and Statistics Faculty of a prestigious university. She is in charge of managing the application process for Maths and Statistics degree courses.

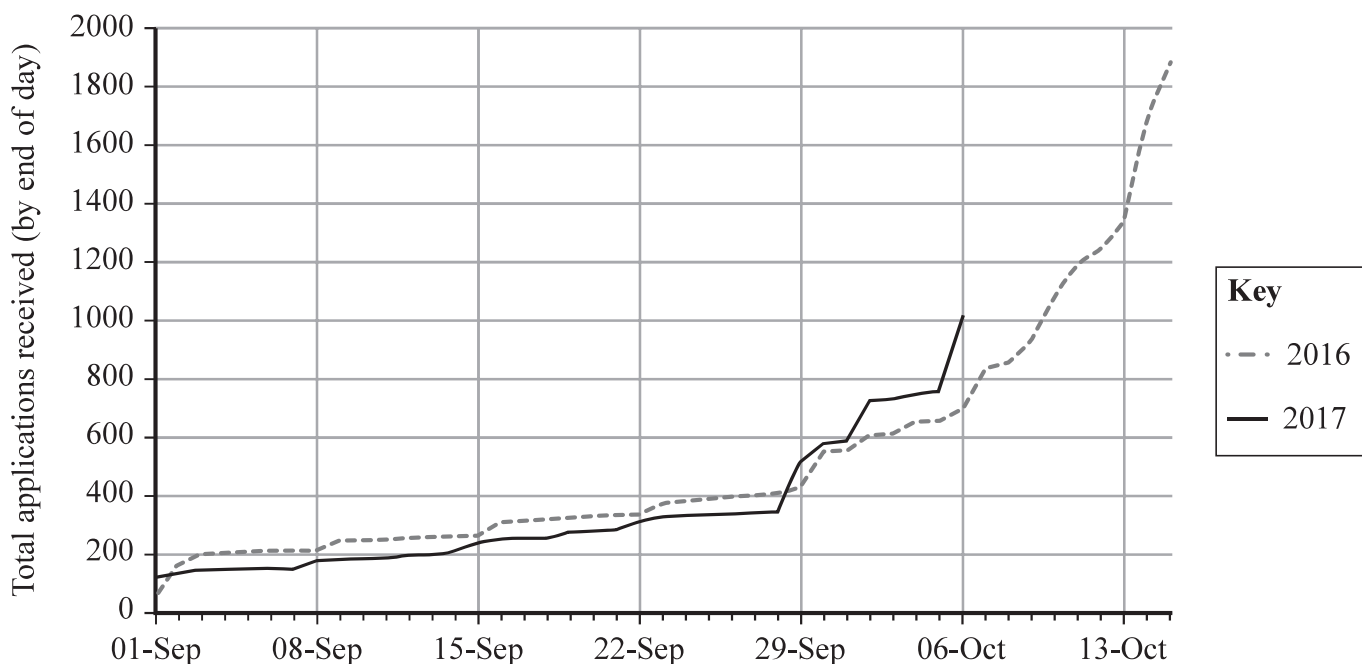
Applications open each year on the 1st of September and close on the 15th of October.

Rebecca keeps a daily record of the number of applications received.

On the 7th of October 2017, she used spreadsheet software to produce the graph shown in **Figure 3**.

**Figure 3** illustrates the **total** number of applications received since the start of the application period, up to the end of each day in the application period.

**Figure 3** shows data for the whole 2016 application period, and for the 2017 period up to the 6th of October 2017.



**Figure 3**

(a) Approximately how many applications did the university receive **on** the 29th September 2017?

(2)

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(b) How many more days did it take in 2016 for the total applications to reach 1000 than it did in 2017?

(1)

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7 A journalist presents a story to the editor stating that:

***'District councils in England are having to cut costs to ever greater levels. From the tax year 2015-16 to the tax year 2016-17, the expenditure on employee salaries, benefits and expenses has reduced by 6%, on average.'***

The journalist is unable to quote a reliable source, and the editor suspects that the 'reduced' figure of 6% is too high. The editor has very limited statistical knowledge, so puts Diane, who has studied some statistics, in charge of investigating these figures.

Diane is unable to find complete data for the whole of England on district council expenditure. She uses data from a sample of district councils whose accounts she has found online.

Diane's collected data is presented in the table in **Figure 4**.

District Council	15-16 employee expenditure (£000)	16-17 employee expenditure (£000)	Percentage change (%)
A	25 059	24 328	-2.92
B	20 967	18 263	-12.90
C	195 953	204 564	4.39
D	11 367	11 359	-0.07
E	32 706	33 361	2.00
F	19 825	18 852	-4.91
G	10 825	10 925	0.92
H	9 202	8 300	-9.80
I	28 633	27 961	-2.35

(Data source: Data from nine district council accounts)

**Figure 4: Employee expenditure for Diane's sample of district councils**

(a) Write down the employee expenditure of District Council E in 2016-17.

(1)







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**Question 7 continued**

- (c) Diane later finds out that not all district councils store their accounts online, accessible to the public.

Explain why this might affect the validity of the test performed in (b).

(1)

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- (d) During the month of May each year, all district councils are legally required to have their accounts available online, accessible to the public.

Explain how a spreadsheet program could be used during May to improve the sampling method.

(3)

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**(Total for Question 7 is 14 marks)**



- 8 Andrew is a sports medicine researcher who is investigating correlation between different types of physical aptitude.

He takes a random sample of female gym members and assesses their physical aptitudes using the following activities.

### Beep test

This records the number of successful runs between two points 20 metres apart. The next point must be reached before the beep for the run to be considered successful. Each successful run is called a lap.

Level 1 is at the lowest beep speed. Each level has 10 laps at the same speed.

The speed levels get gradually faster for each level up to Level 10.

Andrew records, for each gym member, the **highest level reached**, along with the number of **completed laps at that level**.

### Maximum leg press

Andrew records, for each gym member, the maximum mass (in kg) that their legs can push.

Andrew's recorded results are presented in **Figure 5**.

Member	Beep test		Maximum leg press (kg)
	Highest level reached	Completed laps at highest level	
A	7	0	145
B	4	6	160
C	9	5	222
D	1	8	114
E	3	6	291
F	6	1	143
G	9	1	81
H	2	6	92
I	3	0	61
J	2	9	122
K	8	9	233

(Data source: Adapted from research data)

**Figure 5**













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