Please check the examination details below before entering your candidate information

Candidate surname	Other names

Pearson Edexcel Level 3 Certificate

Centre Number | Candidate Number

Time 1 hour 40 minutes

Paper reference **7MC0/01**

Mathematics in Context

PAPER 1: Comprehension

You must have: Ruler graduated in centimetres and millimetres, 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 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.
- Good luck with your examination.

Turn over ▶

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SECTION A

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

CYCLING

Refer to **data source A** in the source booklet for Question 1.

1 The table below shows information about the quarterly sales of new bicycles in the United Kingdom between 2015 and 2018.

Quarter	Sales of new bicycles (thousands)	4-point moving average (nearest thousand)
2015 Q1	398	
2015 Q2	403	
2015 Q3	363	404
2015 Q4	451	409
2016 Q1	418	423
2016 Q2	459	443
2016 Q3	442	467
2016 Q4	547	477
2017 Q1	459	475
2017 Q2	452	475
2017 Q3	442	475
2017 Q4	547	476
2018 Q1	463	478
2018 Q2	461	483
2018 Q3	462	.....
2018 Q4	592	

(a) Calculate the percentage increase in the total number of new bicycles sold from 2015 to 2016.

(3)

(b) (i) Explain why a moving average has been used with this data.

(1)

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(ii) Calculate the missing 4-point moving average.

(2)

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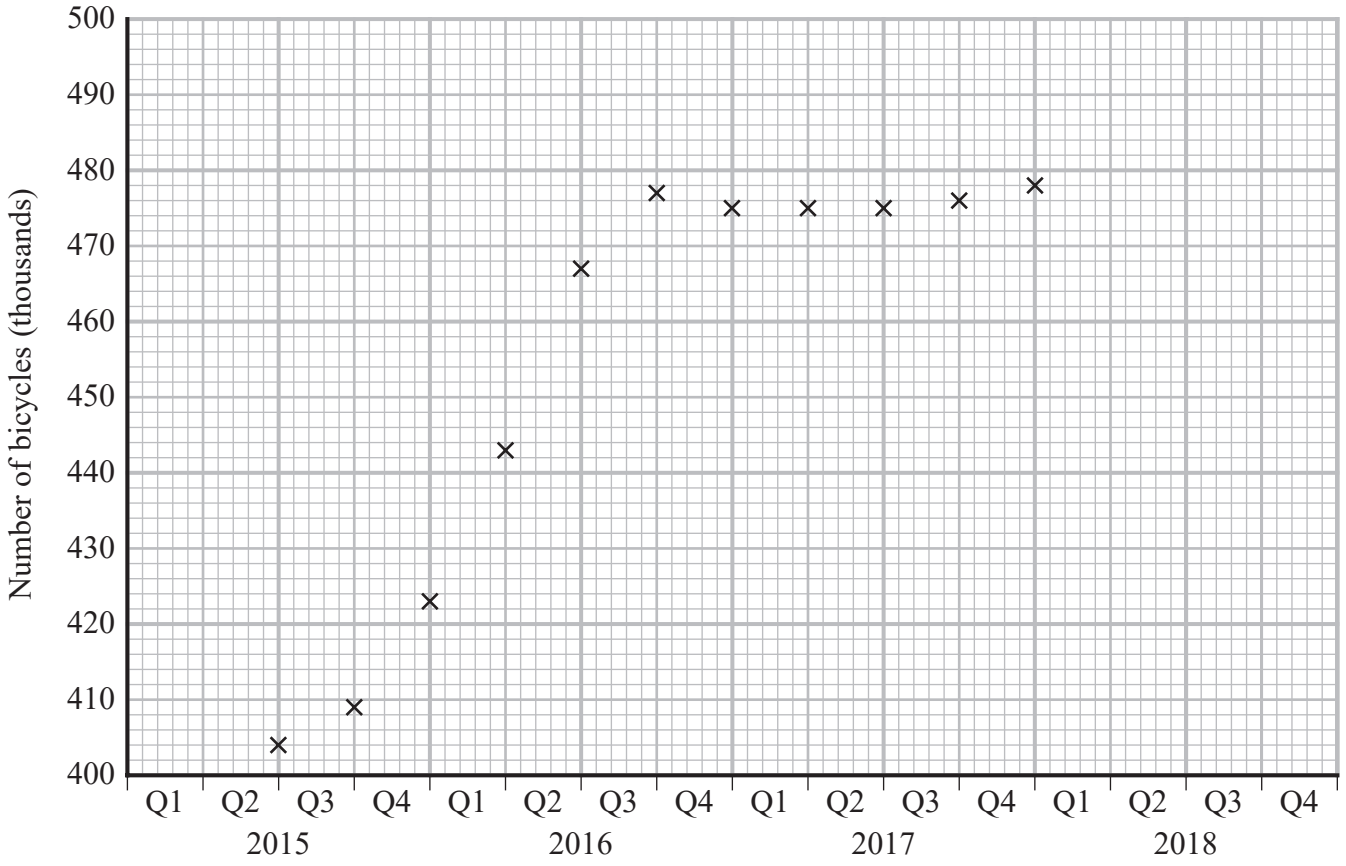
Sales of new bicycles in the United Kingdom,
4-point moving average 2015–2018



Eleven of the moving averages have been plotted on the grid.

(c) Plot the final **two** moving averages.

(1)

Two predictions were made for the sales of new bicycles for Q4 of 2019.

The predictions were 550 000 and 750 000

The predictions were made in Q2 of the years 2016 and 2018.

(d) (i) Which prediction was made in which year?
Give reasons for your answer.

(2)

(ii) Which prediction is likely to be the more reliable?
Give a reason for your answer.

(1)

(Total for Question 1 is 10 marks)

Refer to **data source B** in the source booklet for Question 2.

2 The table gives some information about the number of days cycling per week for the 1244 males.

Number of days cycling per week	**Number of males**				
5 – 7	364				
3 – 4	531				
1 – 2	349				
Total	1244				

(a) (i) Calculate an estimate for the mean number of days cycling per week for the males.

(4)

(ii) Calculate an estimate for the standard deviation of the number of days cycling per week for the males.

(3)

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An estimate for the mean number of days cycling per week for the females was 3.28

An estimate of the standard deviation for the number of days cycling per week for the females was 1.63

(b) By using the data above and your answers to (a), compare the number of days cycling per week for males and females.

(2)

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(Total for Question 2 is 9 marks)

Refer to **data source C** in the source booklet for Question 3.

3 (a) Explain why the total of the numbers in the non-active commute column in Table 4 is **not** 206 299

(1)

One person is selected at random from the 206 299 people who have a non-active commute and the 6751 people who cycle to work.

(b) (i) Show that the probability that this person cycles to work is 0.032 correct to 3 decimal places.

(1)

Given that this person cycles to work,

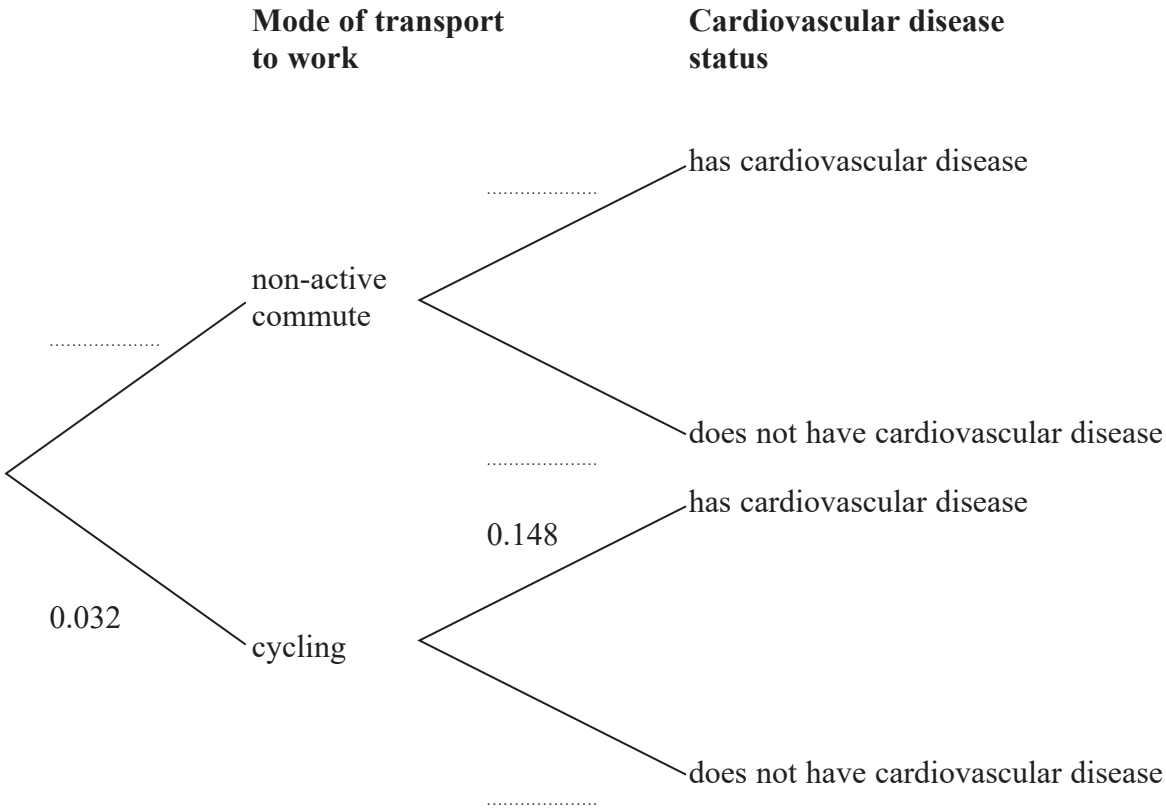
(ii) show that the probability that this person has cardiovascular disease is 0.148 correct to 3 decimal places.

(2)

The probability that a person with a non-active commute has cardiovascular disease is 0.235

(iii) Complete the probability tree diagram.

(2)



Tisam claims that cycling to work and having cardiovascular disease are independent events.

(iv) Determine whether or not cycling to work (A) and having cardiovascular disease (B) are independent events.

(3)

Tisam also claims that people who have a non-active commute to work are approximately 60% more likely to have cardiovascular disease than those who cycle to work.

(c) Determine whether this claim is correct.
Justify your answer.

(2)

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(Total for Question 3 is 11 marks)
(Total for CYCLING is 30 marks)

TOTAL FOR SECTION A IS 30 MARKS

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Turn over for SECTION B

SECTION B

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

FOOD

Refer to **data source D** in the source booklet for Questions 4 and 5.

4 What percentage of root crops, fruit and vegetables produced globally each year is **not** lost or wasted?

.....

(Total for Question 4 is 1 mark)

5 The table below shows the data from Table 5 in the source booklet ranked by food waste per person.

Country	Food waste per person (tonnes)	GDP per person (US$)		
Australia	361	47 000		
United States	278	59 500		
Japan	157	43 900		
Germany	154	44 800		
Portugal	135	32 200		
France	106	42 800		
South Korea	95	38 300		
United Kingdom	75	43 900		
Brazil	71	15 500		
Russia	56	25 500		
India	51	7100		
China	44	16 800		

(i) Calculate Spearman's rank correlation coefficient for the data in the table.

(6)

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Melanie thinks that there is more food waste per person in rich countries than in poor countries.

(ii) Is Melanie correct?
Justify your answer.

(1)

(Total for Question 5 is 7 marks)

Refer to **data source E** in the source booklet for Questions 6 and 7.

6 The EU aims to halve food waste per person by 2030.

One proposal was to reduce the amount of food waste per person by 5% of the previous year's food waste each year after 2017.

(a) (i) Determine whether this proposal would enable the EU to achieve its aim.

(3)

(ii) Calculate the **total** amount of food waste per person predicted by this proposal for the 14-year period from 2017 to 2030 inclusive.

(3)

An alternative proposal was to reduce the amount of food waste per person by a **fixed** amount each year after 2017.

(b) Calculate the fixed amount that would be needed for the EU to halve food waste per person by 2030.

(2)

(Total for Question 6 is 8 marks)

7 A newspaper report claims that a consumer in a high-income country contributes a larger proportion to the total food waste in their region than a consumer in a middle-income country or in a low-income country.

To what extent does the information in Table 6 support the newspaper's claim? Justify your answer.

(Total for Question 7 is 4 marks)

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Turn over for Question 8

Refer to **data source F** in the source booklet for Question 8.

8 (a) Calculate the water footprint per person per day for beef consumption in the United Kingdom in 2017.

(3)

Let m kg be the mass of soybeans that contains the same amount of protein as the average amount of beef consumed per person per year in the United Kingdom in 2017.

(b) Calculate the value of m.

(3)

Jon wants to reduce his yearly water footprint by 25%
He eats an average amount of beef every year.

Jon decides to replace the beef in his diet with soybeans.
The soybeans will have the same total amount of protein as the beef.
The rest of his diet will remain the same.

(c) Determine whether Jon will succeed in reducing his yearly water footprint by 25%
You must show detailed working to support your conclusion.

(4)

(Total for Question 8 is 10 marks)
(Total for FOOD is 30 marks)

TOTAL FOR SECTION B IS 30 MARKS
TOTAL FOR PAPER IS 60 MARKS

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Pearson Edexcel Level 3 Certificate

Time 1 hour 40 minutes

Paper reference **7MC0/01**

Mathematics in Context

PAPER 1: Comprehension

Source Booklet

Do not return this Booklet with the question paper.

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Formulae sheet

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

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

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

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

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

or $\sqrt{\left[\dfrac{\sum (x - \bar{x})^2}{n}\right]}$

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

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

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

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

The product moment correlation coefficient is

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

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

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

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

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

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

SECTION A: CYCLING

Data source A

Table 1: Sales of new bicycles in the United Kingdom 2015–2018

Quarter	Sales of new bicycles (thousands)
2015 Q1	398
2015 Q2	403
2015 Q3	363
2015 Q4	451
2016 Q1	418
2016 Q2	459
2016 Q3	442
2016 Q4	547
2017 Q1	459
2017 Q2	452
2017 Q3	442
2017 Q4	547
2018 Q1	463
2018 Q2	461
2018 Q3	462
2018 Q4	592

Data source B

Gender differences in recreational and transport cycling.

Adult members of a community cycling organisation completed an online survey about their cycling patterns in 2012. Table 2 shows some of the information from the survey.

Table 2: Number of days cycling per week

Number of days cycling per week	Number of males	Number of females
5 – 7	364	88
3 – 4	531	192
1 – 2	349	159
Total	1244	439

Data source C

Between April 2007 and December 2010, UK Biobank surveyed 227 272 participants who were in paid employment or self employed and did not always work at home.

Table 3 gives information about the main mode of transport to work for the participants in the survey.

All participants in the survey selected only one option from car, bus, train, walk, cycle.

A non-active commute is one using car, bus or train.

Table 3: Mode of transport to work

Non-active commute	Walk	Cycle
206 299	14 222	6751

Table 4 gives information about the health issues for the participants in the survey.

Some participants had two or more health issues; some participants had no health issues.

Table 4: Mode of transport to work and associated health issues

Health issue	Non-active commute	Walk	Cycle
Diabetes history	7 879	427	110
Hypertension	41 822	2721	869
Cancer history	11 620	856	286
Longstanding illness	51 615	3276	1286
Cardiovascular disease	48 550	3142	998
Depression history	65 780	4949	1782

SECTION B: FOOD

Data source D

33% of all food produced globally is lost or wasted every year. 45% of root crops, fruit and vegetables produced globally is lost or wasted per year. 25% of the food wasted globally could feed all 795 million undernourished people in the world.

The GDP (gross domestic product) for each country is the total value, in US dollars, of all the transactions (goods and services) in one year.

The GDP per person is the GDP for that country divided by the population of that country. Richer countries have a higher GDP than poorer countries.

Table 5: Food waste per person and GDP per person for 12 countries in 2017

Country	Food waste per person (tonnes)	GDP per person (US$)
Australia	361	47 000
Brazil	71	15 500
China	44	16 800
France	106	42 800
Germany	154	44 800
India	51	7100
Japan	157	43 900
Portugal	135	32 200
Russia	56	25 500
South Korea	95	38 300
United Kingdom	75	43 900
United States	278	59 500

Data source E

The EU and its member states are committed to meeting Sustainable Development Goal (SDG) 12.3, adopted in September 2015. This sets a target for member states to halve food waste at the retail and consumer level by 2030 and to reduce food losses along the food production and supply chains.

In 2017, food wastage in the EU was 275 kg per person per year.

Table 6: Annual food loss and waste worldwide 2017

Region	UN Income level	Food waste per person by stage (kg)					Total
		Pre-harvest	Post-harvest	Processing	Distribution	Consumer	
European Union (EU)	High	99	30	34	19	93	275
North America and Oceania	High	98	32	31	23	118	302
Industrialised Asia	Upper middle	63	46	21	31	72	233
Latin America	Middle	87	49	33	26	24	219
North Africa, West and Central Asia	Middle	71	50	41	36	35	233
South and Southeast Asia	Lower middle	38	43	12	20	11	124
Sub-Saharan Africa	Low	64	65	23	24	7	183

Data source F

The water footprint measures the amount of water used to produce each of the goods and services we use. It can be measured for a single process, such as growing rice, for a product, such as a pair of jeans, for the fuel we put in our car, or for an entire multinational company.

The water footprint can also tell us how much water is being consumed by a country – or globally – in a specific river basin or from an aquifer. In the United Kingdom domestic water use only accounts for around 4% of an individual's water footprint. Water scarcity affects over 2.7 billion people for at least one month each year. An individual country's water footprint can have a global effect as many goods and foods are imported.

The United Kingdom has an average water footprint of 2757 litres per person per day.

In 2017 the average amount of beef consumed per person in the United Kingdom was 18.4 kg.

Table 7: Water footprint and nutritional content of some meats and soybeans

Foodstuff	Water footprint (litres/kg)	Nutritional content (per kilogram)		
		Calories	Protein (g)	Fat (g)
Chicken meat	4325	1440	127	100
Pig meat	5988	2786	105	259
Sheep/goat meat	8763	2059	139	163
Beef	15 415	1513	138	101
Soybeans	2145	1730	166	90

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Source information

Data source A adapted from:
Crown Copyright
https://www.cyclinguk.org/statistics

Data source B adapted from:
https://ijbnpa.biomedcentral.com/track/pdf/10.1186/1479-5868-9-106

Data source C adapted from:
https://www.bmj.com/content/357/bmj.j1456

Data source D adapted from:
https://www.statista.com/statistics/933059/per-capita-food-waste-of-selected-countries/
https://data.worldbank.org/indicator/NY.GDP.PCAP.PP.CD?view=chart

Data source E adapted from:
https://www.governmenteuropa.eu/reducing-food-waste-eu/91604/
https://www.statista.com/statistics/948358/global-food-loss-and-waste-per-capita-by-stage-and-region/
https://datahelpdesk.worldbank.org/knowledgebase/articles/906519-world-bank-country-and-lending-groups

Data source F adapted from:
https://www.nationalbeefassociation.com/resources/beef-statistics/
https://www.foodmatterslive.com/news-and-comment/comment/meat-free-diets-could-cut-water-footprint
https://evgenii.com/water-footprint/en/
https://www.healthline.com/nutrition/foods/soybeans#nutrition