



Business Mathematics

31 May 2016

Examination Paper

Section A	Answer ALL questions from this section.
Section B	Answer any THREE (3) questions from this section. Clearly cross out surplus answers. Failure to do this will result in only the first THREE (3) answers being marked.

Time: 2.5 hours

The maximum mark for this paper is 100.

Any reference material brought into the examination room must be handed to the invigilator before the start of the examination.

A formula sheet is provided at the beginning of the question paper.

Candidates are allowed to use a scientific calculator during this examination.

Graph paper will be provided by the centre.

You must show your workings.
Marks are awarded for these in all sections.

1. Solution of quadratic equations

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

2. Measures of location

Population mean

Ungrouped data:

$$\mu = \frac{\sum x}{N}$$

Ungrouped frequency table:

$$\mu = \frac{\sum fx}{N} = \frac{\sum fx}{\sum f}$$

Grouped frequency table:

$$\mu = \frac{\sum fm}{N} = \frac{\sum fm}{\sum f}$$

Sample mean

Ungrouped data:

$$\bar{x} = \frac{\sum x}{n}$$

Ungrouped frequency table:

$$\bar{x} = \frac{\sum fx}{n} = \frac{\sum fx}{\sum f}$$

Grouped frequency table:

$$\bar{x} = \frac{\sum fm}{n} = \frac{\sum fm}{\sum f}$$

3. Measures of dispersion

Population variance

Ungrouped data:

$$\sigma^2 = \frac{\sum(x - \mu)^2}{N}$$

Population standard deviation

Ungrouped data:

$$\sigma = \sqrt{\frac{1}{N} \left[\sum (x - \mu)^2 \right]} = \sqrt{\frac{1}{N} \left[\sum x^2 - \frac{(\sum x)^2}{N} \right]}$$

Ungrouped frequency table:

$$\sigma = \sqrt{\frac{1}{N} \left[\sum f(x - \mu)^2 \right]} = \sqrt{\frac{1}{N} \left[\sum fx^2 - \frac{(\sum fx)^2}{N} \right]} = \sqrt{\frac{1}{\sum f} \left[\sum fx^2 - \frac{(\sum fx)^2}{\sum f} \right]}$$

Grouped frequency table:

$$\sigma = \sqrt{\frac{1}{N} \left[\sum f(m - \mu)^2 \right]} = \sqrt{\frac{1}{N} \left[\sum fm^2 - \frac{(\sum fm)^2}{N} \right]} = \sqrt{\frac{1}{(\sum f)} \left[\sum fm^2 - \frac{(\sum fm)^2}{\sum f} \right]}$$

Sample variance

Ungrouped data:

$$s^2 = \frac{\sum(x - \bar{x})^2}{n - 1}$$

Sample standard deviation

Ungrouped data:

$$s = \sqrt{\frac{1}{n - 1} \left[\sum (x - \bar{x})^2 \right]} = \sqrt{\frac{1}{n - 1} \left[\sum x^2 - \frac{(\sum x)^2}{n} \right]}$$

Ungrouped frequency table:

$$s = \sqrt{\frac{1}{n - 1} \left[\sum f(x - \bar{x})^2 \right]} = \sqrt{\frac{1}{n - 1} \left[\sum fx^2 - \frac{(\sum fx)^2}{n} \right]} = \sqrt{\frac{1}{(\sum f) - 1} \left[\sum fx^2 - \frac{(\sum fx)^2}{\sum f} \right]}$$

Grouped frequency table:

$$s = \sqrt{\frac{1}{n - 1} \left[\sum f(m - \bar{x})^2 \right]} = \sqrt{\frac{1}{n - 1} \left[\sum fm^2 - \frac{(\sum fm)^2}{n} \right]} = \sqrt{\frac{1}{(\sum f) - 1} \left[\sum fm^2 - \frac{(\sum fm)^2}{\sum f} \right]}$$

4. Exponential forecasting

$$F_{t+1} = F_t + \alpha(x_t - F_t)$$

Section A
Answer ALL questions from this section

Marks

Question 1

Express 3204 in standard form.

1

Question 2

Calculate 7% of 485.

1

Question 3

Round 93452 to three significant figures.

1

Question 4

Calculate:

$$-3(2 + 6)$$

1

Question 5

The number of passengers on a train is recorded. Is this data continuous or discrete?

1

Question 6

What fraction of a week is two days?

1

Question 7

Expand:

$$7x(2x - 3)$$

1

Question 8

The probability that it will rain on Wednesday is 0.7. What is the probability that it will not rain on Wednesday?

1

Question 9

Simplify:

$$m^4 \times m^3 \times m^{-1}$$

1

Question 10

Find:

$$\frac{2}{5} + \frac{1}{4}$$

1

Question 11

Calculate the first three 4-point moving averages for the following data:

23 37 29 24 31 39

3

Question 12

A savings account offers interest at a rate of 3.5% compounded annually. If Richard opens an account with \$100 and leaves it for 9 years, how much will he have at the end of 9 years? Give your answer to the nearest dollar (\$).

3

Question 13

Solve the following equation:

$$4(x + 3) = 8x - 8$$

3

Question 14

Calculate the mean, median and mode of the following data set:

11 11 13 14 14 14 15 15 19 19 20 21

3

Question 15

Solve these simultaneous equations algebraically.

$$3x - 2y = 12$$

$$x + 4y = 18$$

3

Question 16

Find:

$$\frac{1}{2} \div \frac{2}{5} - \frac{2}{3} \times \frac{3}{4}$$

3

Question 17

A box contains 36 pens. $\frac{1}{4}$ of the pens are blue and the rest are black. 24 of the pens have lids. If one pen is selected at random from the box, what is the probability that it will be black and have a lid?

3

Marks

Question 18

The price of a train ticket increases by 15%

The new price of a train ticket is £7.59

What was the price of the train ticket before the increase?

3

Question 19

Find the equation of the line perpendicular to the line $y = 2x + 3$ that passes through the point (4, 7).

3

Question 20

Divide 240 into the ratio 3:2:1

3

Total 40 Marks

Section B**Answer any THREE (3) questions from this section****Marks****Question 21**

- a) There are 16 female students and 12 male students in a science class. What is the ratio of females to males? Write your answer in its simplest form. **1**
- b) A recipe for 20 biscuits requires 200g of flour. How much flour would you need to make 36 biscuits? **2**
- c) A bakery sells three varieties of biscuits: lemon, raisin and chocolate. On a particular day the bakery sells 72 biscuits in the ratio 1:2:5
- i) What fraction of total sales are the chocolate biscuits? **1**
- ii) How many chocolate biscuits were sold? **1**
- iii) If the bakery makes 25p profit on each raisin biscuit sold, how much profit did the bakery make on the raisin biscuits? **3**
- iv) The next day, the three types of biscuit are sold in the same ratio, i.e. 1:2:5 but on this particular day, 22 raisin biscuits are sold. How many biscuits are sold altogether? **2**
- d) A survey recorded the time a group of students spent watching television one evening. Complete the table below and use this information to draw a histogram of the data. **7**

Time t (minutes)	Frequency	Frequency density
$0 \leq t < 20$	25	
$20 \leq t < 45$	45	
$45 \leq t < 75$	75	
$75 \leq t < 120$	54	
$120 \leq t < 150$	15	
$150 \leq t < 200$	10	

- e) A survey of 90 people asked which supermarket they preferred. The results are shown in the table below: **3**

Supermarket	A	B	C	D	E
Frequency	14	23	10	37	6

A pie chart of the data is drawn to illustrate the results. Calculate the angle of the sector for Supermarket A, Supermarket C and Supermarket D.

Total 20 Marks

Question 22

- a)** Ibrahim, Ingrid, Sarah and John apply for two job vacancies. Two people are selected.
- i) List all the possible pairs selected. **3**
 - ii) What is the probability that both of them will have the same first letter in their name? **1**
 - iii) What is the probability that both of them will have a different first letter in their name? **1**
- b)** A fair, five sided spinner numbered 1 to 5 is rolled.
- i) What is the probability that the spinner will land on a 5? **1**
 - ii) What is the probability that the spinner will land on a 4 or a 5? **2**
- c)** Joe tosses a coin. The coin is biased so that the probability of landing on tails is $\frac{3}{4}$
- i) What is the probability of the coin landing on heads? **1**
 - ii) The coin is tossed twice. What is the probability that the coin will land on tails twice? **2**
- d)** A café records the number of customers over a two week period. The café is closed on a Sunday. The results are shown in the table below: **9**

	Week 1						Week 2					
Day	M	T	W	Th	F	S	M	T	W	Th	F	S
Number of customers	85	81	76	98	112	123	86	78	70	90	99	113

Draw a time series graph for the data.

Total 20 Marks

Question 23

a) Consider the TWO (2) graphs $y = 4x + 1$ and $y = 6x - \frac{1}{2}$

i) Which of the TWO (2) graphs will be the steepest? **1**

ii) Complete the following table of values for the graphs $y = 4x + 1$ and $y = 6x - \frac{1}{2}$ **6**

x	-2	-1	0	1	2
$y = 4x + 1$		-3		5	

x	-2	-1	0	1	2
$y = 6x - \frac{1}{2}$	-12.5			5.5	

iii) Draw accurate graphs for both equations and set of values above using the graph paper. **7**
 Use the graphs to solve graphically the simultaneous equations $y = 4x + 1$ and $y = 6x - \frac{1}{2}$

b) A box contains seven black pens and six green pens. Two pens are selected at random from the box without replacement.

i) Draw a tree diagram to show all the possible outcomes. **4**

ii) Calculate the probability that both pens selected are green. **2**

Total 20 Marks

Question 24

- a) The number of students absent from a college is recorded each day for two weeks (they do not have lessons on a Wednesday and Sunday). The results are shown in the table below.

	Week 1					Week 2				
Day	Mon	Tue	Thu	Fri	Sat	Mon	Tue	Thu	Fri	Sat
Number of absent students	...	20	18	23	27	30	21	16	24	29

- i) Outline why it is appropriate to calculate a five-point moving average for this data. **1**
- ii) The value of the first five-point moving average is 24. Calculate the number of students absent on Monday of week 1. **2**
- b) The height of a group of people is recorded and shown in the table below.

Height, h (cm)	Frequency
$120 \leq h < 125$	5
$125 \leq h < 130$	11
$130 \leq h < 135$	15
$135 \leq h < 140$	19
$140 \leq h < 145$	22
$145 \leq h < 150$	24
$150 \leq h < 155$	18
$155 \leq h < 160$	11

- i) Is this data quantitative or qualitative? **1**
- ii) How many people's heights were recorded? **1**
- iii) What is the modal class of the data? **1**
- iv) Calculate an estimate of the population mean for this data. Give your answer to 1 decimal place. **5**
- v) Calculate an estimate of the population standard deviation for the data. Give your answer to 1 decimal place. **9**

Total 20 Marks

End of paper