NCFE Level 3 Certificate in
Mathematics for Everyday Life (603/3437/X)

Paper 2
Business and Administration
Paper number: **SAMPLE**

DATE   **9:30am – 11:30am**

Time allowed: 2 hours

Learner instructions
- Use black or blue ink.
- Read each question carefully.
- Answer **all** questions.
- Write your responses in the spaces provided.
- Use the graph paper provided where instructed.
- All of the work you submit **must** be your own.

Learner information
- The marks available for each question are shown in brackets.
- The maximum mark for this paper is **90**.
- You may use a calculator.

To be completed by the examiner	Mark
Section 1	
Section 2	
Section 3	
Section 4	
TOTAL MARK	

Please complete the details below clearly and in BLOCK CAPITALS.

Learner name _____

Centre name _____

Learner number [   ]   Centre number [   ]

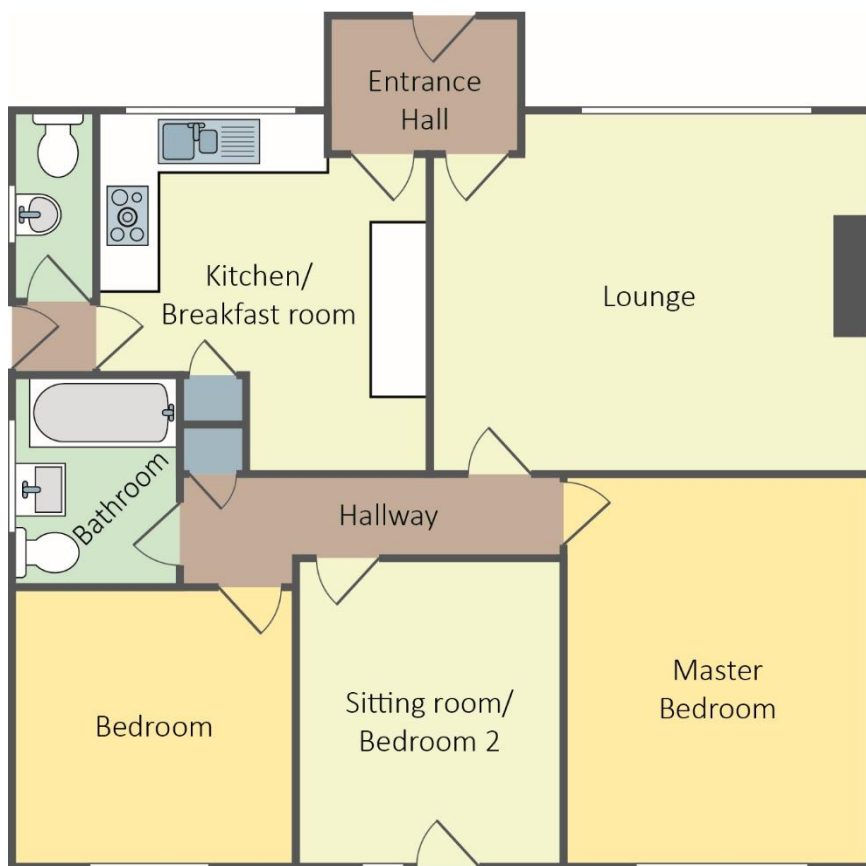**Do not turn over until the invigilator tells you to do so.**

Section 1

This section has a possible **26 marks**.

We recommend that you spend **35 minutes** on this section.

Answer **all** questions in the spaces provided.

1 The diagram below shows the floorplan of a bungalow that is currently on sale in Exeter for £260,000.

TOTAL APPROX. FLOOR AREA 837 SQ. FT. (77.8 SQ.M.)

a) i. What is the price per m^2 of this house based on the information given?

[1 mark]

ii. According to **Article A,** this bungalow should cost approximately £194,200

Give **two** possible reasons for this discrepancy.

[2 marks]

iii. Based on **Article A,** how much would this bungalow be worth if it was located in each of the following locations?

Give your answer to the nearest whole pound.

Burnley.

[1 mark]

Cambridge.

[1 mark]

iv The owners of the bungalow are considering building a conservatory on to their property. What size would you suggest they build the conservatory? Explain your thinking.

[2 marks]

v. According to the government figures, how much value would the conservatory add to the property in Exeter?

[1 mark]

b) The owners of the bungalow decide to have the extension built and then re-advertise the property.

The table shows some of the activities involved in building the extension.
The table gives their durations and their immediate predecessors.

	Activity	Immediate predecessors	Duration (days)
A	Excavate	-	2
B	Lay the foundations	A	4
C	Put up a rough wall	B	10
D	Put on the roof	C	4
E	Install the exterior plumbing	C	2
F	Install the interior plumbing	E	2
G	Lay patio	D	3
H	Do the exterior finishing	E,G	4
I	Do the electrical work	C	5
J	Install doors and windows	F,I	3
K	Do the internal finishing	J	5
L	Install exterior fittings	H	2
M	Install interior fittings	K	2

i. Draw an activity-on-arc network for these activities.

[4 marks]

ii. The activity network includes one dummy activity. Explain why this dummy activity is needed.

[1 mark]

iii. Mark on your diagram the early and late times for each event. Give the minimum completion time and identify the critical activities.

[6 marks]

Use your diagram to complete this question.

iv. What are the float times for each non-critical activity?

[2 marks]

v. Draw a Gantt chart to illustrate the situation.

[3 marks]

vi. Each task is completed by only one person.

Explain why Simon will require help if the tasks are all to be completed within the minimum time.

[1 mark]

vii. Simon's friends offer to help. What is the minimum number of friends needed to complete the project in the minimum time?

[1 mark]

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Please turn over for the next question.

Section 2

This section has a possible **19 marks**.

We recommend that you spend **25 minutes** on this section.

Answer **all** questions in the spaces provided.

2 a) The table shown below is an extract of the data given in **Article B**. It contains data on the busiest 14 airports in the UK.

Airport	Number of Flights	On time (%) (2017)	Mean delay in minutes (2017)	Mean delay in minutes (2016)
Heathrow	471041	77.43	12.39	13.52
Gatwick	281710	65.31	18.83	22.90
Manchester	193512	69.57	17.17	14.97
Stansted	161270	69.18	16.46	14.47
Edinburgh	116771	72.69	14.65	14.81
Birmingham	109065	68.58	17.37	14.61
Luton	104062	68.68	17.08	18.25
Glasgow	88246	74.91	14.45	14.23
London City	75797	81.60	10.45	12.83
Bristol	63332	68.81	17.82	14.64
Aberdeen	48588	75.97	14.98	13.75
Newcastle	43278	80.08	11.73	11.80
Belfast International	39972	74.73	15.74	16.78
Southampton	39262	78.25	13.71	12.89

i. In their in-flight magazine, London City Airport claimed to be the most reliable airport in the UK.
Give **two** reasons to show how this data supports their claim.

[2 marks]

ii. In their in-flight magazine, Gatwick claimed to be the most improved airport in the UK.

Give one reason to show how this data supports their claim **and** one reason why this claim is possibly misleading.

[2 marks]

Please turn over for the next question.

b) Ms Bell asked each member of her class to represent this information on a suitable diagram and then make observations as to what their diagram shows.

Alan drew a scatter graph of the mean delay time in 2017 against the mean delay time in 2016. His scatter graph is shown below.
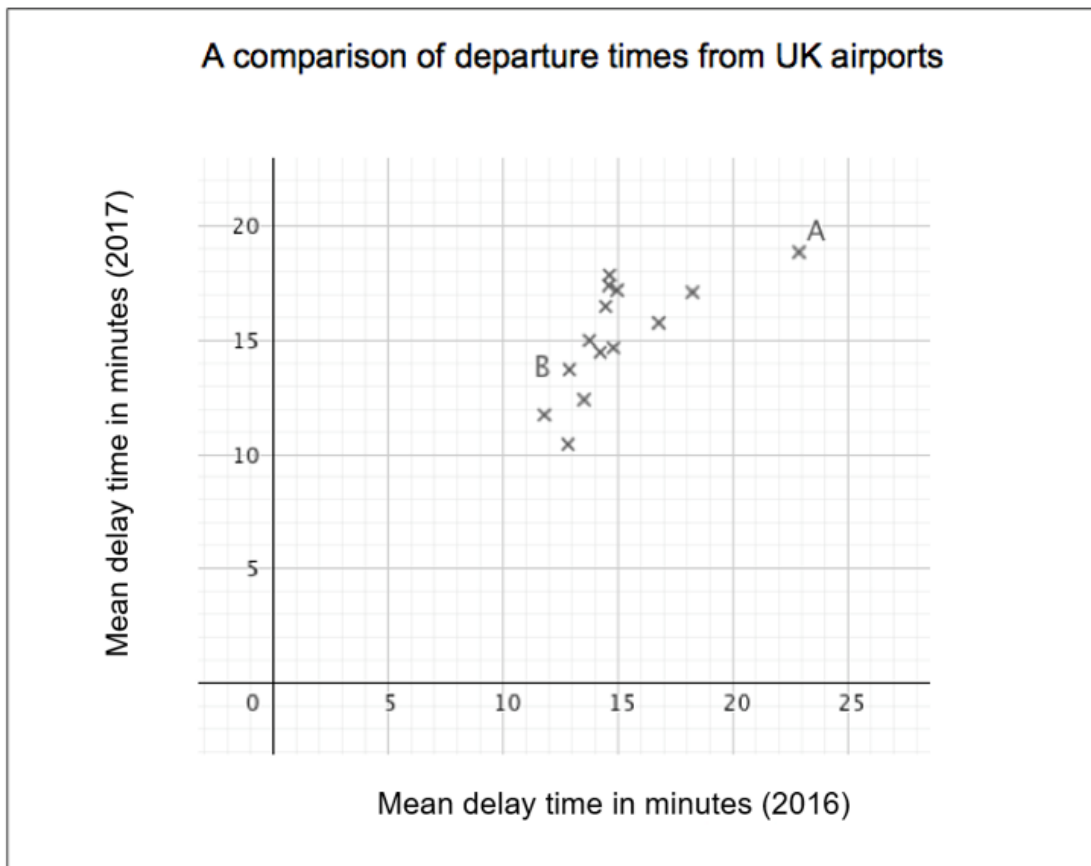
i. Which airports are represented by the points labelled A and B?

[2 marks]

ii. What type of correlation does his graph show?

[1 mark]

iii. What does this mean in this context?

[1 mark]

iv. Using the table below, calculate the value of Spearman's rank correlation coefficient for these data.

The formula for Spearman's rank is $r_s = 1 - \dfrac{6 \sum d^2}{n(n^2 - 1)}$

[5 marks]

Mean delay in minutes (2017)	Rank (r_1)	Mean delay in minutes (2016)	Rank (r_2)	d	d^2
12.39	3	13.52			
18.83		22.90	14		
17.17		14.97			
16.46		14.47			
14.65		14.81			
17.37		14.61			
17.08		18.25			
14.45	5	14.23			
10.45	1	12.83			
17.82		14.64			
14.98		13.75			
11.73	2	11.80			
15.74		16.78			
13.71	4	12.89			

Please turn over

c) Heidi summarised the key points in the data as shown in the table below.

	Minimum (Q_0)	Lower quartile (Q_1)	Median (Q_2)	Upper quartile (Q_3)	Maximum (Q_4)
2016	11.80	13.58	14.54	14.93	22.90
2017	10.45	13.71	15.36	17.17	18.83

She then drew two comparative boxplots of the data as shown below.
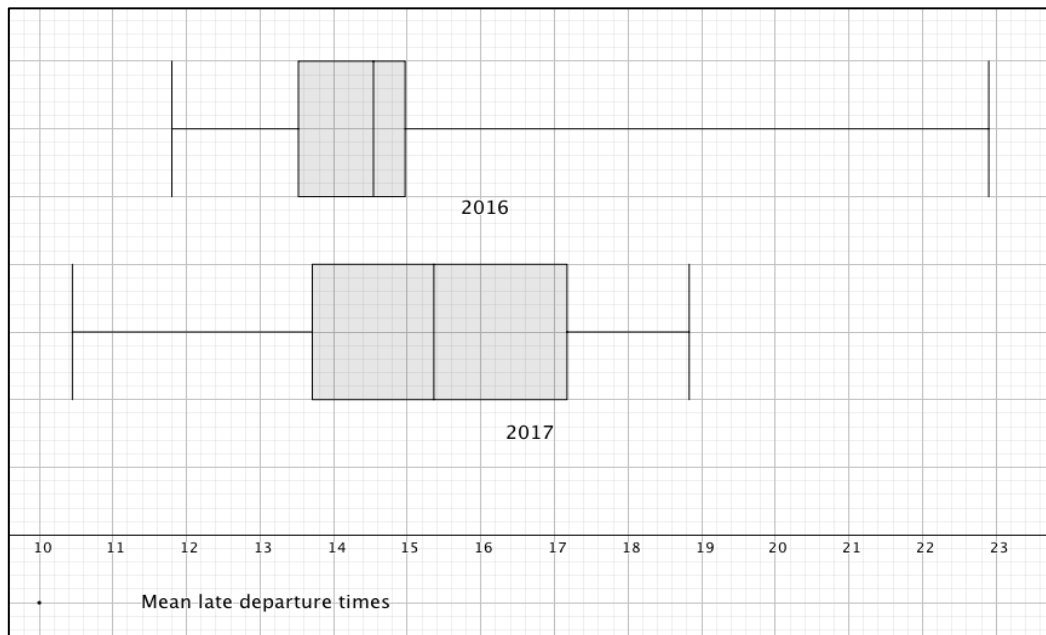
i. Write down **two** differences between the two sets of data and explain the significance of these differences.

[2 marks]

ii. In Heidi's report, she claimed that the diagrams suggest there may be some outliers in the 2016 data but not in the 2017 data.

Test Heidi's theory by identifying any outliers in the 2016 data.

[4 marks]

Section 3

This section has a possible **19 marks.**

We recommend that you spend **25 minutes** on this section.

Answer **all** questions in the spaces provided.

3 a) Mark is an industrial air conditioning salesman based in York.

As a full demonstration takes 1.5 days, he can see up to 3 potential customers in a week.

Over a long period of time he has recorded the total number of sales made per week and the probability distribution of the number of sales during this period, X, is shown in the table below.

No of sales (r)	0	1	2	3
Probability P(X=r)	0.76	0.15	?	0.01

i. Show that P(X=2) = 0.08

[2 marks]

**ii.** Find the expected number of sales in one week.

[2 marks]

iii Find the expected number of sales in one year, assuming that 52 weeks in the year are worked.

[1 mark]

**Please turn over for the next question.**

b) Mark is in York when he gets an urgent sales enquiry from a company in Carlisle. The company stress that if Mark wants the sale, it is important that he gets there as soon as possible.

A road map of the area is shown below. Due to roadworks there is currently no direct route from York to Scotch Corner.
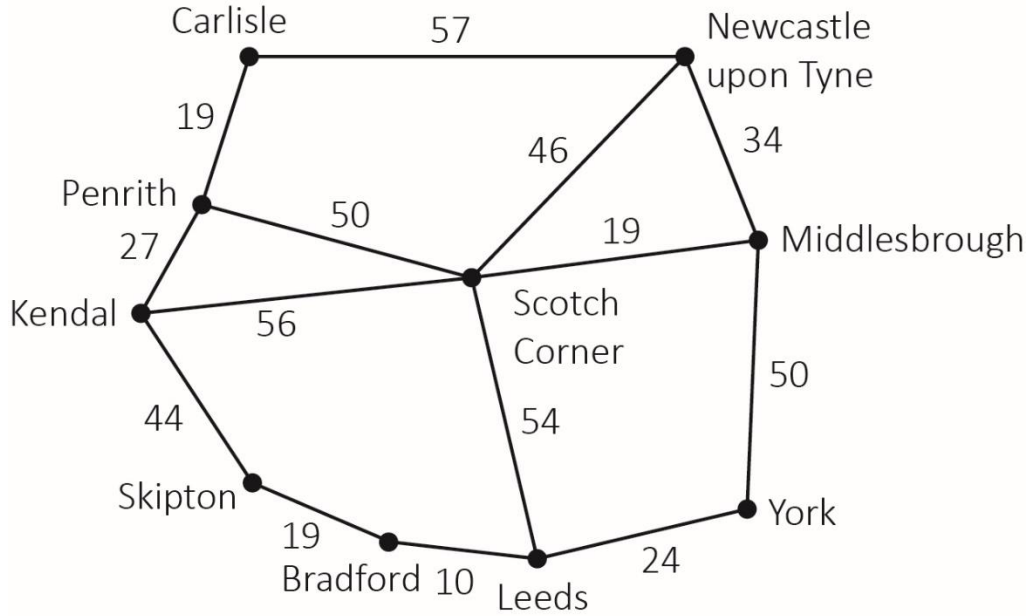
i. Find the shortest route from York to Carlisle using Dijkstra's algorithm.
You should use the diagram below to show all of your working.

[5 marks]
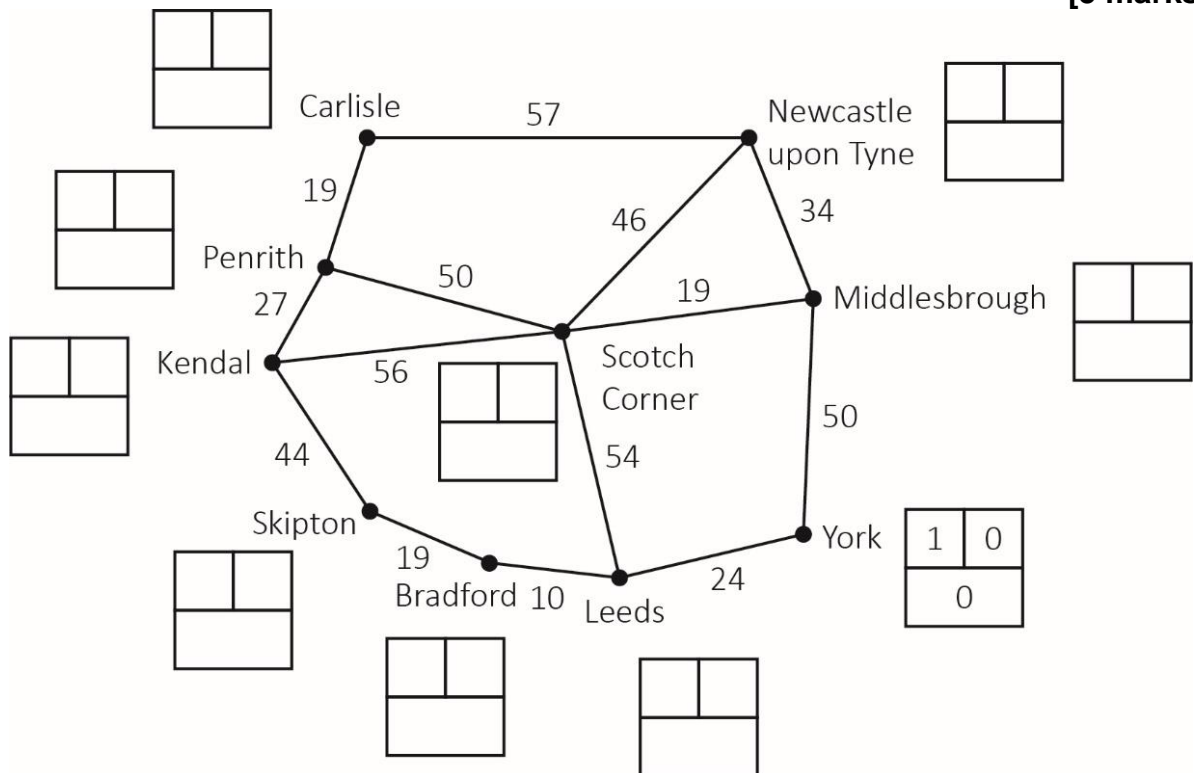
c) Mark sells two air conditioning models, A and B. Historical records indicate that 20% of his sales are for model A.

So far this year, he has made 13 sales.

i. How many of these sales would be expected to be of model A?

[2 marks]

ii. What is the probability of each of the following:

That **none** of the sales are for model A?

[2 marks]

That **exactly** 4 of the sales are for model A?

[2 marks]

Please turn over

That at **least** 4 of the sales are for model A?

[3 marks]

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Section 4

This section has a possible **26 marks.**

We recommend that you spend **35 minutes** on this section.

Answer **all** questions in the spaces provided.

4 a) Oliver Hughes and his daughter Emma both work for a marketing company.

Mr Hughes is the managing director and earns £66,000 per year.
Emma is an apprentice and is paid £10.98 per hour. She normally works 38 hours each week.

Mr Hughes pays 8% of his gross salary into a private pension fund and has never had a student loan.
Emma pays 3.5% of her salary into a pension fund and has a student loan of £18,000. She began her course on 1st September 2014.

Both of them have the same standard personal allowance for 2017-18 and have NI deducted at source.

No tax is paid on personal pension contributions.

i. Calculate Mr Hughes' net income for 2017-18

[6 marks]

ii. Calculate Emma's net income for April 2017 assuming she worked 196 hours.

[6 marks]

Please turn over for the next question.

b) In marketing, half-life is a formula for estimating the total responses to be expected from a direct marketing campaign to regular customers.

The half-life of an offer is the day when half of the consumer responses to the mailing have been received. The symbol for half-life is $T\frac{1}{2}$

For example, if the half-life of a popular clothes catalogue is 20 days, and it is mailed to 1000 customers, 500 will respond in the first 20 days. In the next 20 days, another 250 people will respond and in the next 20 days 125 more customers will respond.

i Mr Hughes has asked Emma to predict the number of clients yet to respond to a new cruise ship offer sent to 2000 regular clients of the travel agent.

Past experience tells Mr Hughes that the half-life of such promotions is 3 days.

Complete the table below for Emma.

[2 marks]

Time (days)	Customers yet to respond to the offer.
0	2000
3	1000
6	
9	
12	
15	

ii. Using the completed table, draw a graph to show your results.

[3 marks]

You must use the graph paper provided.

iii. From your graph, estimate for Mr Hughes each of the following:

- The number of customers who have not responded after 5 days.
- The time taken for said campaign to be over*.

*The campaign is "over" when at least 95% of customers have responded.

[2 marks]

Please turn over for the next question.

c) A popular supermarket mailshots 1600 of its most regular customers every two days with a different special offer and asks Emma to predict the level of response.

The half-life of this offer is two days.

Emma uses a spreadsheet to monitor the expected number of customers yet to respond over the first 11 days of the campaign.

	A	B	C	D	E	F	G	H
1	Offer Day	Offer 1	Offer 2	Offer 3	Offer 4	Offer 5	Offer 6	Totals
2	1	1600	x	x	x	x	x	1600
3	3	800	1600	x	x	x	x	2400
4	5	400	800	1600	x	x	x	
5	7	200	400		1600	x	x	
6	9	100				1600	x	
7	11	50					1600	

i. What would be the formula written in cell H7?

[1 mark]

ii. Complete the remainder of the spreadsheet above.

[2marks]

iii. What does the total in column H represent for any particular time?

[1 mark]

iv. Sketch a graph of 'Totals against Time' from these results.

[1 mark]

v. Comment on the shape of your graph and what this implies.

[2 marks]

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Assessment Objective Grid

Question	AO1	AO2	AO3	Total
1				
2				
3				
4				
Total				