NCFE

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

Paper 2
Health and Science
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 [   ]

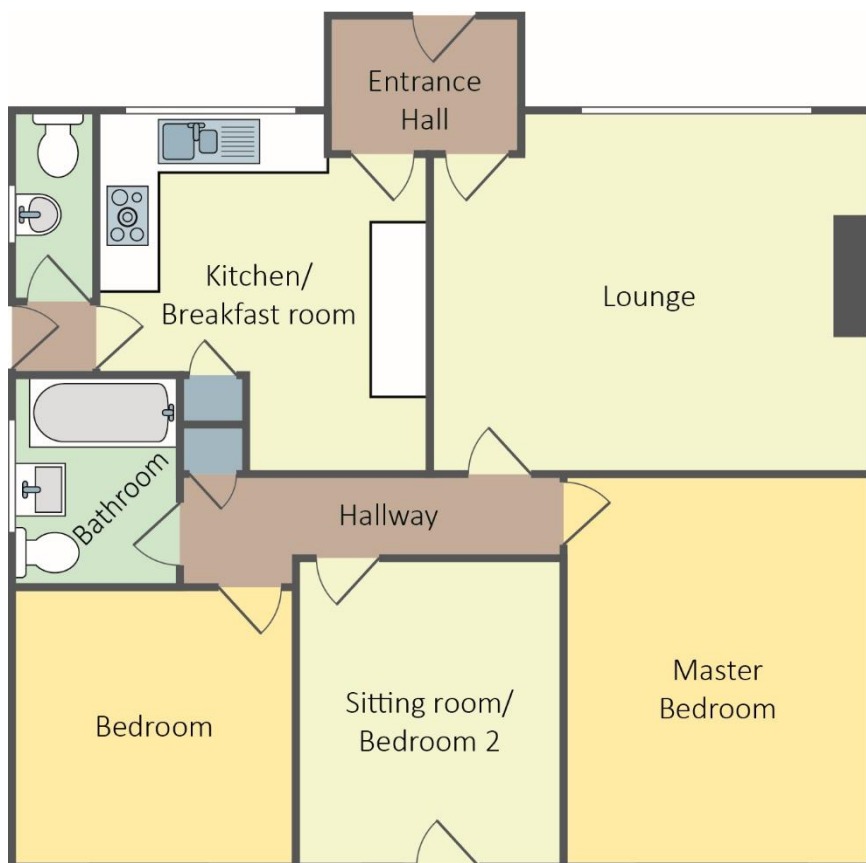**Do not turn over until the invigilator tells you to do so.**

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]

Please turn over

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]

Please turn over

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.

A comparison of departure times from UK airports
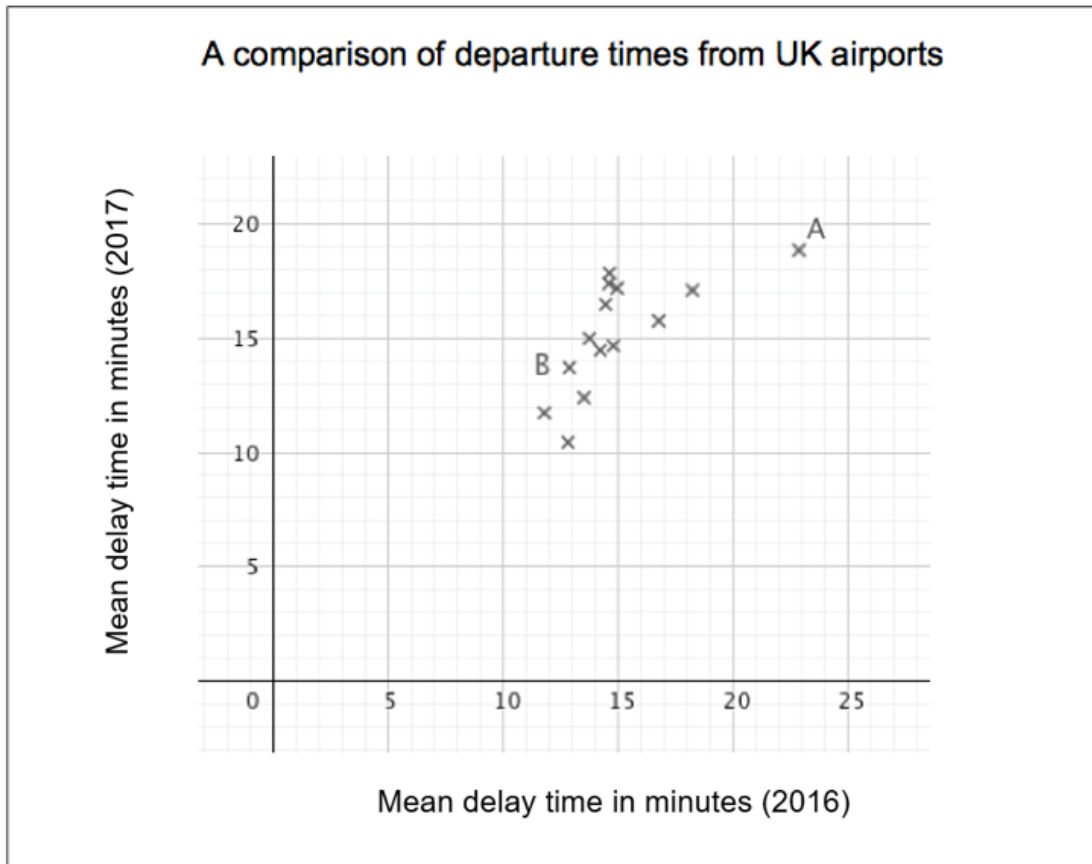
i. Which airports are represented by the points labelled A and B?

[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.
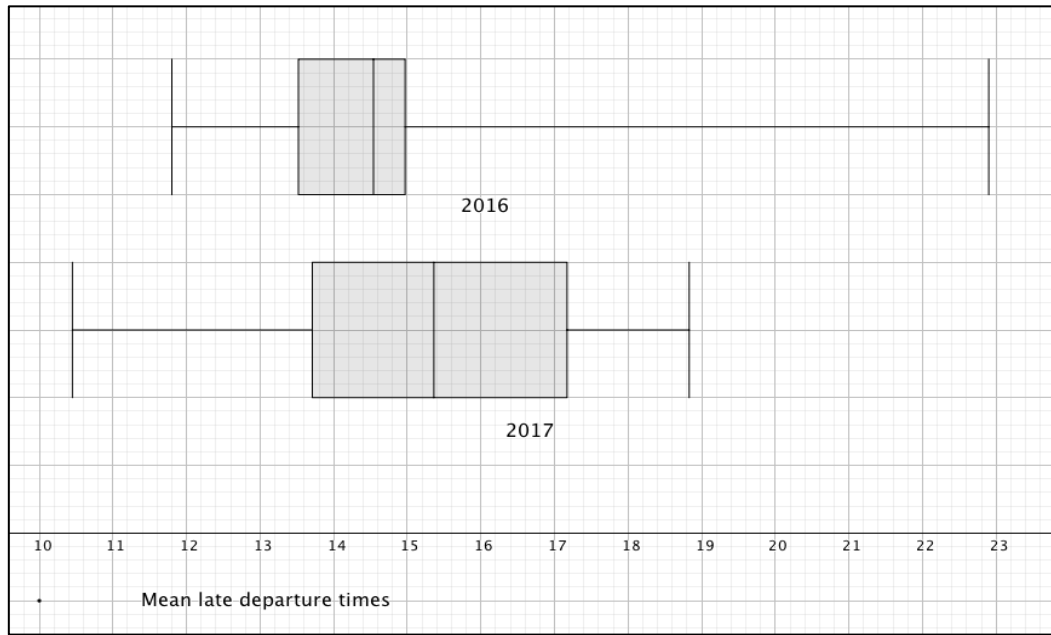
i. Write down **two** differences between the two sets of data and explain the significance of these differences.

[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

3 a) The number of accidents at a particular junction between 4:30pm and 6:30pm on a Friday is between 0 and 3.

Over a long period of time the total number of accidents during this period is recorded and the probability distribution of the number of accidents during this period, X, is shown in the table below.

No of accidents (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 accidents on a Friday between 4.30pm and 6.30pm.

[2 marks]

iii. Find the expected number of accidents on a Friday between 4.30pm and 6.30pm in one year.
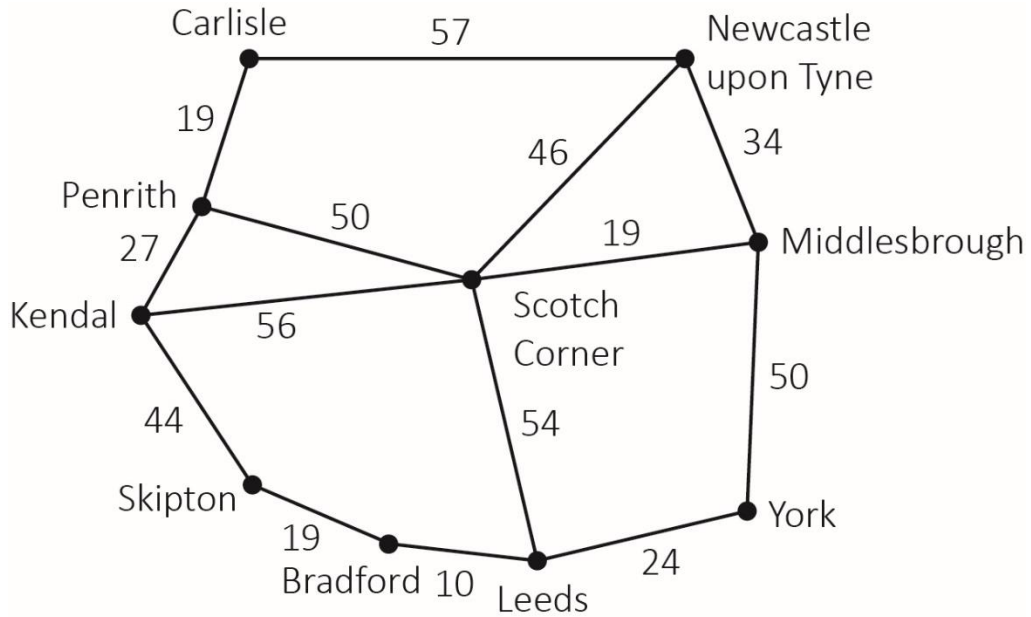
[1 mark]

Please turn over for the next question.

b) Following an accident at the junction, a paramedic travels from York to the accident scene in Carlisle.
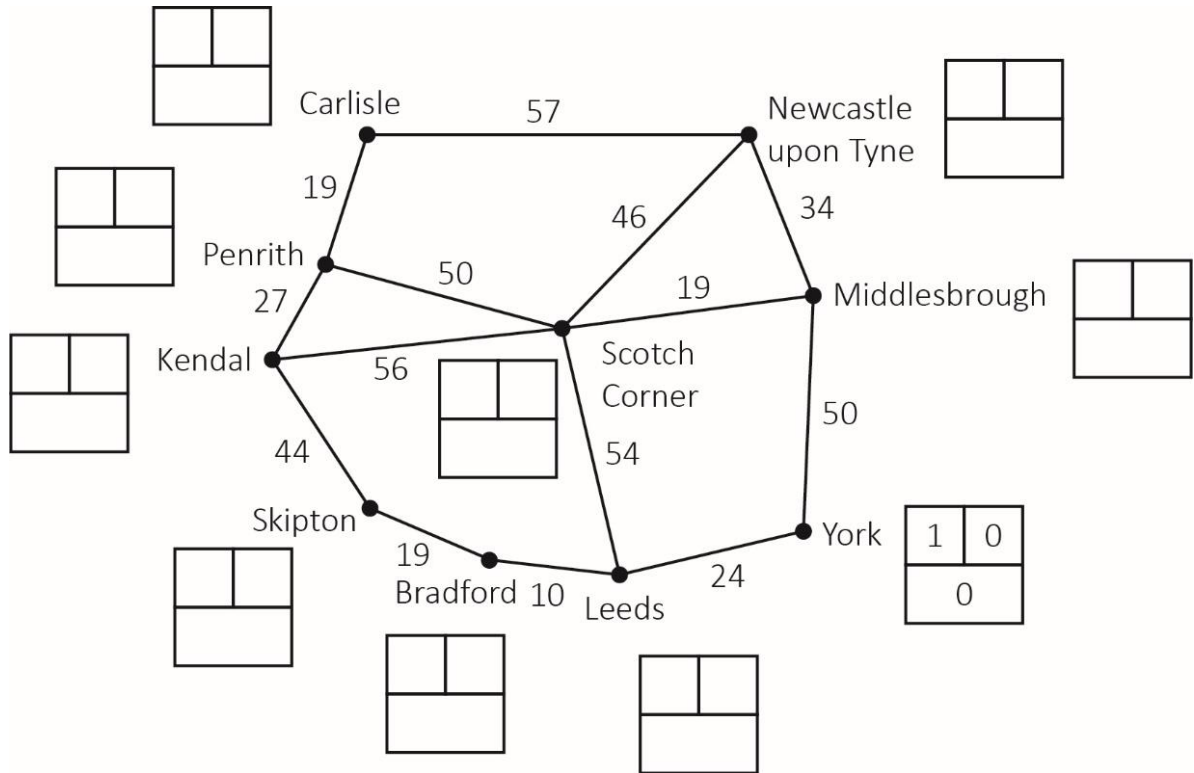
It is important that he gets there as soon as possible.

A road map of the area is shown below.

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) Historical records indicate that 20% of the hospital's patients are of Rhesus negative blood group.

On a particular evening in December 13 patients are brought into Accident and Emergency that require blood transfusions.

i. How many of these patients would be expected to be Rhesus negative?

[2 marks]

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

That **none** of the patients are Rhesus negative?

[2 marks]

That **exactly** 4 of the patients are Rhesus negative?

[2 marks]

Please turn over

That at **least** 4 of the patients are Rhesus negative?

[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) Dr Khan and Mr Roberts both work at a small country clinic.

Dr Khan is the senior doctor and earns £66,000 per year.

Mr Roberts is a band 3 nurse and is paid £10.98 per hour. He normally works 38 hours each week.

Dr Khan pays 8% of her gross salary into a private pension fund and has never had a student loan. Mr Roberts pays 3.5% of his salary into a pension fund and has a student loan of £18,000. He began the 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 Mr Roberts's net income for April 2017 assuming he worked 196 hours.

[6 marks]

Please turn over for the next question.

b) The half-life of a drug is the period of time taken for the amount in the body to be reduced by exactly one half or 50%.

The symbol for half-life is $T\frac{1}{2}$. For example, if drug A has a half-life of 4 hours and the initial plasma level of the drug, given as a single dose, is 1800mg/L then after 4 hours the plasma level will be 900mg/L and after another 4 hours, the plasma level would be 450mg/L and so on.

i.   Dr Khan has prescribed Drug B, which has a half-life of 3 hours. The initial plasma level of the drug, given as a single dose, is 200mg/L.

Complete the table below to evidence the plasma level of the drug for the remaining times.

[2 marks]

Time (hrs)	Plasma level of the drug (mg/L)
0	200
3	100
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 Dr Khan each of the following:

- The level of the drug in the blood stream after 5 hours.
- The time taken for your system to be clear of the drug*.

*Your blood stream is classed as clear when at least 95% of a drug has been eliminated from the blood stream.

[2 marks]

Please turn over for the next question.

c) Drug C has a half-life of 2 hours and is given in doses of 160mg/L every 2 hours.

Dr Khan used a spreadsheet to monitor the amount of drug C in the patient's system over the next 6 hours.

	A	B	C	D	E	F	G	H
1	Time	8am (dose 1)	10am (dose 2)	12noon (dose 3)	2pm (dose 4)	4pm (dose 5)	6pm (dose 6)	Totals
2	8am	160	x	x	x	x	x	160
3	10am	80	160	x	x	x	x	240
4	12noon	40	80	160	x	x	x	
5	2pm	20	40		160	x	x	
6	4pm	10				160	x	
7	6pm	5					160	

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				