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

DATE

Paper 2: **SAMPLE**

Mark Scheme

V2.1

This mark scheme has been written by the Assessment Writer and refined, alongside the relevant questions, by a panel of subject experts through the external assessment writing process and at standardisation meetings.

The purpose of this mark scheme is to give you:

- examples and criteria of the types of response expected from a learner
- information on how individual marks are to be awarded
- the allocated assessment objective(s) and total mark for each question.

Marking guidelines

General guidelines

You must apply the following marking guidelines to all marking undertaken throughout the marking period. This is to ensure fairness to all learners, who must receive the same treatment. You must mark the first learner in exactly the same way as you mark the last.

- The mark scheme must be referred to throughout the marking period and applied consistently. Do not change your approach to marking once you have been standardised.
- Reward learners positively giving credit for what they have shown, rather than what they might have omitted.
- Be prepared to award zero marks if the learner's response has no creditworthy material.
- Do not credit irrelevant material that does not answer the question, no matter how impressive the response might be.
- The marks awarded for each response should be clearly and legibly recorded in the grid on the front of the question paper.
- If you are in any doubt about the application of the mark scheme, you must consult with your Team Leader or the Chief Examiner.

Guidelines for using the marking grid

Marks in the mark scheme are explicitly referenced against the following:

M	Method Marks: Marks available for the correct or suitable method used.
A	Accuracy Marks: Marks available for an accurate answer where the correct or suitable method has also been used. Unless otherwise stated with cao.
BOD	Benefit of the doubt: Marks available for the correct answer with no working shown.
B	Independent of other marks available used to award for a single correct answer.
G	Graph marks: marks available for completing a graph or diagram accurately.
E	Explanation: Marks available for an accurate explanation
CAO	Correct Answer only: Marks available for the correct answer- no method required.
FT	Follow through

Assessment objectives

This unit requires learners to:

AO1	Deepen competence in the selection and use of mathematical methods and techniques.
AO2	Develop confidence in representing and analysing authentic situations mathematically and in applying mathematics to address related questions and issues.
AO3	Build skills in mathematical thinking, reasoning and communication.

The weightings of each assessment objective can be found in the qualification specification.

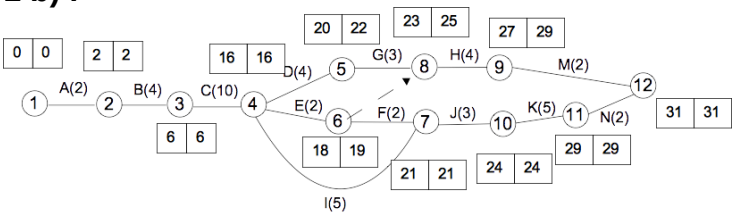
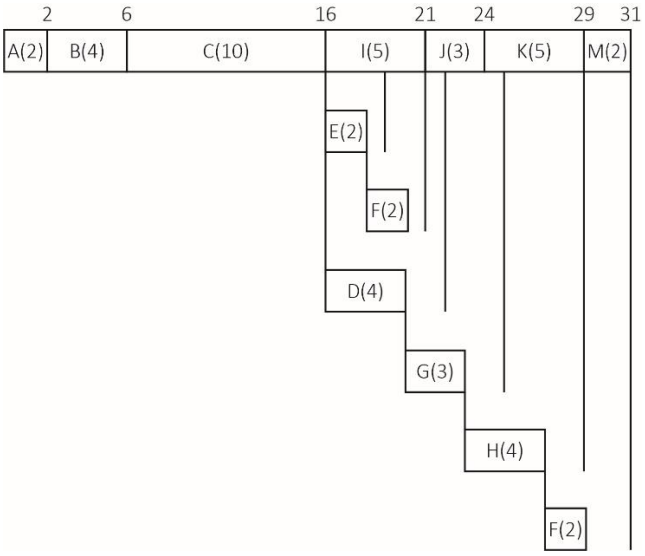
Qu	Mark scheme	Total marks

Section 1 **Total for this section: 26 marks**

1 a) i	What is the price per m^2 of this house based on the information given?
1 a) ii	According to **Article A**, this bungalow should cost approximately £194,200 Give two possible reasons for this discrepancy.
1 a) iii	Based on **Article A,** how much would this bungalow be worth if it was located in each of the following locations? Burnley. Cambridge.
1 a) iv	What size would you suggest they build the conservatory? Explain your thinking.
1 a) v	According to the government figures, how much value would the conservatory add to the property in Exeter?
1 b) i	Draw an activity-on-arc network for these activities.
1 b) ii	The activity network includes one dummy activity. Explain why this dummy activity is needed.
1 b) iii	Mark on your diagram the early and late times for each event. Give the minimum completion time and identify the critical activities.
1 b) iv	What are the float times for each non-critical activity?
1 b) v	Draw a Gantt chart to illustrate the situation.
1 b) 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 b) vii	Simon's friends offer to help. What is the minimum number of friends needed to complete the project in the minimum time?

Mark allocation	**26**
Assessment Objective/s	AO1=6 AO2=10 AO3=10

1 a) i 260,000 ÷ 77.8 = £3,341.90	**A1**	**AO1=1**
1 a) ii The government's figures are on based on 2016 values and house prices have risen since then. The government's price is an average price covering all areas. Some areas will be worth more.	**B2** Two reasonable suggestions **B1** if only one reason given	**AO2=2**

1 a) iii Burnley = 77.8 x 829 = £64,496. Cambridge = 77.8 x 4747 = £369,317.	**A1** **A1**	**AO2=2**
1 a) iv I would build an extension at the rear of the house accessible from the sitting room, so 2.9m by 2.5m. This would then not block either of the main bedrooms.	**B1** any sensible dimensions **B1** any sensible reason given	**AO1=2**
1 a) v Extra value = 2.9 x 2.5 x 2,496 = £18,096	**B1**	**AO2=1**
1 b) i  	**M1** activity-on-arc **A1** single start and end **A1** dummy **A1** rest	**AO3=4**
1 b) ii A dummy is needed because H depends on E and G whereas F depends only on E.	**B1**	**AO1=1**
1 b) iii See diagram Minimum completion time is 31 days. Critical activities are A, B, C, I, J, K and M.	**M1** **A1** forward pass **M1** **A1** backward pass **B1** **B1**	**AO3=6**
1 b) iv Float time for E and F is one day. Float times for D, G, H and L are 2 days. **Allow FT**	**M1** **A1**	**AO2=2**
1 b) v  **Allow FT**	**M1** Critical activities shown **M1** Non-critical activities earliest start time shown **M1** Float shown for non-critical activities	**AO1=2** **AO2=1**
1 b) vi Simon needs help because some jobs take place simultaneously and so can't be done by one man.	**B1**	**AO2=1**
1 b) vii 3 men needed, so Simon and 2 friends.	**B1**	**AO2=1**

Qu	Mark scheme	Total marks

Section 2 **Total for this section: 19 marks**

2 a) i	In their in-flight magazine, London City Airport claimed to be the most reliable airport in the UK. Give **two** reasons how this data supports their claim.
2 a) ii	In their in-flight magazine, Gatwick claimed to be the most improved airport in the UK. Give one reason how this data supports their claim **and** one reason why this claim is possibly misleading.
2 b) i	Which airports are represented by the points labelled A and B?
2 b) ii	What type of correlation does his graph show?
2 b) iii	What does this mean in this context?
2 b) iv	Using the table below, calculate the value of Spearman's rank correlation coefficient for these data.
2 c) i	Write down **two** differences between the two sets of data and explain the significance of these differences.
2c) ii	Test Heidi's theory by identifying any outliers in the 2016 data.

Mark allocation	**19**
Assessment Objective/s	AO1=5 AO2=11 AO3=3

2a) i They had the highest percentage of "on time" departures. They had the lowest mean delay time for 2017.	**B2** (one for each)	**AO1=1** **AO2=1**
2a) ii They had the greatest improvement in mean delay times between 2016 and 2017 They had the lowest percentage number of flights on time	**B2** (one for each)	**AO3=2**
2b) i A = Gatwick; B = Southampton	**B2** (one for each)	**AO1=1** **AO2=1**
2b) ii Positive correlation.	**B1**	**AO1=1**
2b) iii It means that in general the worst airports are still the worst and the best airports are still the best.	**B1** – any sensible answer	**AO3=1**

2 b) iv

Spearman's rank (r_s) = $1 - \frac{6\sum d^2}{n(n^2-1)}$

= $1 - \frac{6 \times 86}{14 \times 195}$ = 0.811 (to 3dp)

Mean delay in minutes (2017)	Rank (r_1)	Mean delay in minutes (2016)	Rank (r_2)	d	d^2
12.39	3	13.52	4	-1	1
18.83	14	22.90	14	0	0
17.17	11	14.97	11	0	0
16.46	9	14.47	7	2	4
14.65	6	14.81	10	-4	16
17.37	12	14.61	8	4	16
17.08	10	18.25	13	-3	9
14.45	5	14.23	6	-1	1
10.45	1	12.83	2	-1	1
17.82	13	14.64	9	4	16
14.98	7	13.75	5	2	4
11.73	2	11.80	1	1	1
15.74	8	16.78	12	-4	16
13.71	4	12.89	3	1	1
					86

M1 for ranking (allow all ranks reversed)
M1 for d^2
A1 cao for $\sum d^2$
M1 for structure of r_s using their $\sum d^2$
A1 ft for $|r_s| < 1$

No ranking scores **[0]**

AO2=5

2 c) i

The results for 2016 were more spread out than 2017.
The middle 50% of results in 2016 were more closely bunched than the results in 2017.

B2 one each any suitable comments

AO2=2

2 c) ii

For 2016 the IQR = 14.93 – 13.58 = 1.35
1.35 x 1.5 = 2.025.
High outliers > 14.93 + 2.025 = 16.955, so two outliers Luton and Gatwick
Low outliers < 13.58 – 2.025 = 11.53, so no low outliers

B1 cao for seeing 2.025 (or implied)
A1 for 16.955 cao
B1 (both outliers named)
A1 for 11.53 cao

AO1=2
AO2=2

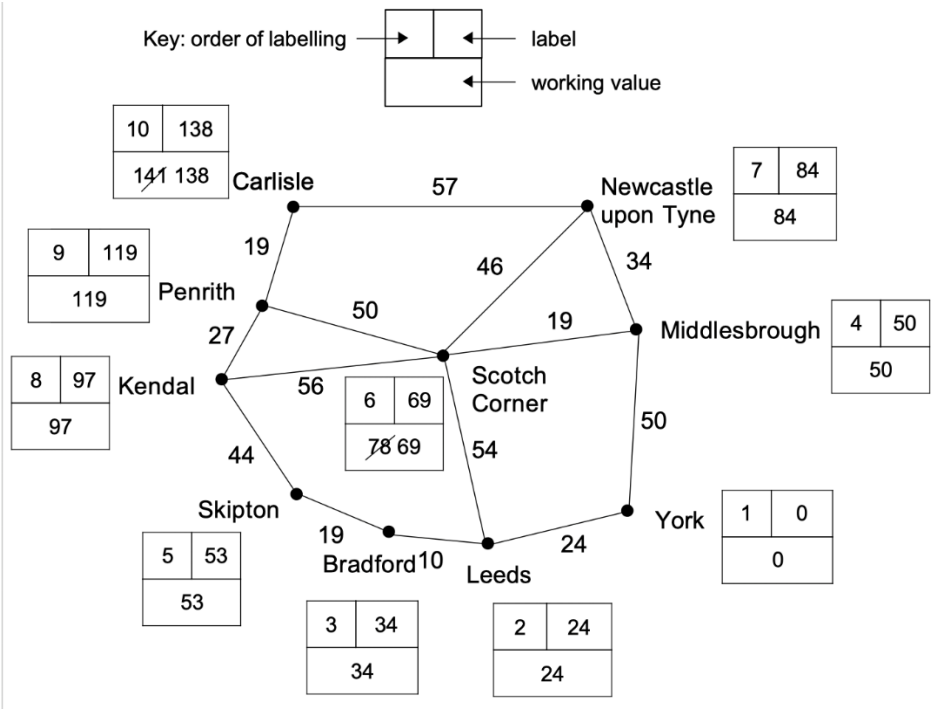
Qu	Mark scheme	Total marks

Section 3 **Total for this section: 19 marks**

3 a) i	Show that P(X=2) = 0.08
3 a) ii	Find the expected number of sales in one week.
3 a) iii	Find the expected number of sales in one year, assuming that 52 weeks in the year are worked.
3 b) 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.
3 c) i	How many of these sales would be expected to be of model A?
3 c) ii	What is the probability of each of the following: That **none** of the sales are model A? That **exactly** 4 of the sales are model A? That **at least** 4 of the sales are model A?

Mark allocation	19
Assessment Objective/s	AO1=6 AO2=11 AO3=2

3 a) i Since $\sum P(X = r) = 1$, P(X=2) = 1 – (0.76 + 0.15 + 0.01 + 0) = 1 – 0.92 = 0.08	**M1** **A1**	**AO2=2**
3 a) ii E(X) = $\sum xP(r)$ = 0 x 0.76 + 1 x 0.15 + 2 x 0.08 + 3 x 0.01 = 0.15 + 0.16 + 0.03= 0.34 **Allow FT**	**M1** **A1**cao	**AO2=2**
3 a) iii In one year, 52 x 0.34 = 17.68 sales in one year. **Allow FT**	**A1** Allow 17 or 18 **A1** if less than 52 weeks used, if a reason is given.	**AO1=1**

3 b) i  Shortest route: York, Middlesbrough, Scotch Corner, Penrith, Carlisle Distance 138 miles.	**M1** starting at York **A1** order of labelling **A1** working values **B1** **B1**	**AO2=3** **AO3=2**
3 c) i and 3 c) ii Let X be the number of sales for model A then X ~ B(13, 0.2) μ = E(X) = 13 x 0.2 = 2.6 P(X = 0) = $^{13}C_0$ x 0.8^{13} = 0.0550 P(X = 4) = $^{13}C_4$ x 0.8^9 x 0.2^4 = 0.1536 P(X ≥ 4) = 1 – P(X ≤ 3) = 1 – 0.7473 = 0.2527	**M1, A1** cao **M1, A1** cao **M1**, **A1** cao **M2**, **A1** cao (M1 only if P(X≤3) or P(X≤4) found instead.	**AO1=5** **AO2=4**

Qu	Mark scheme	Total marks

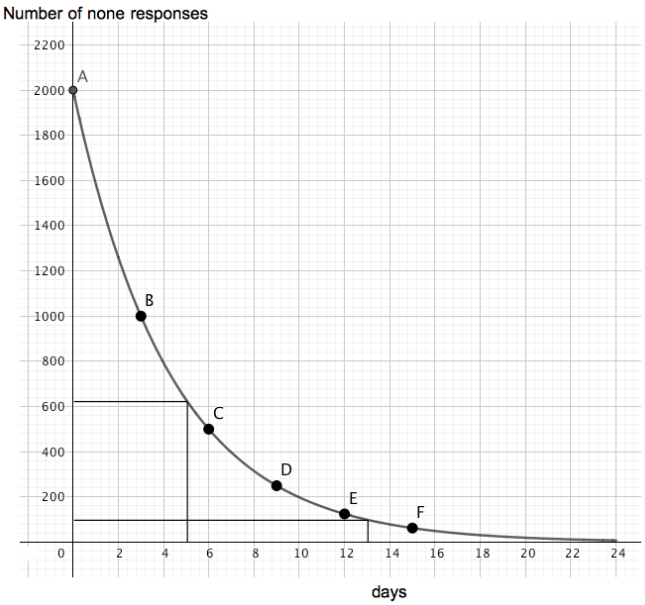
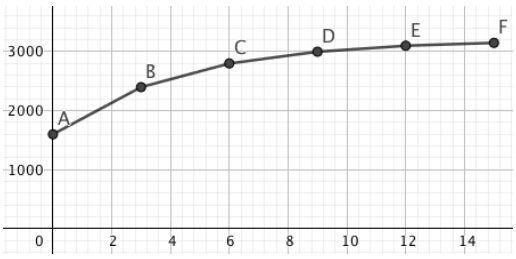
Section 4 **Total for this section: 26 marks**

4 a) i	Calculate Mr Hughes' net income for 2017-18
4 a) ii	Calculate Emma's net income for April 2017 assuming she worked 196 hours.
4 b) 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.
4 b) ii	Using the completed table, draw a graph of your results.
4 b) 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.
4 c) i	What would be the formula written in cell H7?
4 c) ii	Complete the remainder of the spreadsheet above.
4 c) iii	What does the total in column H represent for any particular time?
4 c) iv	Sketch a graph of 'Totals against Time' from these results.
4 c) v	Comment on the shape of your graph and what this implies.

Mark allocation	26
Assessment Objective	AO1=8 AO2=5 AO3=13

4 a) i Mr Hughes Gross Pay = £66,000 Personal allowance = 11,500 Pension contribution = 5,280 Taxable income = 66,000 – 11,500 – 5,280 = 49,220 Tax on 33,500 = 0.2 x 33,500 = £6,700 Tax on 49,220 – 33,500 = 0.4 x 15,720 = 6,288 Total tax = £12,988 No NI on £8,164 NI on 66,000 – 8,164 = 57,836 NI on 45,000 – 8,164 = 0.12 x 36,836= 4,420.32	**M1** Calculates threshold for basic tax **M1** Calculates threshold for higher tax rate **M1** Calculates threshold for basic NI **M1** Calculates threshold for NI on higher earnings **M1** Calculates pension contributions **A1** Calculates net pay	**AO1=3** **AO2=3**

<table>
<tr><td>NI on 66,000 – 45,000 = 0.02 x 21,000 = 420.00
Total NI = 4,840.32
Net pay = 66,000 – 12,988 – 4,840.32 – 5,280 = £42,891.68</td><td></td><td></td></tr>
<tr><td>4 a) ii
Emma
Monthly pay 196 x 10.98 = 2,152.08
Personal allowance = 958
Pension = 0.035 x 2,152.08 = £75.32
Taxable pay = 2,152.08 – 958 -75.32 = 1,118.76
Tax payable = 223.75
No NI on 680
NI on 2,152.08 – 680 = 1,472.08 x 0.12 = 176.65
Student loan – monthly allowance £1,750
Loan repayment (2,152.08 – 1750) x 0.09 = 36.19
Net pay for the month = 2,152.08 – (223.75 + 176.65 + 75.32 + 36.19) = £1,640.17</td><td>M1 Calculates monthly pay
M1 Calculates tax correctly
M1 Calculates NI correctly
M1 Calculates pension contributions correctly
M1 Calculates student loan payments correctly
A1 Calculates net pay</td><td>AO1=2
AO2=2
AO3=2</td></tr>
<tr><td>4 b) i
<table><tr><th>Time (days)</th><th>Customers yet to respond to the offer.</th></tr><tr><td>0</td><td>2000</td></tr><tr><td>3</td><td>1000</td></tr><tr><td>6</td><td>500</td></tr><tr><td>9</td><td>250</td></tr><tr><td>12</td><td>125</td></tr><tr><td>15</td><td>62.5</td></tr></table></td><td>A2 All correct
A1 If one error FT</td><td>AO3=2</td></tr>
</table>

4 b) ii 	**G1** sensible labelled axes **G1** Points plotted accurately **G1** An attempt to draw a smooth curve through the points (do not allow joining by straight lines)	**AO1=1** **AO3=2**
4 b) iii (from the graph) 620 have not responded (ii) (from the graph) 13 days	**M1** Allow 600 – 640 **M1** Allow 14 days 3150	**AO1=1** **AO3=1**
4 c) i =sum(B7:G7) or = B7+C7+D7+E7+G7	**B1**	**AO1=1**
4 c) ii Spreadsheet completed correctly Check - Column H should be H Totals 1600 2400 2800 3000 3100 3150	**B2** [**B1** if only 3 correct totals]	**AO3=2**
4 c) iii The number of responses to date.	**B1**	**AO3=1**
4 c) iv Sketch of graph drawn 	**G1** shape generally correct (axes do not need to be labelled)	**AO3=1**

4 c) v The graph starts at 1600, initials rises quickly, continues to rise but more slowly, starts to flatten out. It implies the level responses will reach a steady state.	**M1** – any sensible comments **M1** – must identify that the level of responses reaches a limit.	**AO3=2**

Assessment Objective Grid

Question	AO1	AO2	AO3	Total
1	4	15	7	26
2	8	2	9	19
3	11	5	3	19
4	0	16	10	26
Total	**23**	**38**	**29**	**90**