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

Specimen Assessment Data Material

To be used in conjunction with delivery for the 2019/20 academic session

The delivery of this qualification should be data driven, allowing learners to become familiar with working with data and data sets. The data provided should always be engaging allowing learners to develop a curiosity to investigate further.

NCFE have provided resources such as NCFE Maths News and their teaching packs to support this aim, these and more resources can be found on our Core Maths padlet here.

Along with this we are providing centres with these data sets that can be used as a teaching material throughout the delivery of the course. With the data sets we have supplied some specimen questions taken from a sample assessment that show an example of the questions that may be used based on this particular data, however we encourage you to use different examples along with these with your learners.

This document links the data with the specimen questions however it can be utilised by the centre or the learner in a different way should they see fit.

Please note that while these data sets and specimen questions are in the style similar to what our assessment materials will look like the content that is used will vary for the actual assessments.

For all information on this qualification please go to the following page on our QualHub.co.uk site:

https://www.qualhub.co.uk/qualification-search/qualification-detail/ncfe-level-3-certificate-in-mathematics-for-everyday-life-4825

Data Set 1

Punctuality statistics for 25 UK Airports

Punctuality statistics are calculated for 25 UK Airports. The planned time of operation is obtained from the airport scheduling committees and merged in with the actual time of operation on the air transport movement records collected in UK Airport Statistics.

Information is published each month which shows the average delays on scheduled and charter services at each of the airports both in total and at an individual route/airline level.

Southend is being included for the first time from April 2016.

It should be noted that the statistics in this notice cover only those flights which were operated; they do not cover those flights which were cancelled. Some airport or airline business models prioritise delaying flights rather than cancelling them outright.

The information contained in these reports has been compiled from various sources of data. CAA validates this data, however, no warranty is given as to its accuracy, integrity or reliability. CAA cannot accept liability for any financial loss caused by a person's reliance on any of these statistics. No statistical data provided by CAA may be sold on to a third party. CAA insists that they are referenced in any publication that makes reference to CAA Statistics.

The data for 2017 together with some comparative data for 2016 is provided on the next page.

	2017								2016		
Airport	Total Flights	On time (Less by 15 minutes late) (%)	Late by 16 - 30 minutes (%)	Late by 31 - 60 minutes (%)	Late by 61- 180 minutes (%)	Late by 181 - 360 minutes (%)	Late by more than 360 minutes (%)	Mean delay in minutes	Total Flights	Late by 15 minutes or less	Mean delay in minutes
HEATHROW	471041	77.43	11.43	7.22	3.47	0.35	0.1	12.39	470641	76.35	13.52
GATWICK	281710	65.31	16.08	11.48	6.45	0.59	0.1	18.83	275289	61.31	22.9
MANCHESTER	193512	69.57	14.34	9.52	5.9	0.58	0.09	17.17	182400	73.64	14.97
STANSTED	161270	69.18	15.24	10.21	4.72	0.51	0.14	16.46	152331	73.14	14.47
EDINBURGH	116771	72.69	13.68	8.61	4.57	0.42	0.04	14.65	110278	73.11	14.81
BIRMINGHAM	109065	68.58	15.42	9.82	5.61	0.49	0.08	17.37	102904	74.8	14.61
LUTON	104062	68.68	14.73	10.15	5.8	0.56	0.08	17.08	99953	66.32	18.25
GLASGOW	88246	74.91	11.8	7.96	4.74	0.51	0.07	14.45	84735	75.21	14.23
LONDON CITY	75797	81.6	8.39	5.73	3.93	0.33	0.02	10.45	80446	76.47	12.83
BRISTOL	63332	68.81	14.42	10	6.11	0.59	0.08	17.82	60737	75.36	14.64
ABERDEEN	48588	75.97	10.62	7.13	5.55	0.68	0.05	14.98	45118	78.82	13.75
NEWCASTLE	43278	80.08	10.18	5.8	3.53	0.35	0.06	11.73	40877	80.74	11.8
BELFAST INTERNATIONAL	39972	74.73	11.41	7.99	5.25	0.49	0.13	15.74	37084	72.38	16.78
SOUTHAMPTON	39262	78.25	9.56	6.49	5.05	0.57	0.08	13.71	37431	79.42	12.89
BELFAST CITY (GEORGE BEST)	36532	80.82	8.8	6.21	3.93	0.24	0.01	11.14	41286	84.58	9.29
EAST MIDLANDS INTERNATIONAL	35208	77.33	12.33	6.46	3.48	0.33	0.07	12.68	34923	77.8	12.94
LIVERPOOL (JOHN LENNON)	35182	75.8	12.65	6.95	4.02	0.5	0.09	14.02	37928	76.37	14.1
LEEDS BRADFORD	33864	81.02	9.65	5.53	3.34	0.4	0.06	13.7	31296	82.1	11.3
JERSEY	22414	73.48	11.4	7.81	6.46	0.7	0.16	16.92	23791	72.35	17.12
CARDIFF WALES	16633	75.23	11.96	7.07	4.85	0.81	0.08	15.14	15571	76.82	14.11
EXETER	13042	78.1	9.45	6.56	5.23	0.59	0.07	13.82	12471	80.45	12.95
SOUTHEND	10905	81.05	7.74	5.86	4.48	0.81	0.07	12.94	6214	79.95	14.61
DONCASTER SHEFFIELD	9645	77.36	11.78	6.49	3.95	0.4	0.02	12.85	9429	76.98	13.78
BOURNEMOUTH	4192	78.96	11.38	6.37	2.89	0.38	0.02	11.67	4232	77.84	12.31
DURHAM TEES VALLEY	3943	72.46	13.57	7.91	5.45	0.51	0.1	16.66	3623	81.34	12.15

Specimen Questions for Data Set 1

The table shown below is an extract of the data given on previous page. 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	471,041	77.43	12.39	13.52
GATWICK	281,710	65.31	18.83	22.90
MANCHESTER	193,512	69.57	17.17	14.97
STANSTED	161,270	69.18	16.46	14.47
EDINBURGH	116,771	72.69	14.65	14.81
BIRMINGHAM	109,065	68.58	17.37	14.61
LUTON	104,062	68.68	17.08	18.25
GLASGOW	88,246	74.91	14.45	14.23
LONDON CITY	75,797	81.60	10.45	12.83
BRISTOL	63,332	68.81	17.82	14.64
ABERDEEN	48,588	75.97	14.98	13.75
NEWCASTLE	43,278	80.08	11.73	11.80
BELFAST INTERNATIONAL	39,972	74.73	15.74	16.78
SOUTHAMPTON	39,262	78.25	13.71	12.89

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.

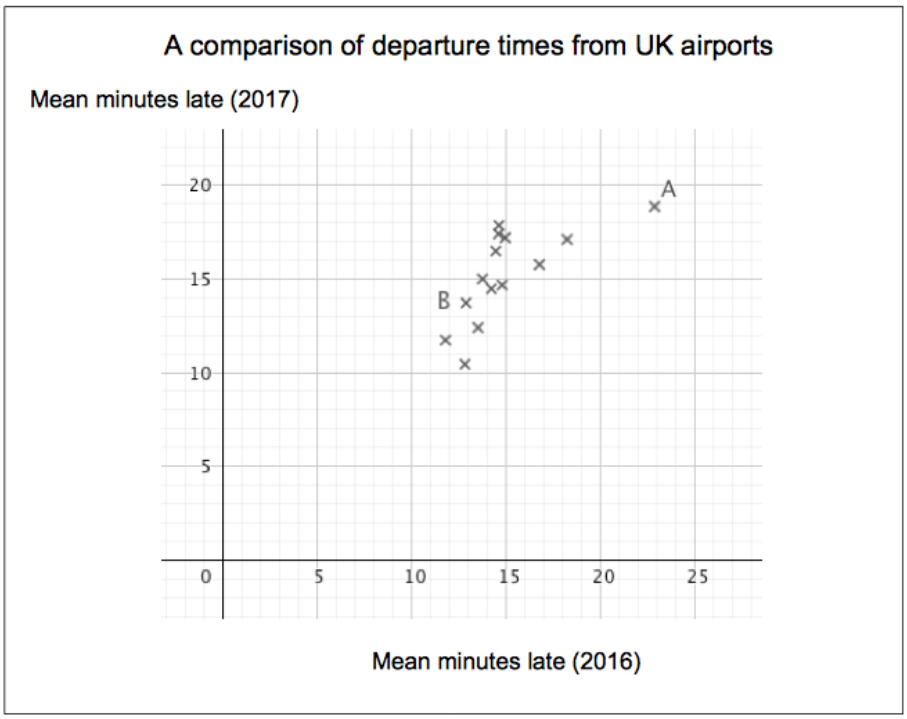
[2 marks]

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 marks]

Ms Bell asked each member of the class to represent this information on a suitable diagram and then to 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.



Which airports are represented by the points labelled A and B?

[2 marks]

What type of correlation does his graph show?

[1 mark]

What does this mean in this context?

[1 mark]

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

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

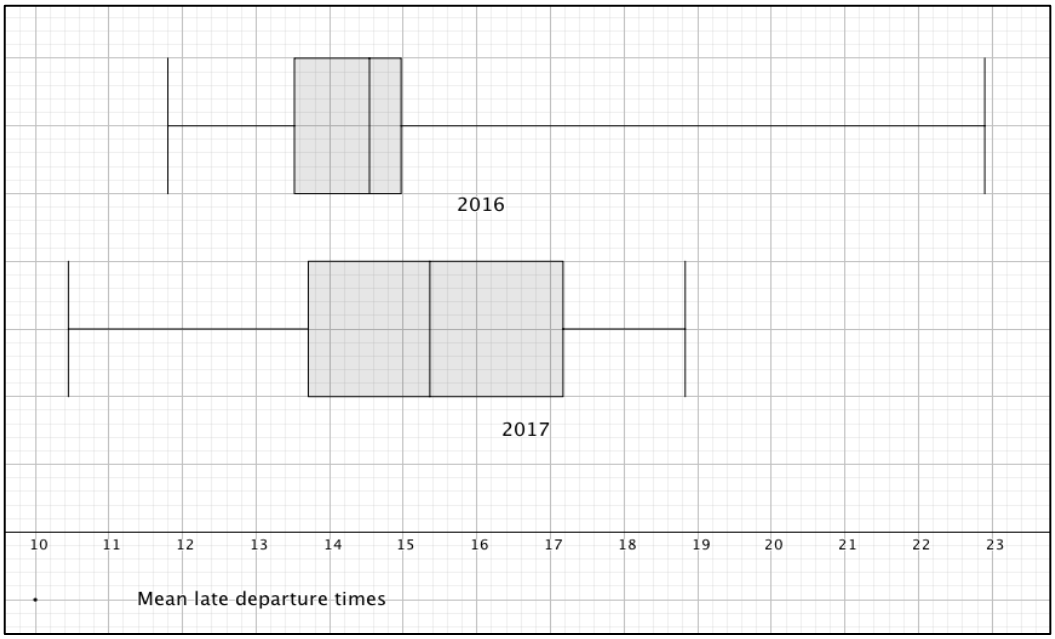
Mean delay in minutes (2017)	Rank (r_1)	Mean delay in minutes (2016)	Rank (r_2)	d	d^2
12.39	3	13.52			
18.83		22.90	14		
17.17		14.97			
16.46		14.47			
14.65		14.81			
17.37		14.61			
17.08		18.25			
14.45	5	14.23			
10.45	1	12.83			
17.82		14.64			
14.98		13.75			
11.73	2	11.80			
15.74		16.78			
13.71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

[5 marks]

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.



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

[2 marks]

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]

Data Set 2

Income Tax and National Insurance 2017 – 2018

Income tax rates and taxable bands 2017 – 2018

PAYE tax rates and thresholds	2017 -2018
Personal allowance	£221 per week £958 per month £11,500 per year
Basic rate	20% on annual earnings above the PAYE threshold and up to £33,500
Higher rate	40% on annual earnings from £33,501- £150,000
Additional	45% on annual earnings over £150,000

To calculate your income tax if your annual income is £100,000 or less.

Find your taxable income by subtracting your personal tax allowance from your annual gross income.

You pay income tax at 20% on the first £33,500 of your taxable income.

You pay income tax at 40% on your taxable income over £33,500

National Insurance (NI) 2017 - 2018

You only make National Insurance deductions on earnings above the Lower Earning Limit (LEL).

Class 1 National Insurance thresholds

LEL	£113 per week £490 per month £5,876 per year
Primary Threshold (PT)	£157 per week £680 per month £8,164 per year
Upper Earnings Limit (UEL)	£866 per week £3,750 per month £45,000 per year

Class 1 National Insurance rates

Earnings at or above LEL up to and including PT	0%
Earnings above PT and up to and including UEL	12%
Balance of earnings above UEL	2%

Examples

A person who had a weekly income of £375 pays 12% on the amount above £157.

A person who had a monthly income of £4,250 pays 12% on the amount between £680 and £3,750 plus 2% of the amount above £3,750.

Gross pay

Your gross pay is your wage or salary, before any deductions are made.

Net pay

Your net pay (or take-home pay) is the amount of money you receive after income tax, National Insurance and other deductions have been taken off your gross pay.

National Minimum Wage (from April 1st 2018)

National Living Wage (25+)	£7.83 per hour
NMW (21 – 24)	£7.38 per hour
NMW (18 – 20)	£5.90 per hour
NMW (16 -17)	£4.20 per hour

Student Loans

The Student Loans Company (SLC) gives loans to students at university.

There are two types of repayment plan for student loans. If you started your course before 1 September 2012 you will be on repayment plan 1

If you started your course on or after 1 September 2012 you will be on repayment plan 2.

Repayment plan 1

You only start making repayments when your gross income is over the threshold of £18,333 a year (£1,527 per month, £352 per week). You pay 9% of anything you earn over the threshold.

Repayment plan 2

You only start making repayments when your gross income is over the threshold of £25,000 a year (£2,083 per month, £480 per week). You pay 9% of anything you earn over the threshold. For either plan you can also make additional voluntary repayments to SLC at any time which will reduce your balance earlier.

Specimen Questions for Data Set 2

Ananya Batt and her son, Krish both work for a small engineering company.

Ananya is the managing director and earns £66,000 per year.

Krish is an apprentice in the software engineering department and is paid £10.98 per hour. He normally works 38 hours each week.

Ms Batt pays 8% of her gross salary into a private pension fund and has never had a student loan.

Krish pays 3.5% of his salary into a pension fund and has a student loan of £18,000. He began his course on 1st September 2014.

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

Calculate Ms Batt's net income for 2017-18.

[5 marks]

Calculate Krish's net income for March 2017 assuming he worked 196 hours.

[5 marks]

As technology continues to evolve rapidly, it has become important for engineers to see themselves as life-long learners.

The half-life of an engineer's technical skills is the time it would take for half of everything an engineer knew about his or her field to become obsolete. For mechanical engineers this is 6 years, for electrical engineers it is 3 years and for software engineers, it is only 2 years. Ms Batt has devised a scale to measure the current level of an engineer's technical skills.

The symbol for half-life is $T_{½}$. For example, if a mechanical engineer is currently rated at 180 on this scale, then, since $T_{½} = 6$, in 6 years' time he will be rated at 90, and another 6 years later at 45 and so on.

Ms Batt has asked Krish to make a chart for the staff handbook emphasising the need for everyone to keep up to data. She suggests, as an example, Krish uses an electrical engineer who has a current rating of 200 on her scale.

Complete the table below.

[2 marks]

Time (years)	Current rating
0	200
3	100
6	
9	
12	
15	

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

[3 marks]

[Use graph paper for this activity]

From your graph estimate for Ms Batt each of the following.

The rating after 5 years.
The time taken for the employer to be classed as unskilled*.

*An employer is classed as being unskilled when his rating has dropped below 95% of the standard required.

[2 marks]

Ms Batt insists that her software engineers are retrained every 2 years.
Mrs Batt has noted over a period of time that retraining adds 160 points to each employee's rating. Krish, who has a current rating of 160, constructed a spreadsheet to predict his future ratings.

	A	B	C	D	E	F	G	H
1	Time	Year 0	Year 2	Year 4	Year 6	Year 8	Year 10	Totals
2	0	160	x	x	x	x	x	160
3	2 years	80	160	x	x	x	x	240
4	4 years	40	80	160	x	x	x	
5	6 years	20	40		160	x	x	
6	8 years	10				160	x	
7	10 years	5					160	

What would be the formula written in cell H7?

[1 mark]

Complete the remainder of the spreadsheet above.

[2 marks]

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

[1 mark]

Sketch a graph of 'Totals against Time' from these results?

[2 marks]

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

[3 marks]

Data set 3

House prices: how much does one square metre cost in your area?

Price per square metre.

In 2016 the average cost of property sold in England and Wales was £2,395 per square metre. Unsurprisingly, 19 of the top 20 most expensive local authority areas are in London, with Kensington and Chelsea, the City of London, Westminster and Camden topping the list. Barking and Dagenham was the least expensive London borough, where homes cost £3,994 per square metre.

Elmbridge in Surrey is the costliest area outside London, while York was the most expensive area in the North of England. South Wales and Lancashire are the cheapest places to buy property. In Blaenau Gwent, Merthyr Tydfil, Neath Port Talbot, Burnley and Hyndburn, homes cost less than £1,000 per square metre.

Homes in the most expensive area of England and Wales cost 25 times as much as in the cheapest area, according to the Office for National Statistics (ONS) analysis of 2016 property prices. One square metre of floor space – an area about the size of a red phone box – costs almost £19,439 in Kensington and Chelsea, while in Blaenau Gwent in the South Wales valleys, the same amount of space costs £777.

ONS also found that new flats in England and Wales have got 18% bigger in the last three years, while new houses have remained around the same size.

We've used ONS data on property prices per square metre to help you find out what extra floor space could be worth in your area.

Location	Price per m^2 of housing
Middlesbrough	1063
York	2591
Nottingham	1391
Swindon	2224
Southend-on-Sea	2972
Windsor and Maidenhead	4951
Brighton and Hove	3964
Wycombe	3999
Exeter	2496
Kensington and Chelsea	17988
Westminster	13135
Burnley	829
Manchester	1630
Cambridge	4747

Specimen Questions for Data Set 3

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.)

Whilst every attempt has been made to ensure the accuracy of the floor plan contained here, measurements of doors, windows, rooms and any other items are approximate and no responsibility is taken for any error, omission, or mis-statement. This plan is for illustrative purposes only and should be used as such by any prospective purchaser. The services, systems and appliances shown have not been tested and no guarantee as to their operability or efficiency can be given

Made with Metropix ©2012

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

[1 mark]

According to the government report, this bungalow should cost approximately £194,200.

Give two possible reasons for this discrepancy.

[2 marks]

Based on the government data**.** How much would this bungalow be worth if it was located in each of the following locations?

Burnley.

[1 mark]

Cambridge.

[1 mark]

What size would you suggest they build the conservatory? Explain your thinking.

[2 marks]

According to the government figures, how much value would this add to the property in Exeter?

[1 mark]

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
M	Install exterior fittings	H	2
N	Install interior fittings	K	2

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

[4 marks]

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

[1 mark]

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 on the previous page to complete this question.

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

[2 marks]

Draw a Gantt chart to illustrate the situation.

[3 marks]

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]

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

[1 mark]

External links to data sets

Punctuality statistics for 25 UK Airports

https://www.caa.co.uk/Data-and-analysis/UK-aviation-market/Flight-reliability/Datasets/Punctuality-data/Punctuality-statistics-2017/

Accessed 23/01/2020.

Rates and allowances: HM Revenue and Customs

https://www.gov.uk/guidance/rates-and-thresholds-for-employers-2017-to-2018

Accessed 23/01/2020.

House prices: how much does one square metre cost in your area?

https://www.ons.gov.uk/peoplepopulationandcommunity/housing/articles/housepriceshowmuchdoesonesquaremetrecostinyourarea/2017-10-11

Accessed 23/01/2020.