# Business Mathematics

## SAMPLE TIME CONSTRAINED ASSESSMENT
### MARKING SCHEME

This marking scheme has been prepared as a **guide only** to markers. This is not a set of model answers, or the exclusive answers to the questions, and there will frequently be alternative responses which will provide a valid answer. Markers are advised that, unless a question specifies that an answer be provided in a particular form, then an answer that is correct (factually or in practical terms) **must** be given the available marks.

If there is doubt as to the correctness of an answer, the relevant NCC Education materials should be the first authority.

**Throughout the marking, please credit any valid alternative point.**

**Where markers award half marks in any part of a question, they should ensure that the total mark recorded for the question is rounded up to a whole mark.**

## 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:

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

*Population standard deviation*

Ungrouped data:

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

Ungrouped frequency table:

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

Grouped frequency table:

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

*Sample variance*

Ungrouped data:

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

*Sample standard deviation*

Ungrouped data:

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

Ungrouped frequency table:

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

Grouped frequency table:

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

## 4. Exponential forecasting

$$F_{t+1} = F_t + \alpha(x_2 - F_t)$$

| Section A |
| --- |
| **Answer ALL questions from this section** |

**Marks**

### Question 1

Simplify the ratio 12:9    **1**

*Mark scheme*

*4:3 (1 mark)*

### Question 2

Calculate: $60 - 20 \times 2$    **1**

*Mark scheme*

*20 (1 mark)*

### Question 3

Round 4025 to ONE (1) *significant figure.*    **1**

*Mark scheme*

*4000 (1 mark)*

### Question 4

Express 54203 in *standard form.*    **1**

*Mark Scheme*

$5.4203 \times 10^4$ *(1 mark)*

### Question 5

Write TWO (2) days as a fraction of a week.    **1**

*Mark scheme*

$\frac{2}{7}$ *(1 mark)*

**Question 6**

Calculate 2% of $430                                    **1**

*Mark scheme*

*$8.60 (1 mark)*

**Question 7**

State the *gradient* of the line $10x - 9$               **1**

*Mark scheme*

*10 (1 mark)*

**Question 8**

State the *y-intercept* of the line $y = 3x + \frac{1}{2}$    **1**

*Mark scheme*

$\frac{1}{2}$*(1 mark)*

**Question 9**

Simplify: $m^5 \times m^3$                               **1**

*Mark scheme*

$m^8$*(1 mark)*

**Question 10**

Write $\frac{17}{3}$ as a mixed number.                  **1**

*Mark scheme*

$5\frac{2}{3}$ *(1 mark)*

**Question 11**

Calculate the THREE (3) 4-point moving averages for the following data: **3**

$$101 \quad 152 \quad 147 \quad 136 \quad 104 \quad 124$$

*Mark scheme*

$(101 + 152 + 147 + 136) \div 4 = 134$ *(1 mark)*
$(152 + 147 + 136 + 104) \div 4 = 134.75$ *(1 mark)*
$(147 + 136 + 104 + 124) \div 4 = 127.75$ *(1 mark)*

**Question 12**

Find: **3**
$$\frac{4}{5} \times \frac{3}{4} + \frac{2}{3} \div \frac{1}{5}$$

Show your workings fully.

*Mark scheme*

$\frac{4}{5} \times \frac{3}{4} = \frac{12}{20} = \frac{3}{5}$ *(1 mark, simplified or not)*
$\frac{2}{3} \div \frac{1}{5} = \frac{2}{3} \times \frac{5}{1} = \frac{10}{3}$ *(1 mark)*
$\frac{3}{5} + \frac{10}{3} = \frac{9+50}{15} = \frac{59}{15} = 3\frac{14}{15}$ *(1 mark)*

*(Total 3 marks)*

**Question 13**

Make $b$ the subject of the following equation: **3**
$$\frac{\sqrt{ab}}{d} = e$$

*Mark scheme*

*Multiply by d:*
$\sqrt{ab} = de$
*Square both sides:*
$$ab = (de)^2$$
*Divide by a:*
$$b = \frac{(de)^2}{a}$$
- *1 mark for partially correct method, 2 marks for wholly correct method.*
- *Correct answer (1 mark)*

*(Total 3 marks)*

## Question 14

A savings account offers interest at a rate of 2.3% compounded annually. If Manisha opens an account with £240 and leaves it for EIGHT (8) years, calculate how much will be in the account at the end of EIGHT (8) years. Give your answer to the nearest pound (£).

**3**

*Mark scheme*

*The multiplier for an increase of 2.3% is 1.023 (1 mark for use of correct multiplier).*
*So, $£240 \times 1.023^8 = £288$ the nearest pound) (1 mark for method, 1 mark for correct answer, rounded correctly)*

*(Total 3 marks)*

## Question 15

Solve these *simultaneous equations* algebraically:

**3**

$$5x - 3y = 27$$
$$11x + 9y = -3$$

*Mark scheme*

*Multiply the first equation by 3:*
$$15x - 9y = 81$$
*Add the second equation:*

$$15x - 9y = 81$$
$$11x + 9y = -3$$
$$26x = 78$$

*So, $x = 3$ (1 mark for working, 1 mark for value of $x$. Please note workings may vary between candidates but credit should be given for any valid workings.)*

*Substitute value of $x$ into $5x - 3y = 27$*

$$5(3) - 3y = 27$$
$$-3y = 12$$

*So $y = -4$ (1 mark)*

*(Total 3 marks)*

**Question 16**

Solve the following equation by *completing the square*:  <span style="float:right">**3**</span>

$$x^2 + 6x = -7$$

You may leave your answer in surd form or round your answer to TWO (2) decimal places.

***Mark Scheme***

***Add*** $(3)^2 = 9$

***Rewrite as:*** $x^2 + 6x + 9 = 2$

***So,*** $(x + 3)^2 = 2$

***Take the square root of each side:*** $x + 3 = \pm\sqrt{2}$

***So,***

$x = \pm\sqrt{2} - 3$
***So*** $x = -1.59$ ***(to 2. d.p.) or*** $x = -4.41$ ***(to 2 d.p.)***

***Award 1 mark for partially correct workings, award 2 marks for wholly correct workings.***
***Correct answer – accept either surd form or rounded answer. (1 mark)***

***(Total 3 marks)***

**Question 17**

200 people were asked to state their preferred brand of toothpaste. The results are below:  <span style="float:right">**3**</span>

|  | Bright Smile | Fresh 'n' Minty | Smiths | Natural Smile |
|---|---|---|---|---|
| Frequency | 98 | 62 | 12 | 28 |

A pie chart of the data is drawn to illustrate the results. Calculate the angles of the sectors for 'Bright Smile', 'Fresh 'n' Minty' and 'Natural Smile'.

You are not required to construct a pie chart.

***Mark Scheme***

***Bright Smile:*** $\frac{98}{200} \times 360° = 176.4°$ ***(1 mark)***
***Fresh 'n' Minty:*** $\frac{62}{200} \times 360° = 111.6°$ ***(1 mark)***
***Natural Smile:*** $\frac{28}{200} \times 360° = 50.4°$ ***(1 mark)***

**Question 18**

A shop sells phone cases. It has 120 phone cases in stock. 3/4 of the phone cases    **3**
are large and the rest are small. 80 of the phone cases are patterned and the rest are
plain. If ONE (1) phone case is selected at random, calculate the probability that it will
be a small, plain phone case. Assume that size is independent of whether phone
case is patterned or plain.

*Mark scheme*

$P(small) = \frac{1}{4}$ *(1 mark)*

$P(plain) = \frac{40}{120} = \frac{1}{3}$     *(1 mark)*

$P(small, plain) = \frac{1}{4} \times \frac{1}{3} = \frac{1}{12}$

*Correct answer (1 mark)*

*(Total 3 marks)*

**Question 19**

Calculate the *mean, median* and *mode* of the following data set:    **3**

30  27  25  32  27  25  30  31  30  26

*Mark scheme*

*Mean:* $\frac{283}{10} = 28.3$ *(1 mark)*

*Median value:* $28.5$ *(1 mark)*

*Mode: 30 (1 mark)*

**Question 20**

The number of customers booking holidays online increased by 2% in 2018 and 5% **3** in 2019. Calculate the overall *percentage change* in the number of customers booking holidays online.

*Mark scheme*

*In 2018, the increase was 2%, so the multiplier is 1.02.*
*In 2019, the increase was 5%, so the multiplier is 1.05*

*1.02 x 1.05 = 1.071*

*So, the overall percentage change was 7.1%*

*1 mark for partially correct method, 1 mark for wholly correct method.*

*Correct answer (1 mark)*

*(Total 3 marks)*

**Total 40 Marks**

**Marks**

**Question 21**

a) An electrician charges £$C$ for a job depending on $h$ (amount of time in hours) according to the relationship:

$C = 45h + 50$

i) Complete the following table for the graph $C = 45h + 50$ **3**

| $h$ | 0 | 3 | 6 | 9 | 12 |
|---|---|---|---|---|---|
| $C$ | 50 | | | 455 | |

*Mark scheme*

| $h$ | *0* | *3* | *6* | *9* | *12* |
|---|---|---|---|---|---|
| *C* | *50* | *185* | *320* | *455* | *590* |
| | | *(1 mark)* | *(1 mark)* | | *(1 mark)* |

ii) Plot the graph of $C = 45h + 50$ for $0 \leq h \leq 12$ **4**

*Mark scheme*
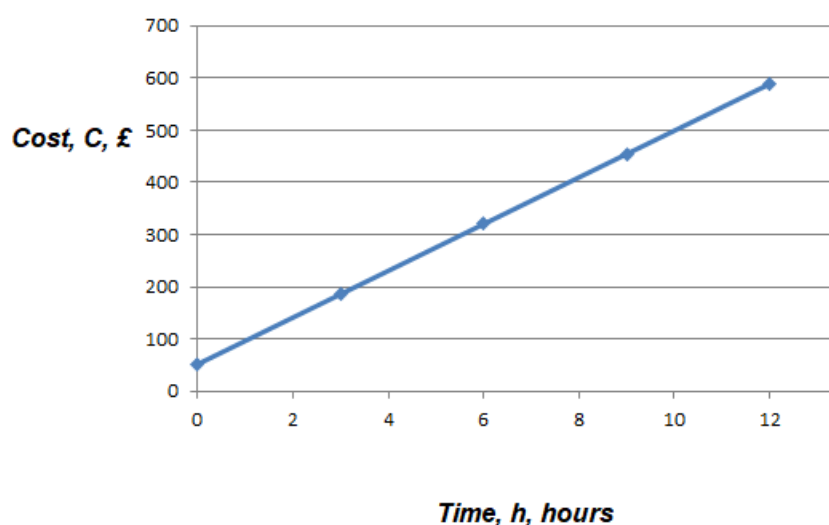


- *Axis drawn and correctly labelled (1 mark)*
- *Award 1 mark for two data points correctly plotted. Award 2 marks for all 5 data points correctly plotted.*
- *Points joined with a straight line (1 mark)*

iii) Use the graph to find out how much it would cost for a job that takes FOUR (4) hours. **1**

*Mark scheme*

*£230 (1 mark)*

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iv) Use the graph to find out how many hours a job costing £297.50 takes. **1**

*Mark scheme*

*5 ½ hours (1 mark)*

v) Explain why a job cannot cost less than £50. **2**

*Mark scheme*

*The y-intercept is 50, i.e. £50, so the cost cannot be lower (1 mark). This is the fixed starting price (or call out fee) (1 mark).*

**b)** Another electrician charges a £60 call out fee plus £35 per hour. Write this information as a *linear equation*.

**2**

***Mark scheme***

$C = 35h + 60$

***1 mark for $35h$ and 1 mark for + 60***

**c)** A company records the number of sick days taken by its employees over the past three months. The data is recorded below.

| 0 | 3 | 2 | 2 | 0 |
|---|---|---|---|---|
| 8 | 5 | 5 | 3 | 1 |
| 1 | 8 | 2 | 7 | 2 |
| 2 | 1 | 6 | 1 | 2 |
| 4 | 4 | 5 | 1 | 3 |
| 0 | 0 | 4 | 3 | 1 |
| 2 | 3 | 5 | 6 | 1 |
| 4 | 0 | 0 | 4 | 0 |
| 2 | 3 | 6 | 1 | 2 |

i) State the number of employees recorded.

**1**

***Mark scheme***

***45 (1 mark)***

***Questions continue on the next page***

ii)   Construct a suitable *frequency table* for the data.

*Mark scheme*

| Number of sick days | Frequency |
|---|---|
| 0 | 7 |
| 1 | 8 |
| 2 | 9 |
| 3 | 6 |
| 4 | 5 |
| 5 | 4 |
| 6 | 3 |
| 7 | 1 |
| 8 | 2 |

*Correct format (1 mark)*
*Correct frequency values (1 mark)*

*(Total 2 marks)*

iii)   Calculate the *sample mean* of the data.

*Mark scheme*

| Number of sick days $x$ | Frequency $f$ | $fx$ |
|---|---|---|
| 0 | 7 | 0 |
| 1 | 8 | 8 |
| 2 | 9 | 18 |
| 3 | 6 | 18 |
| 4 | 5 | 20 |
| 5 | 4 | 20 |
| 6 | 3 | 18 |
| 7 | 1 | 7 |
| 8 | 2 | 16 |

*Correct $fx$ column (1 mark)*
$\sum f = 45$

$\sum fx = 125$ *(1 mark)*

*Sample mean:*
$\bar{x} = \frac{\sum fx}{\sum f} = \frac{125}{45}$ *(1 mark)*
$\quad\quad = 2.8$ *(to 1 d.p.) (1 mark)*

*(Total 4 marks)*

**Total 20 Marks**

**Question 22**

**a)** In an experiment, Reena rolls a seven-sided spinner, numbered 1 to 7, 630 times. The results are recorded in the table below.

| Score | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|---|---|---|---|---|---|---|---|
| Frequency | 65 | 64 | 80 | 140 | 73 | 155 | 53 |

i) Calculate the *relative frequency* of the spinner landing on a 7. **1**

**Mark scheme**

**Relative frequency of landing on 7:** $\frac{53}{630}$ **(1 mark)**

ii) Calculate the *relative frequency* of the spinner landing on a 2 **or** a 7. **2**

**Mark scheme**

**Relative frequency of landing on a 7:** $\frac{53}{630}$ **from i) above.**

**Relative frequency of landing on a 2:** $\frac{64}{630}$ **(1 mark)**

**Relative frequency of landing on a 1 or a 2:** $\frac{53}{630} + \frac{64}{630} = \frac{117}{630} = \frac{13}{70}$

**or 0.19 (to 2 d.p.) (1 mark for correct answer, simplified or not)**

**(Total 2 marks)**

iii) Find the *theoretical probability* of a fair, seven-sided spinner landing on a 7. State the number of times you would expect a fair, seven-sided spinner to land on a 7 in a trial of 630 spins. **2**

**Mark scheme**

**The theoretical probability of a fair, seven - sided spinner landing on a 7 is:** $P\ (landing\ on\ a\ 7) = \frac{1}{7}$ **(1 mark)**

**The number of times that a fair, seven-sided spinner would be expected to land on a 7 in a trial of 630 throws is:** $\frac{1}{7} \times 630 = 90$ **(1 mark)**

**(Total 2 marks)**

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iv) State whether you think that the spinner used in Reena's experiment is fair.  **2**
Give a reason for your answer.

*Mark scheme*

*No, I do not think the Spinner is fair (1 mark)*
*The relative frequency of landing on a 1 (2, 3, 5 or 7) is lower than the theoretical probability, whilst the relative frequencies of landing on a 4 or 6 are higher than the theoretical probability. Therefore, it is likely that the spinner is not fair (valid reason, 1 mark).*

*If the candidate thinks that the spinner is fair, award full marks if they provide a suitable argument.*

**b)** A courier company records the number of parcels, in thousands (000s), carried over a two year period.

| Year | 2019 | | | | 2020 | | | |
|---|---|---|---|---|---|---|---|---|
| Quarter | 1 | 2 | 3 | 4 | 1 | 2 | 3 | 4 |
| Number of parcels (000s) | 485 | 381 | 470 | 525 | 501 | 405 | 492 | 580 |

i) Draw a *time series graph* for this data using the graph paper provided.  **6**

*Mark scheme*



Time - series showing the number of parcels (000s) carried by a courier company over a two-year period
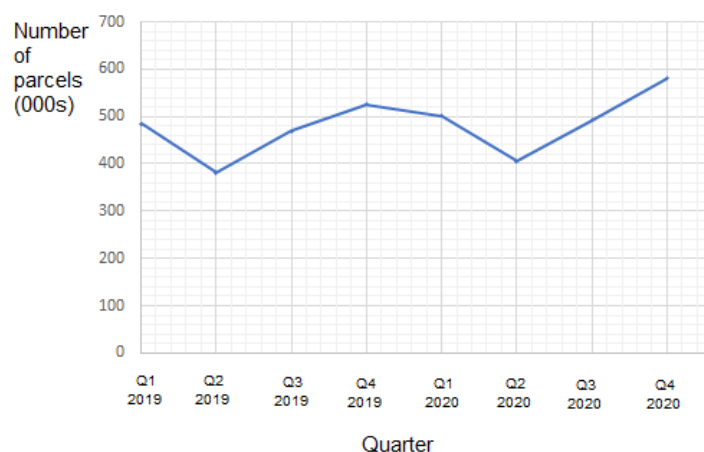
- *1 mark for each correctly drawn and labelled axis (2 marks)*
- *Points plotted correctly (3 marks) NB. Deduct 1 mark for each error, up to a maximum of 3 marks*
- *Points joined by a straight line (1 mark)*

*(Total 6 marks)*

ii)   The first three four-point averages for the data are 465.25, 469.25 and
      475.25 Calculate the fourth and fifth four-point moving averages.

***Mark Scheme***
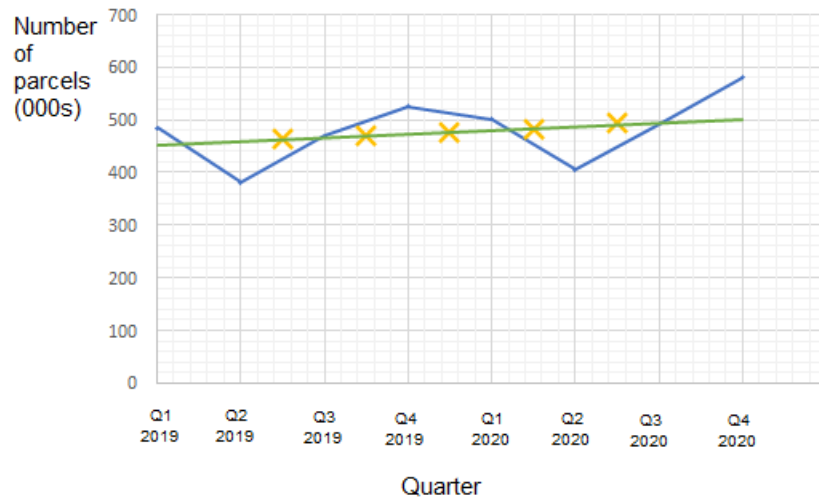
$(525 + 501 + 405 + 492) \div 4 = 480.75$ *(1 mark)*
$(501 + 405 + 492 + 580) \div 4 = 494.5$ *(1 mark)*

***(Total 2 marks)***

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iii) Plot the moving averages on the time series graph constructed in i) and draw    **3**
the trendline.

**Mark scheme**

Time - series showing the number of parcels (000s) carried
by a courier company over a two-year period



- **Moving averages plotted correctly (up to 2
  marks). NB. Deduct 1 mark for each error up to a maximum of 2
  marks.**
- **Trendline (1 mark)**
**(Total 3 marks)**

iv) Use the graph to comment upon *seasonality* and *trend*.    **2**

- **The data suggests there is a high season in Q4 and a low season
  in Q2 (1 mark)**
- **The trendline indicates that the number of parcels carried by the
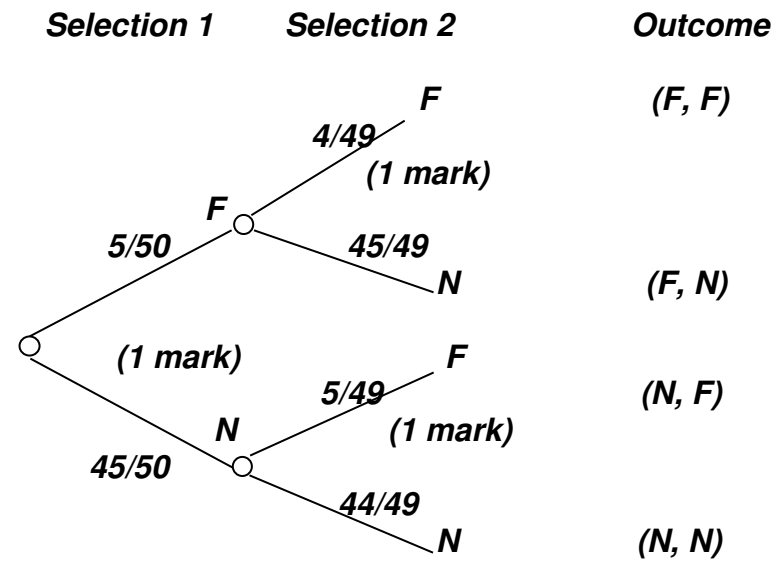  courier increasing (1 mark)**

**Total 20 Marks**

**Question 23**

**a)** A factory produces 50 laptops . FIVE (5) of the laptops  are faulty. TWO (2)
laptops s are selected at random without replacement.

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

*Mark scheme*

*Suggested tree diagram below where F denotes a faulty shirt and N denotes a laptop with no faults.*

| Selection 1 | Selection 2 | Outcome |
|---|---|---|

```
                                        F          (F, F)
                                 4/49
                                   (1 mark)
                     F  ○
              5/50            45/49
                                   N          (F, N)

      ○
           (1 mark)              F          (N, F)
                          5/49
                 N           (1 mark)
          45/50   ○
                       44/49
                                   N          (N, N)
```

*3 marks for correct branches, 1 mark for correct outcomes.*
*Total 4 marks*

ii) Calculate the probability that the first laptop selected is faulty and the second laptop selected is not.    **2**

   ***Mark scheme***

   $$P(FN) = \frac{5}{50} \times \frac{45}{49} = \frac{9}{98}$$

   ***(1 mark for working, 1 mark for correct answer, simplified or not.)***

iii) Calculate the probability that both laptops are faulty.    **2**

   ***Mark scheme***

   $$P(FF) = \frac{5}{50} \times \frac{4}{49} = \frac{2}{245}$$

   ***(1 mark for working, 1 mark for correct answer, simplified or not.)***

iv) Calculate the probability that both laptops selected are either faulty or not faulty.    **3**

   ***Mark scheme***

   $$P(both\ faulty\ or\ both\ not\ faulty) = P(FF) + P(NN)$$
   $$= \frac{5}{50} \times \frac{4}{49} + \frac{45}{50} \times \frac{44}{49}$$
   $$= \frac{2}{245} + \frac{198}{245}$$
   $$= \frac{40}{49}$$

   ***(1 mark partially correct working, 2 marks for wholly correct working, 1 mark for correct answer, simplified or not.)***

v) Calculate the probability that at least one of the laptops selected will not be faulty.    **2**

   ***Mark scheme***

   $$P(at\ least\ one\ shirt\ not\ faulty) = 1 - P(FF)$$ *P(at least one laptop not faulty) = 1 – P (FF) }*
   $$= 1 - \frac{2}{245}$$
   $$= \frac{243}{245}$$

**d)** Using the quadratic formula, find the exact solutions of: **3**

$$2x^2 - 5x + 1 = 0.$$

Then, give your answers to 2 d.p.

***Mark scheme***

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

$a = 2, \ b = -5, \ c = 1$

$x = \frac{5 \pm \sqrt{(-5)^2 - (4 \times 2 \times 1)}}{2 \times 2}$  ***(correct substitution, 1 mark)***

$= \frac{5 \pm \sqrt{17}}{4}$

$x = 2.28 \ (to \ 2 \ d.p.) \ and \ x = 0.22 \ (to \ 2 \ d.p.)$

***Method (1 mark)***
***Correct answers (1 mark)***

***(Total 3 marks)***

**Total 20 Marks**

**b)** *Factorise* completely: **2**
$x^2 - 14x + 45$

***Mark scheme***

$(x - 9)(x - 5)$

*1 mark for* $(x - 9)$
*1 mark for* $(x - 5)$

***(Total 2 marks)***

**c)** *Expand* and *simplify*: **2**
$(x + 4)(x + 3)$

***Mark scheme***

$x^2 + 7x + 12$

***Correct equation (2 marks)***
***Deduct 1 mark per error, up to a maximum of 2 marks.***

***(Total 2 marks)***

**Question 24**

**a)** An online company want to know how frequently customers purchase products up to £250. Data is recorded in the table below.

| Price range, $p$, £ | Frequency |
|---|---|
| $0 \leq p < 50$ | 13 |
| $50 \leq p < 100$ | 16 |
| $100 \leq p < 150$ | 24 |
| $150 \leq p < 200$ | 29 |
| $200 \leq p < 250$ | 18 |

i) Complete the *cumulative frequency* column for the data. **2**

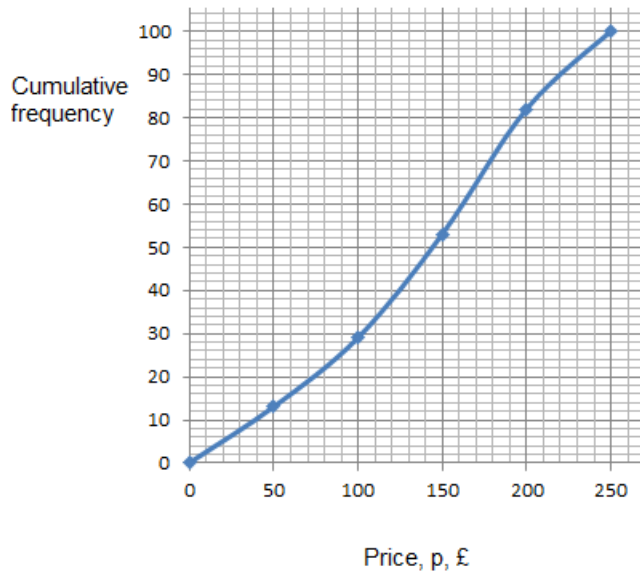| Price range, $p$, £ | Frequency | Cumulative frequency |
|---|---|---|
| $0 \leq p < 50$ | 13 | |
| $50 \leq p < 100$ | 16 | |
| $100 \leq p < 150$ | 24 | |
| $150 \leq p < 200$ | 29 | |
| $200 \leq p < 250$ | 18 | |

*Mark scheme*

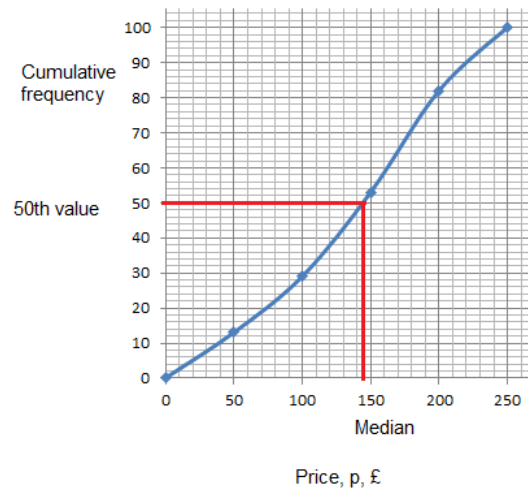| Price range, $p$, £ | Frequency | Cumulative frequency |
|---|---|---|
| $0 \leq p < 50$ | 13 | 13 |
| $50 \leq p < 100$ | 16 | 29 |
| $100 \leq p < 150$ | 24 | 53 |
| $150 \leq p < 200$ | 29 | 82 |
| $200 \leq p < 250$ | 18 | 100 |

*Award 2 marks for correctly completed cumulative frequency column – deduct 1 mark for any error up to maximum of 2 marks.*

Business Mathematics

ii)   Plot a cumulative frequency graph for the data using the graph paper
      provided.

      ***Mark scheme***



      - ***Cumulative frequency diagram with marks along
        the horizontal axis and cumulative frequency on vertical axis.
        Axis scale should be clear and appropriate. (2 marks)***
      - ***Points correctly plotted at upper end of class
        interval e.g. (50, 13)***
      - ***(2 marks, 1 mark deducted for error)***
      - ***Points joined in a smooth curve starting at the origin (1 mark)***

iii)  Use your cumulative frequency graph to estimate the *median*. You should   **2**
      show how you found the *median* on your graph.

*Mark scheme*



- *Accept values of the median between 142 and 148*
- *Award 1 mark for some indication of how median has been found using graph and 1 mark for value of median.*

iv)  Use your cumulative frequency graph to estimate the values of the *lower quartile* and the *upper quartile*. You should show how you have found the *lower quartile* and *upper quartile* on your graph.          **4**

*Mark scheme*
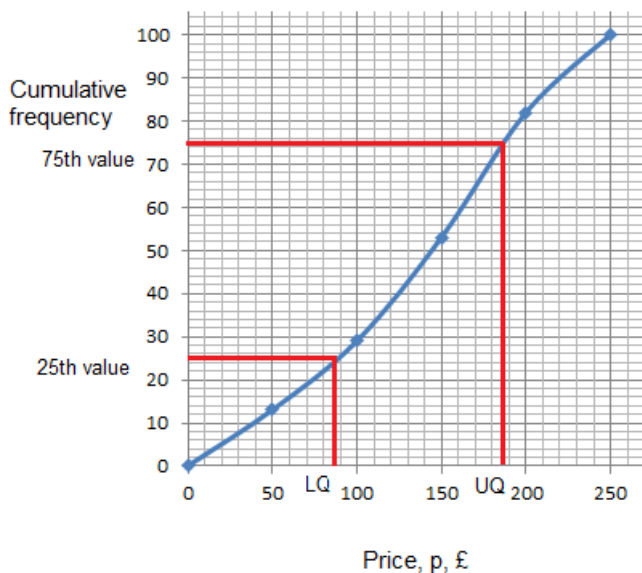


- *Accept value of lower quartile between 82 and 90 (1 mark)*
- *Award 1 mark for some indication of how lower quartile has been found using graph.*

- *Accept value of upper quartile between 182 and 190 (1 mark)*
- *Award 1 mark for some indication of how upper quartile has been found using graph*

v) Calculate the *interquartile range.* Show your workings. **1**

***Mark scheme***

***Interquartile range = upper quartile – lower quartile***

***The actual value of the interquartile range will vary depending on the values of the lower quartile and upper quartile found in (iv). However, to be awarded the mark, it should be clear that the candidate has subtracted the lower quartile from the upper quartile.***

***For example: 187 – 87 = 100***
***(1 mark)***

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**b)** State whether the data collected in part (a) is *quantitative* or *qualitative*. Briefly explain your answer.  **2**

*Mark scheme*

*Quantitative (1 mark)*
*The data is numeric (1 mark)*

**c)** A cafe records the number of customers each day. The results for the past two weeks are shown in the table below:

|  | Week 1 | | | | | | Week 2 | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Day | M | Tu | W | Th | F | S | M | Tu | W | Th | F | S |
| No. of customers | 65 | 58 | 69 | *** | 78 | 91 | 63 | 61 | 72 | 75 | 82 | 90 |

    i) Explain why it is appropriate to calculate a six-point moving average for this data.  **1**

    *Mark scheme*

    *The data has been collected 6 times a week (1 mark)*

    ii) The value of the first six-point moving average is 72. Calculate the number of customers on Thursday of week ONE (1).  **3**

    *Mark scheme*

$$(65 + 58 + 69 + x + 78 + 91) \div 6 = 72$$
$$x + 361 = 432$$
$$\textbf{So, } x = 71$$

- *2 marks for wholly correct method*
- *1 mark for partially correct method*
- *Correct answer (1 mark)*

**Total 20 Marks**

# End of paper

**Learning Outcomes matrix**

| Question | Learning Outcomes assessed | Marker can differentiate between varying levels of achievement |
|---|---|---|
| 1-20 | All | Yes |
| 21 | 1, 2 | Yes |
| 22 | 3, 4 | Yes |
| 23 | 1, 3 | Yes |
| 24 | 2, 4 | Yes |

## Grade descriptors

| Learning Outcome | Fail | Referral | Pass | Merit | Distinction |
|---|---|---|---|---|---|
| Use a range of mathematical and statistical techniques and concepts | Can basically identify, adapt and use appropriate skills, methods and procedures to reach basic solutions. | In a limited way, can identify, adapt and use appropriate skills, methods and procedures to reach limited solutions. | Can adequately Identify, adapt and use appropriate skills, methods and procedures to reach appropriate solutions. | Can soundly identify, adapt and use appropriate skills, methods and procedures to reach supported and appropriate solutions. | Can coherently identify, adapt and use appropriate skills, methods and procedures to reach well supported and highly appropriate solutions. |
| Describe and summarise data | Demonstrates basic ability to review the effectiveness and appropriateness of actions, methods and results | Demonstrates limited ability to review the effectiveness and appropriateness of actions, methods and results | Demonstrates adequate ability to review the effectiveness and appropriateness of actions, methods and results | Demonstrates sound ability to review the effectiveness and appropriateness of actions, methods and results | Demonstrates comprehensive ability to review the effectiveness and appropriateness of actions, methods and results |
| Apply the laws of probability to a range of scenarios | Provides basic interpretation and evaluation of relevant information and ideas to address problems that are well defined but non-routine. | Provides limited interpretation and evaluation of relevant information and ideas to address problems that are well defined but non-routine. | Provides consistent interpretation and evaluation of relevant information and ideas to address problems that are well defined but non-routine. | Provides critical interpretation and evaluation of relevant information and ideas to address problems that are well defined but non-routine. | Provides consistently critical interpretation and evaluation of relevant information and ideas to address problems that are well defined but non-routine. |
| Use data for the purposes of forecasting | Can basically identify, adapt and use appropriate skills, methods and procedures to reach basic solutions. | In a limited way, can identify, adapt and use appropriate skills, methods and procedures to reach limited solutions. | Can adequately Identify, adapt and use appropriate skills, methods and procedures to reach appropriate solutions. | Can soundly identify, adapt and use appropriate skills, methods and procedures to reach supported and appropriate solutions. | Can coherently identify, adapt and use appropriate skills, methods and procedures to reach well supported and highly appropriate solutions. |