

**AQA - Measure of Location and spread – GCSE Statistics – 2021****1. June/2021/Paper\_1F/No.8**

Rachel has a social media account and tracks the number of new followers she gets each day.

The table shows the data for the last three weeks.

| Week 1    | New followers | Week 2    | New followers | Week 3    | New followers |
|-----------|---------------|-----------|---------------|-----------|---------------|
| Monday    | 14            | Monday    | 13            | Monday    | 16            |
| Tuesday   | 16            | Tuesday   | 20            | Tuesday   | 21            |
| Wednesday | 12            | Wednesday | 16            | Wednesday | 17            |
| Thursday  | 11            | Thursday  | 13            | Thursday  | 15            |
| Friday    | 21            | Friday    | 24            | Friday    | 56            |
| Saturday  | 34            | Saturday  | 38            | Saturday  | 55            |
| Sunday    | 40            | Sunday    | 42            | Sunday    | 40            |

(a) Show the data in an ordered stem-and-leaf diagram.

[4 marks]

Key: \_\_\_\_|\_\_\_\_ represents \_\_\_\_ new followers

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You may use the blank space below to sort the data.

- (b) Using the stem-and-leaf diagram, show that the median number of new followers she received during this three-week period is 20.

[1 mark]

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- (c) Rachel makes this statement about **weekends**.

'The mean number of new followers at weekends is more than 20.'

Explain, **without calculation**, why Rachel is correct.

[1 mark]

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- (d) Rachel makes this statement about **weekdays**.

'The mean number of new followers on weekdays is less than 20.'

Decide whether Rachel's second statement is true.

Tick (✓) a box about the statement.

True

False

Cannot tell

You **must** show your calculations.

[3 marks]

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## 2. June/2021/Paper\_1F/No.9

Dr Cho runs a clinic where each appointment is meant to be 5 minutes.

She thinks that some doctors at the clinic are spending much longer than 5 minutes with a patient.

- (a) The table shows information about actual lengths, in minutes, of appointments for one day.

| Length, $t$ (mins) | Frequency |  |  |
|--------------------|-----------|--|--|
| $0 < t \leq 2$     | 8         |  |  |
| $2 < t \leq 4$     | 44        |  |  |
| $4 < t \leq 6$     | 43        |  |  |
| $6 < t \leq 8$     | 11        |  |  |
| $8 < t \leq 10$    | 10        |  |  |

Dr Cho says,

“The data show that the mean length of an appointment is longer than 5 minutes.”

Calculate an estimate of the mean length of appointment to decide if she is correct.

**[5 marks]**

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- (b) Dr Cho wants to investigate any relationship that might exist between the length of an appointment and the age of the patient.

She collects data from a random sample of 20 patients.

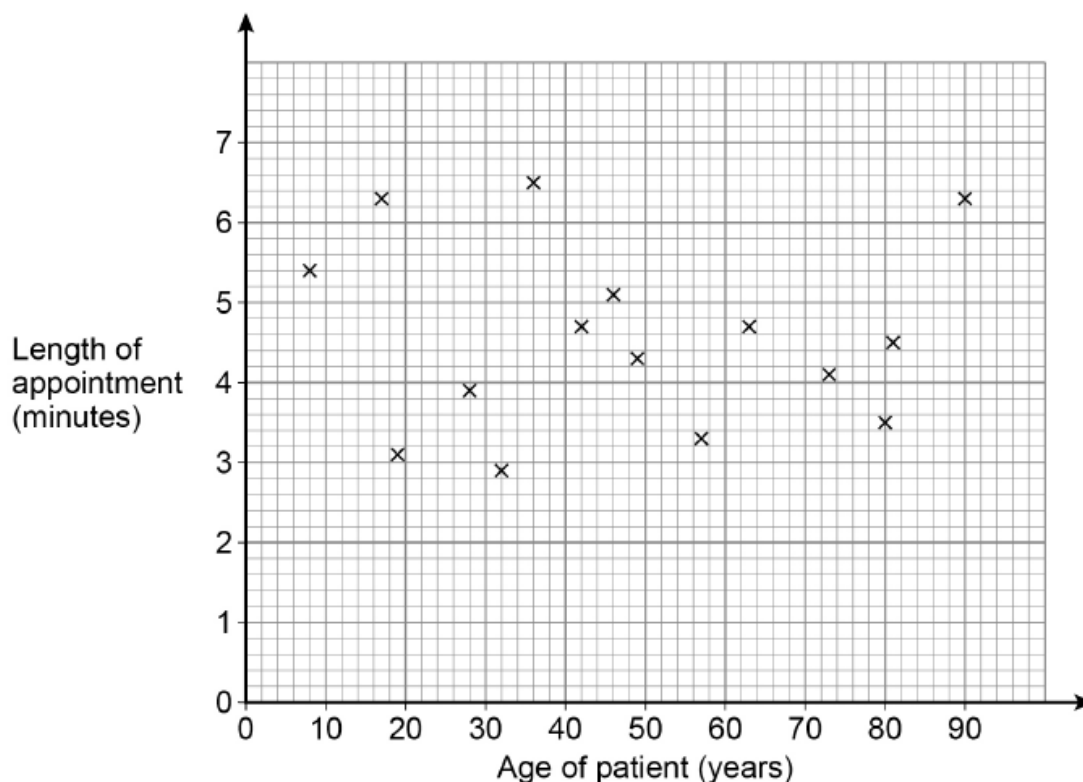
The scatter diagram shows 15 of the results.

The table shows the remaining 5 results.

|  |     |     |     |     |     |
|--|-----|-----|-----|-----|-----|
| <b>Age of patient (years)</b>          | 12  | 26  | 40  | 55  | 76  |
| <b>Length of appointment (minutes)</b> | 3.1 | 2.4 | 4.5 | 2.5 | 5.8 |

- (b) (i) Use the data in the table to complete the scatter diagram.

[2 marks]



- (b) (ii) Dr Cho says she can predict the length of an appointment if she knows the age of a patient.

Comment on her statement.

[1 mark]

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## 3. June/2021/Paper\_1F/No.10

Here is a table showing the cumulative frequencies for the length of 140 sales calls (in minutes) made by Kelly last week.

| Length of call $t$ (in minutes) | Cumulative frequency | Length of call $t$ (in minutes) | Frequency |
|---------------------------------|----------------------|---------------------------------|-----------|
| $t \leq 2$                      | 30                   | $0 < t \leq 2$                  |           |
| $t \leq 4$                      | 80                   | $2 < t \leq 4$                  |           |
| $t \leq 6$                      | 92                   | $4 < t \leq 6$                  |           |
| $t \leq 8$                      | 116                  | $6 < t \leq 8$                  |           |
| $t \leq 10$                     | 124                  | $8 < t \leq 10$                 |           |
| $t \leq 12$                     | 136                  | $10 < t \leq 12$                |           |
| $t \leq 14$                     | 140                  | $12 < t \leq 14$                |           |

- (a) How many calls were 10 minutes or shorter?

[1 mark]

Answer \_\_\_\_\_

- (b) How many calls were **more** than 12 minutes?

[2 marks]

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Answer \_\_\_\_\_

- (c) Which two-minute interval is the modal class?

Justify your answer with calculations.

It may help to complete the extra column in the table at the top of this page.

[3 marks]

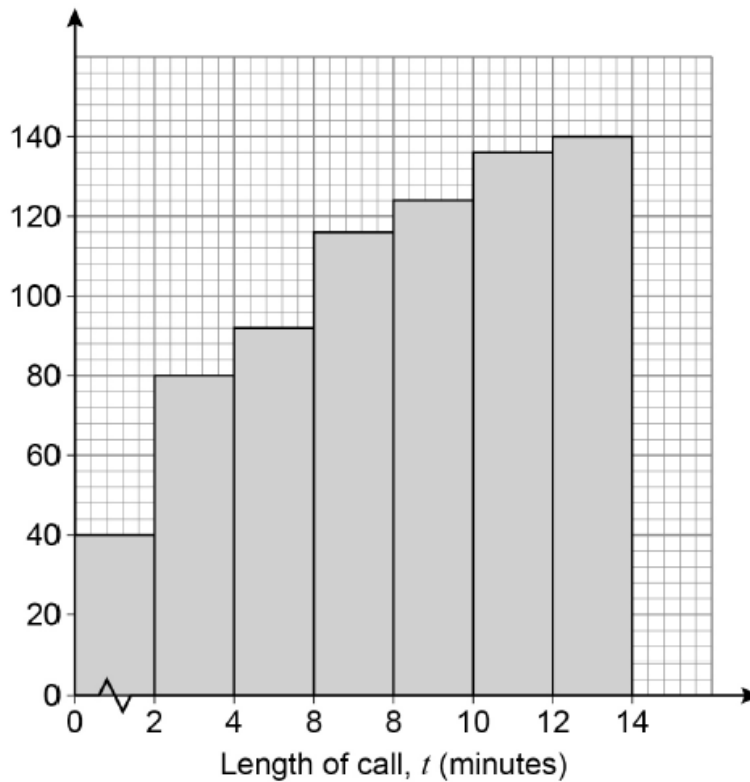
Modal class \_\_\_\_\_ minutes

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- (d) Kelly tries to draw a cumulative frequency graph for her call data.  
This graph has several errors.



Identify **three** of the errors in the graph.

**[3 marks]**

**Error 1** \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

**Error 2** \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

**Error 3** \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

**4. June/2021/Paper\_1F/No.9**

A tech company's website offers rewards according to how many days you visit it.

The table shows the number of rewards achieved by a sample of 500 customers.

| Number of rewards | % of sample |  |
|-------------------|-------------|--|
| 1                 | 52.8        |  |
| 2                 | 27.2        |  |
| 3                 | 10.4        |  |
| 4                 | 7.6         |  |
| 5                 | 2           |  |

**(a)** Show, with working that, for this sample,

median = interquartile range

**[3 marks]**

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(b) The tech company wants to change the reward system so that

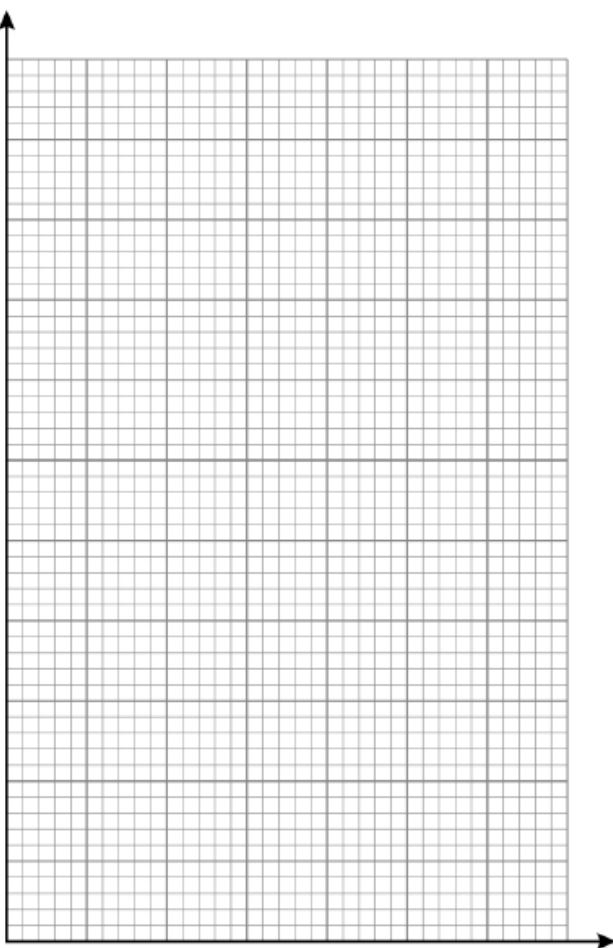
- the median number of rewards is increased
- the interquartile range is increased.

They make some changes and take a new sample of 500 customers.

| Number of rewards | Number in sample |  |
|-------------------|------------------|--|
| 1                 | 190              |  |
| 2                 | 145              |  |
| 3                 | 90               |  |
| 4                 | 60               |  |
| 5                 | 15               |  |

Use the grid to draw an **appropriate** cumulative frequency graph for the data.

[4 marks]

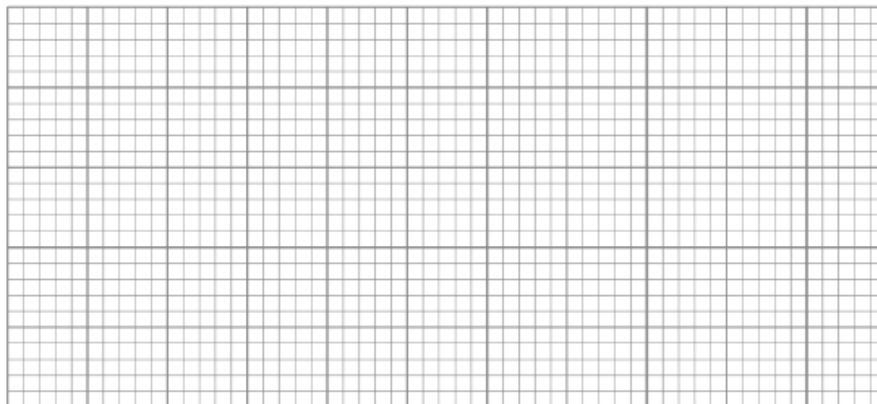




- (c) Use parts (a) and (b) to draw, on the same grid, box plots for the two samples.

When drawing the box plot do **not** check for outliers.

[4 marks]



- (d) Use calculations to confirm that there are no outliers in the new sample of 500 customers.

You **must** show your working.

[3 marks]

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(e) Has the company achieved each of its targets stated in **part (b)**?

You **must** give a reason for each target.

**[2 marks]**

Target 1 – median \_\_\_\_\_

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Target 2 – interquartile range \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

## 5. June/2021/Paper\_1F/No.13

Maisy has her house valued each year.

The table shows the percentage increase in its value, written as a multiplier, over each of the last 5 years.

|                   |       |       |       |       |       |
|-------------------|-------|-------|-------|-------|-------|
| <b>Year</b>       | 2016  | 2017  | 2018  | 2019  | 2020  |
| <b>Multiplier</b> | 1.067 | 1.013 | 1.008 | 1.005 | 1.126 |

- (a) Maisy wants to know the average percentage increase over the 5 years.

She works out the arithmetic mean.

$$\frac{6.7 + 1.3 + 0.8 + 0.5 + 12.6}{5} = 4.4\%$$

Average percentage increase = 4.4% to one decimal place.

- (a) (i) Maisy has used the wrong method.

Name the measure she should have calculated.

[1 mark]

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- (a) (ii) Show that the correct average percentage increase is 4.3% to one decimal place.

[2 marks]

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(a) (iii) In 2020 Maisey's house was worth £200 000.

If the house continues to grow in value at the same average rate, how much will it be worth in 2024?

[2 marks]

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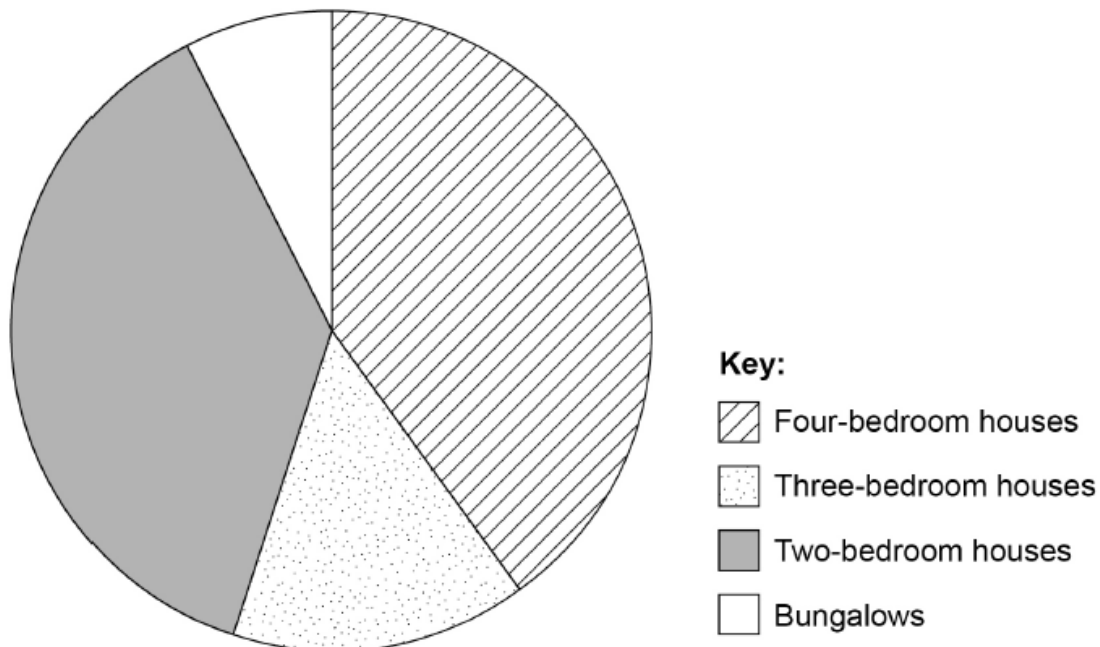
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Answer £ \_\_\_\_\_

- (b) A new housing estate with 80 houses is built near Maisey's house. She sees this pie chart in her local paper showing the types of houses in the estate.



Vicky buys a bungalow on this new estate.

What proportion of the houses on this new estate are bungalows?

**[2 marks]**

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Answer \_\_\_\_\_

(c) Maisy lives on an older housing estate.

On **Maisy's estate** there are,

- 60 four-bedroom houses
- 38 three-bedroom houses
- 22 two-bedroom houses
- 40 bungalows.

In the space below, draw a fully labelled comparative (proportional) pie chart to represent the types of houses on Maisy's estate.

[6 marks]

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**Maisy's estate**

(d) Make **one** comparison between the proportions of one of the types of houses on Maisy's estate with those on the new estate.

[1 mark]

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## 6. June/2021/Paper\_2F/No.4

Four values have a median of 10.

Three of the values are 6, 10 and 10.

Circle the value that the 4th number could **not** be.

[1 mark]

100

12

10

6

## 7. June/2021/Paper\_2F/No.7

There is a busy railway line at the end of Anya's garden.

One day she counts, in 20-minute periods, the number of trains going past in one direction, north to south.

Here are the data she collects.

| Number of trains in 20-minute periods | Frequency |
|---------------------------------------|-----------|
| 3                                     | 5         |
| 4                                     | 7         |
| 5                                     | 8         |
| 6                                     | 6         |
| 7                                     | 4         |

- (a) Give a possible reason why there are no more than 7 trains in any 20-minute period.

[1 mark]

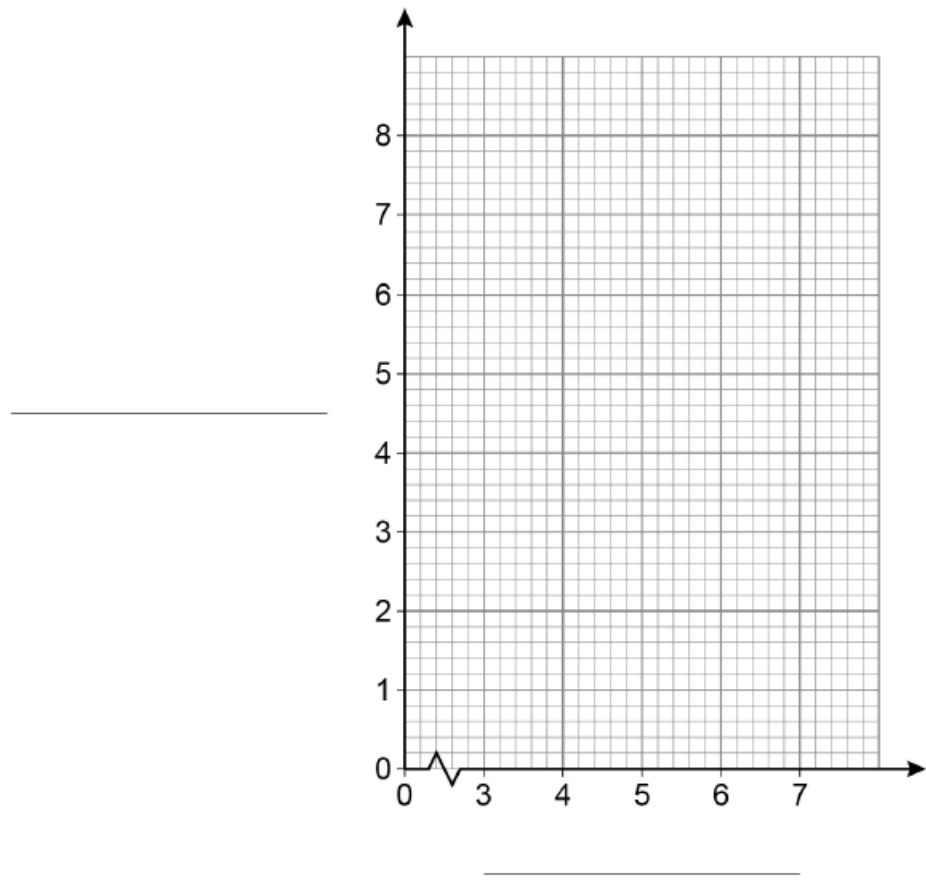
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- (b) Draw a bar line chart (vertical line diagram) for the data on the grid below.  
Include labels for the axes.

[3 marks]





(c) Give a reason why the modal number of trains per 20 minutes is 5.

[1 mark]

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(d) A train passes Anya's garden going north to south at exactly 3.26 pm.

Use the mode to estimate the most likely time of the next train in that direction.

[1 mark]

Answer \_\_\_\_\_ pm

(e) There are far fewer trains going the other way, south to north.

Suggest a possible modal number of trains going the other way for the same set of 20-minute periods.

[1 mark]

Answer \_\_\_\_\_ trains

## 8. June/2021/Paper\_2F/No.9

- (a) The cost of 12 items sold at an auction house one morning are given.  
All values are in pounds.

6    10    10    12    12    15    16    20    20    30    80    155

Which of these best describes the skew of these data?

Circle your answer.

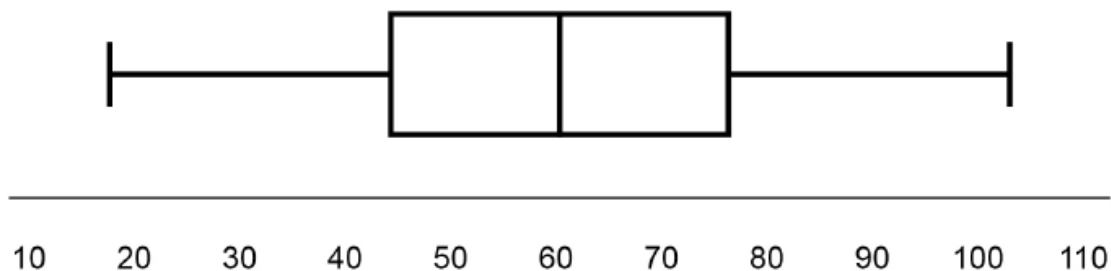
[1 mark]

negative skew

no skew

positive skew

- (b) The box plot shows information about the time in seconds it took to sell the items at the auction house that morning.



Which of these best describes the skew of these data?

Circle your answer.

[1 mark]

negative skew

no skew

positive skew

## 9. June/2021/Paper\_2F/No.11

Pat has a security camera on the front of her house.

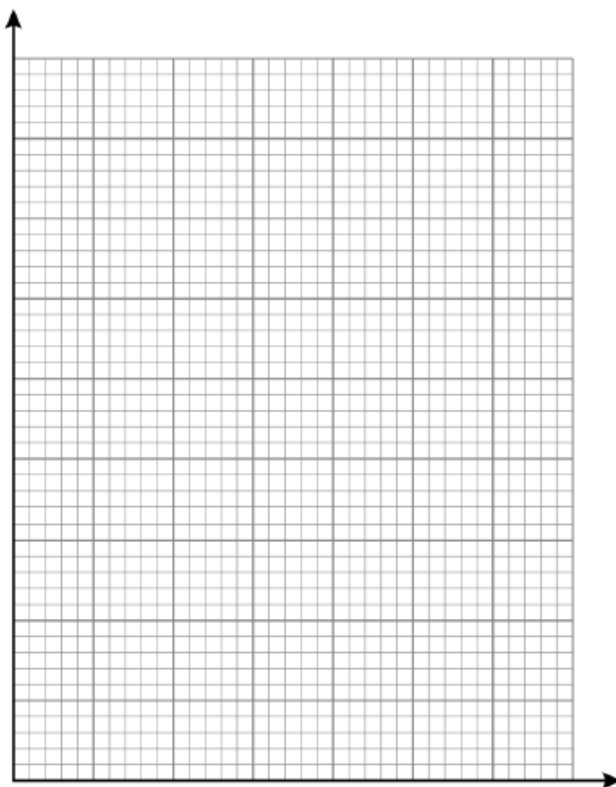
When it detects movement, an alert is sent to Pat's phone.

The periods of time between alerts for part of one day are represented by this table.

| Time between alerts,<br>$t$ (minutes) | Frequency | Cumulative frequency |
|---------------------------------------|-----------|----------------------|
| $0 < t \leq 5$                        | 9         |                      |
| $5 < t \leq 10$                       | 25        |                      |
| $10 < t \leq 15$                      | 21        |                      |
| $15 < t \leq 20$                      | 17        |                      |
| $20 < t \leq 25$                      | 8         |                      |

- (a) Draw a cumulative frequency graph for the data on the grid below.

[5 marks]



- (b) Estimate the median time between alerts.

[1 mark]

Answer \_\_\_\_\_ minutes

(c) (i) Estimate the lower quartile and upper quartile of the times between alerts.

[2 marks]

Answer Upper quartile \_\_\_\_\_ minutes

Lower quartile \_\_\_\_\_ minutes

(c) (ii) Hence, estimate the interquartile range of the times between alerts.

[1 mark]

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Answer \_\_\_\_\_ minutes

(d) Pat puts another camera at the back of the house.

The next day the data for the times between alerts is,

- median = 26 minutes
- interquartile range = 4 minutes.

Make **two** comparisons between the times between alerts for the two cameras.

[2 marks]

Comparison 1 \_\_\_\_\_  
 \_\_\_\_\_

Comparison 2 \_\_\_\_\_  
 \_\_\_\_\_

(e) Give **one** reason why these comparisons might not be valid.

[1 mark]

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**10. June/2021/Paper\_2F/No.13**

- (a) The total number of cars on the road in the UK in 2017 was 32 000 000.  
The number of cars stolen in the UK in 2017 was 86 000.

Calculate the risk of a car being stolen in 2017.

Give your answer as a percentage.

**[2 marks]**

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Answer \_\_\_\_\_ %

- (b) The risk of a car being stolen in 2013 was 0.21%.

- (b) (i) Compare the risk of a car being stolen in 2013 with the risk in 2017.

**[1 mark]**

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- (b) (ii) There were 30 900 000 cars in the UK in 2013.

Calculate an estimate of the number of cars that were stolen in 2013.

**[2 marks]**

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Answer \_\_\_\_\_

## 11. June/2021/Paper\_2H/No.3

Four values have a median of 10.

Three of the values are 6, 10 and 10.

Circle the value that the 4th number could **not** be.

[1 mark]

100

12

10

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## 12. June/2021/Paper\_2H/No.13

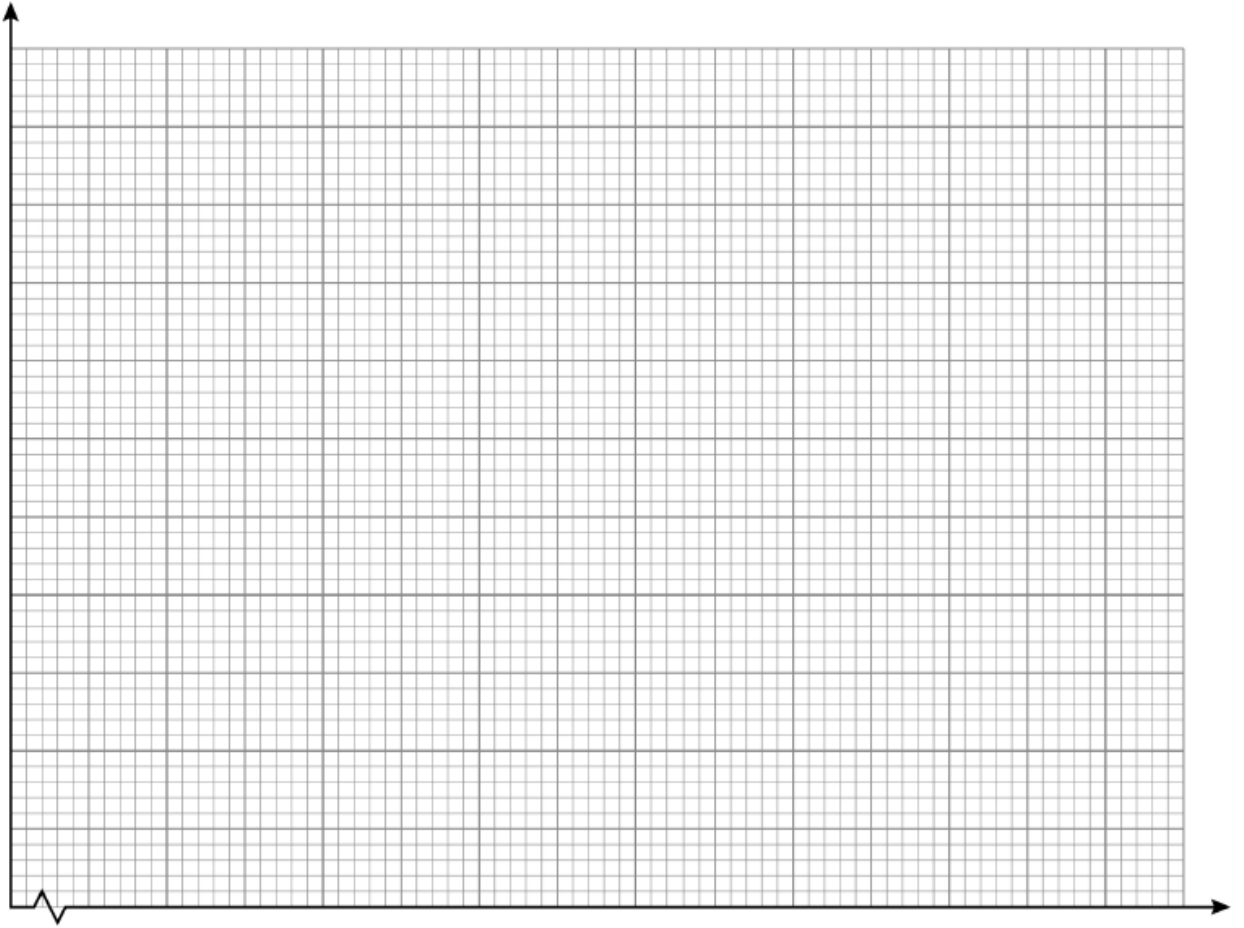
Bob records the maximum and minimum temperatures in his garden each day.

The table summarises the maximum temperatures for days in June over the last 5 years.

| Temperature, $t$<br>(°C) | Frequency |  |  |
|--------------------------|-----------|--|--|
| $14 \leq t < 19$         | 45        |  |  |
| $19 \leq t < 20$         | 20        |  |  |
| $20 \leq t < 22$         | 29        |  |  |
| $22 \leq t < 25$         | 27        |  |  |
| $25 \leq t < 30$         | 20        |  |  |
| $30 \leq t < 40$         | 9         |  |  |

(a) Draw a histogram using the grid below.

[4 marks]



(b) From the frequency table, the estimated mean is  $21.6^{\circ}\text{C}$  and the estimated standard deviation is  $5.0^{\circ}\text{C}$  (both given to one decimal place).

(b) (i) The mean of the individual maximum temperatures for the 150 June days is  $21.9^{\circ}\text{C}$ .

Tick ( $\checkmark$ ) the correct box.

[1 mark]

On average, the actual temperatures are above the midpoint for the group they are in.

On average, the actual temperatures are equal to the midpoint for the group they are in.

On average, the actual temperatures are below the midpoint for the group they are in.

(b) (ii) The highest temperature recorded over the 150 June days was  $37.9^{\circ}\text{C}$ .

Assuming the data is from a Normal distribution, use the estimated mean and estimated standard deviation to determine whether  $37.9^{\circ}\text{C}$  is a statistical outlier.

You **must** show your working.

[2 marks]

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(c) Bob says that over half of the June days had a maximum temperature under  $21^{\circ}\text{C}$ .

Evaluate Bob's statement.

**[3 marks]**

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13. June/2021/Paper\_2H/No.15(c,d)

(c) Fiona carries out her checks on two roads, the A2 and the A229.

(c) (i) Some summary statistics for the lengths of trucks she checks on the A2 are shown.

|                           |              |
|---------------------------|--------------|
| mean                      | 10.20 metres |
| median                    | 9.18 metres  |
| standard deviation (s.d.) | 2.90 metres  |

Calculate the skew of the data.

$$\text{Use skew} = \frac{3(\text{mean} - \text{median})}{\text{s.d.}}$$

[2 marks]

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Answer \_\_\_\_\_

(c) (ii) Fiona says,

“The data show positive skew, so the trucks below median length have more variable lengths than the trucks above median length.”

Has Fiona interpreted the skew correctly?

Tick (✓) a box.

Yes  No

Explain your answer.

[1 mark]

(d)

$$\text{s.d.} = \sqrt{\frac{\sum x^2}{n} - \left(\frac{\sum x}{n}\right)^2}$$

Fiona checks the lengths of 30 trucks on the A229.

The lengths,  $x$  (metres), of these 30 trucks are summarised by

$$\sum x = 267.12 \quad \sum x^2 = 2538.52 \quad \text{skew} = 0.43$$

Compare statistically the length of trucks checked on the A229 with those checked on the A2.

You **must** show your working.

[6 marks]

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