

# Comparing Distributions

## Solutions

For AQA GCSE Mathematics (8300) • Foundation tier

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Each question is shown in grey, followed by the working, one step per line. The final answer is in a box. *Marks* shows how the marks are usually given in the exam, and **Tip** points out a common mistake.

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**1** (5 marks)

A café has two branches, North and South.

The manager records the waiting times, in minutes, of seven customers at each branch.

|       |   |    |   |   |    |    |    |
|-------|---|----|---|---|----|----|----|
| North | 6 | 9  | 5 | 8 | 7  | 10 | 4  |
| South | 2 | 14 | 7 | 3 | 12 | 5  | 11 |

- (a) Work out the median and the range for each branch.  
Write your answers in the table.

|       | Median (minutes) | Range (minutes) |
|-------|------------------|-----------------|
| North |                  |                 |
| South |                  |                 |

**North:** put the times in order: 4, 5, 6, **7**, 8, 9, 10

There are 7 times, so the median is the 4th one: 7 minutes

Range = largest – smallest =  $10 - 4 = 6$  minutes

**South:** put the times in order: 2, 3, 5, **7**, 11, 12, 14

The median is the 4th time: 7 minutes

$$\text{Range} = 14 - 2 = 12 \text{ minutes}$$

**Answer:** North: median 7, range 6. South: median 7, range 12

**Tip:** Always put the numbers in order before you find the median. The middle of the unordered list (8 or 3) is wrong.

*Marks:* 1 mark for each correct median. 1 mark for each correct range.

- (b) The manager wants the branch where the waiting time is more predictable. Which branch should she choose? Give a reason.

Both branches have the same median, so the average waiting time is the same.

More predictable means the times are closer together: this is the spread (the range).

North's range (6 minutes) is smaller than South's (12 minutes).

**Answer:** North, because it has the smaller range

**Tip:** A **smaller** range means **more** consistent. Here the medians are equal, so only the range can decide.

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**2** (2 marks)

The table shows information about the points scored by two basketball teams.

|        | Mean | Range |
|--------|------|-------|
| Team A | 62   | 15    |
| Team B | 68   | 34    |

Compare the scores of the two teams.

Write one comparison about the average and one about the spread.

**Average:** Team B has a higher mean (68 compared with 62).

So on average, Team B scored more points.

**Spread:** Team A has a smaller range (15 compared with 34).

So Team *A*'s scores were more consistent.

**Answer:** B higher on average; A more consistent

**Tip:** Use the words “mean” and “range”, say which team is higher or lower, and say what it means for the points scored. Just writing the numbers does not get the marks.

*Marks:* 1 mark for comparing the means in context (Team *B* scored more on average). 1 mark for comparing the ranges in context (Team *A* was more consistent).

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**3** (1 mark)

The range of the times for Class *X* to run 100 m is 6 seconds.

The range for Class *Y* is 4 seconds.

Sara says, “On average, Class *Y* was faster.”

Is Sara correct? Tick a box.

Give a reason for your answer.

The range tells you how spread out the times are.

It does not tell you which class was faster on average.

To compare averages, Sara should compare the medians (or the means).

**Answer:** No, range shows spread not average

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**4** (4 marks)

Tom cycles to school. Here are his journey times, in minutes, for eight days.

22 31 18 27 24 35 19 28

(a) Work out the mean of Tom's times.

Add the times:  $22 + 31 + 18 + 27 + 24 + 35 + 19 + 28 = 204$

There are 8 times.

Mean =  $204 \div 8 = 25.5$  minutes

**Answer:** 25.5 minutes

**Tip:** Divide by the number of journeys (8), not by 10 or by the number of different values.

*Marks:* 1 mark for  $204 \div 8$ . 1 mark for 25.5.

- (b) Work out the range of Tom's times.

Longest time = 35 minutes. Shortest time = 18 minutes.

Range =  $35 - 18 = 17$  minutes

**Answer:** 17 minutes

- (c) For Mia's journeys, the mean is 27 minutes and the range is 9 minutes.

Tom says,

*"My journeys are quicker on average **and** more consistent than Mia's."*

Is Tom correct?

Give a reason for your answer.

**Average:** Tom's mean (25.5) is less than Mia's (27), so Tom is quicker on average.

**Spread:** Tom's range (17) is more than Mia's (9), so Tom's times are **less** consistent.

Only the first part is true, so Tom is not correct.

**Answer:** No: Tom is quicker on average, but his range is bigger, so he is less consistent

**Tip:** Check both parts of a statement. Tom's first claim is right but his second is wrong.

**5** (4 marks)

The table shows the numbers of goals scored by the Rovers in 12 matches.

| Number of goals | 0 | 1 | 2 | 3 | 4 |
|-----------------|---|---|---|---|---|
| Frequency       | 2 | 3 | 4 | 2 | 1 |

- (a) Work out the mean number of goals per match for the Rovers.

Multiply each number of goals by its frequency:  $0 \times 2 + 1 \times 3 + 2 \times 4 + 3 \times 2 + 4 \times 1$

$= 0 + 3 + 8 + 6 + 4 = 21$  goals

Number of matches  $= 2 + 3 + 4 + 2 + 1 = 12$

Mean  $= 21 \div 12 = 1.75$  goals

**Answer:** 1.75

**Tip:** Divide by the total frequency (12 matches), not by 5 (the number of rows).

*Marks:* 1 mark for  $21 \div 12$ . 1 mark for 1.75.

- (b) For the United, the mean is 1.5 goals and the range is 5 goals.

Compare the goals scored by the two teams.

Write one comparison about the average and one about the spread.

**Average:** the Rovers' mean (1.75) is higher than the United's (1.5), so the Rovers scored more goals per match on average.

**Spread:** the Rovers' range is  $4 - 0 = 4$  goals, which is less than the United's (5).

So the Rovers' numbers of goals were more consistent.

**Answer:** Rovers scored more on average; Rovers more consistent (range  $4 < 5$ )

**Tip:** The range of the Rovers' goals is  $4 - 0 = 4$  (largest number of goals minus smallest), not  $4 - 1 = 3$  (the frequencies).

*Marks:* 1 mark for comparing the means in context. 1 mark for comparing the ranges in context (you must work out the Rovers' range, 4).

**6** (3 marks)

Two couriers,  $X$  and  $Y$ , each made 40 deliveries.

The table shows information about their delivery times.

|                               | Median time<br>(minutes) | Range of times<br>(minutes) |
|-------------------------------|--------------------------|-----------------------------|
| <b>Courier <math>X</math></b> | 34                       | 20                          |
| <b>Courier <math>Y</math></b> | 29                       | 32                          |

Tick **one** box for each statement.

|                                                                                  | True | May be true | Not true |
|----------------------------------------------------------------------------------|------|-------------|----------|
| Courier $Y$ 's longest delivery took longer than Courier $X$ 's longest delivery |      | ✓           |          |
| At least half of Courier $Y$ 's deliveries took 29 minutes or less               | ✓    |             |          |
| Courier $X$ 's delivery times were more spread out                               |      |             | ✓        |

**1:** the table does not give the longest times, only the ranges.  $Y$  has the bigger range, but  $X$ 's times could still include a longer delivery. **May be true.**

**2:** the median is the middle value, so at least half of the times are at or below it.  $Y$ 's median is 29 minutes. **True.**

**3:**  $X$ 's range (20) is smaller than  $Y$ 's (32), so  $X$ 's times were **less** spread out. **Not true.**

**Answer:** May be true, True, Not true

**Tip:** A bigger range does not mean a bigger largest value. The range is largest minus smallest, so you do not know the actual longest time.

*Marks:* 1 mark for each correct row.

**7** (3 marks)

The table shows the masses,  $m$  grams, of 30 apples from each of two orchards.

| Mass, $m$ (grams)  | Orchard A | Orchard B |
|--------------------|-----------|-----------|
| $100 < m \leq 120$ | 6         | 3         |
| $120 < m \leq 140$ | 11        | 8         |
| $140 < m \leq 160$ | 9         | 13        |
| $160 < m \leq 180$ | 4         | 6         |

- (a) Write down the modal class for Orchard A.

The modal class has the highest frequency.

For Orchard A the highest frequency is 11, in the class  $120 < m \leq 140$ .

**Answer:**  $120 < m \leq 140$

- (b) Which class interval contains the median for Orchard B?

There are 30 apples, so the median is halfway between the 15th and 16th values.

Running totals for Orchard B: 3,  $3 + 8 = 11$ ,  $11 + 13 = 24$

The 15th and 16th values are both in the third class.

**Answer:**  $140 < m \leq 160$

**Tip:** The median class is not the middle row of the table. Use running totals to find where the middle value is.

- (c) Jo says, “On average, the apples from Orchard B are heavier.”

Is Jo correct?

Give a reason for your answer.

Running totals for Orchard A: 6, 17, so A’s median is in  $120 < m \leq 140$ .

B’s median is in the higher class  $140 < m \leq 160$ .

So on average the apples from Orchard  $B$  are heavier. Jo is correct.

**Answer:** Yes:  $B$ 's median class ( $140 < m \leq 160$ ) is higher than  $A$ 's ( $120 < m \leq 140$ )

**Tip:** Compare the same average for both orchards: median class with median class (or modal class with modal class).

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