

Comparing Distributions

Solutions

For Pearson Edexcel GCSE Mathematics (1MA1) • Foundation tier

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.

1 (5 marks)

A factory has two machines, P and Q , that fill bags of flour.

Five bags from each machine are weighed. Here are their masses, in grams.

Machine P	502	498	500	501	499
Machine Q	507	493	500	510	490

- (a) Work out the mean and the range of the masses for each machine.
Write your answers in the table.

	Mean (grams)	Range (grams)
Machine P		
Machine Q		

Machine P : total = $502 + 498 + 500 + 501 + 499 = 2500$

Mean = $2500 \div 5 = 500$ g

Range = largest – smallest = $502 - 498 = 4$ g

Machine Q : total = $507 + 493 + 500 + 510 + 490 = 2500$

Mean = $2500 \div 5 = 500$ g

Range = $510 - 490 = 20$ g

Answer: P : mean 500 g, range 4 g. Q : mean 500 g, range 20 g

Marks: 1 mark for each correct mean. 1 mark for each correct range.

- (b) The manager wants the bags to be as close to 500 g as possible.
Which machine should the manager use? Give a reason for your answer.

Both machines have the same mean, 500 g.

Machine *P* has a much smaller range (4 g compared with 20 g).

So machine *P*'s bags are more consistent: they are all close to 500 g.

Answer: Machine *P*, because its range is smaller (same mean)

Tip: When the means are the same, the range decides. A smaller range means the masses are closer together.

2 (2 marks)

Jo grows two types of plant, *A* and *B*.

For type *A*, the median height is 48 cm and the range is 22 cm.

For type *B*, the median height is 41 cm and the range is 9 cm.

Compare the distributions of the heights of the two types of plants.

Median: type *A* has a higher median (48 cm compared with 41 cm).

So on average, type *A* plants are taller.

Range: type *B* has a smaller range (9 cm compared with 22 cm).

So the heights of type *B* plants are less spread out (more consistent).

Answer: A taller on average; B more consistent

Tip: Use the words “median” and “range” (not “average” or “spread”), say which is bigger, and say what it means for the plants.

Marks: 1 mark for comparing the medians in context. 1 mark for comparing the ranges in context.

3 (1 mark)

Two classes sat the same test.

Rob says, “Class A did better because their highest mark was higher.”

Is Rob right?

Give a reason for your answer.

No. The highest mark is just one student’s mark.

To compare the classes, you should compare an average (such as the median or mean) and a measure of spread (such as the range).

Answer: No, compare averages not one value

Tip: Comparing the highest or lowest values is a common mistake. Compare averages (median or mean) and spreads (range) instead.

4 (4 marks)

Here are the numbers of emails received by 9 office workers one day.

12 15 14 11 16 13 58 15 14

(a) Find the median.

Put the numbers in order: 11, 12, 13, 14, **14**, 15, 15, 16, 58

There are 9 values, so the median is the 5th value.

Median = 14

Answer: 14

(b) Work out the mean.

Total = $12 + 15 + 14 + 11 + 16 + 13 + 58 + 15 + 14 = 168$

Mean = $168 \div 9 = 18.66 \dots$

= 18.7 (1 d.p.)

Answer: 18.7 (18.66...)

Marks: 1 mark for $168 \div 9$. 1 mark for 18.7 (or better).

- (c) Which average, the median or the mean, better represents the number of emails received by these workers?
Give a reason for your answer.

One worker received 58 emails, much more than everyone else. This is an extreme value (an outlier).

The outlier pulls the mean up to 18.7, which is higher than 8 of the 9 values.

The median (14) is not affected by the outlier, so it is more typical.

Answer: The median, because the mean is affected by the extreme value 58

Tip: Say **why**: name the extreme value (58) and say it affects the mean but not the median.

5 (4 marks)

The stem and leaf diagram shows the numbers of press-ups done in one minute by 13 Year 10 students.

1	5 8 9
2	0 3 4 6 6 8
3	1 2 5
4	0

Key: 1|5 represents 15 press-ups

Here are the numbers of press-ups done in one minute by 9 Year 7 students.

22 14 19 27 16 21 12 25 18

Compare the distribution of the numbers of press-ups done by the Year 10 students with the distribution of the numbers of press-ups done by the Year 7 students.

Year 10: there are 13 students, so the median is the 7th value.

Count along the leaves: 15, 18, 19, 20, 23, 24, **26**, so the Year 10 median = 26

Year 10 range = $40 - 15 = 25$

Year 7 in order: 12, 14, 16, 18, **19**, 21, 22, 25, 27

There are 9 values, so the Year 7 median is the 5th value, 19. Range = $27 - 12 = 15$

Median: the Year 10 median (26) is higher than the Year 7 median (19), so on average Year 10 did more press-ups.

Range: the Year 7 range (15) is smaller than the Year 10 range (25), so the Year 7 numbers are less spread out (more consistent).

Answer: Year 10: median 26, range 25. Year 7: median 19, range 15. Year 10 did more on average; Year 7 less spread out

Tip: Put the Year 7 list in order before finding the median. The middle of the unordered list (16) is wrong.

Marks: 1 mark for a correct median (26 or 19). 1 mark for comparing the medians in context. 1 mark for a correct range (25 or 15). 1 mark for comparing the ranges in context.

6 (5 marks)

The table shows information about the number of pets owned by each of the 30 students in Class 10A.

Number of pets	Frequency
0	6
1	11
2	7
3	4
4	2

(a) Work out the mean number of pets for Class 10A.

Multiply each number of pets by its frequency:

$$0 \times 6 = 0, \quad 1 \times 11 = 11, \quad 2 \times 7 = 14, \quad 3 \times 4 = 12, \quad 4 \times 2 = 8$$

$$\text{Total number of pets: } 0 + 11 + 14 + 12 + 8 = 45$$

There are 30 students.

$$\text{Mean} = 45 \div 30 = 1.5$$

Answer: 1.5

Tip: Divide by the number of students (30), not by 5 (the number of rows). Students with 0 pets still count.

Marks: 1 mark for at least three of the products. 1 mark for $45 \div 30$. 1 mark for 1.5.

- (b) For Class 10B, the mean number of pets is 1.8 and the range is 3
Compare the numbers of pets owned by the students in Class 10A with the numbers owned by the students in Class 10B.

Mean: Class 10B's mean (1.8) is higher than Class 10A's (1.5).

So on average the students in 10B own more pets.

Range: in 10A the numbers of pets go from 0 to 4 (use these, not the frequencies).

So 10A's range is $4 - 0 = 4$, which is bigger than 10B's range of 3.

So the numbers of pets in 10A are more spread out.

Answer: 10B more pets on average; 10A more spread out (range $4 > 3$)

Marks: 1 mark for comparing the means in context. 1 mark for working out 10A's range (4) and comparing it with 3.