# Comparing distributions with mean and standard deviation

Grade 8 | Worked solutions

**GCSE Statistics topic practice**

**1** Asha can take Bus X or Bus Y to college. The table shows information about the journey times, in minutes, for each bus.

| | Mean | Standard deviation |
|---|---|---|
| **Bus X** | 24 | 6.5 |
| **Bus Y** | 27 | 2 |

a. Compare the journey times for the two buses. (2)

b. Asha says, "Bus X is always quicker than Bus Y." Is Asha correct? Give a reason for your answer. (1)

(3 marks)

a) Compare the means

24 is less than 27

On average, Bus X journeys are quicker

Compare the standard deviations

2 is less than 6.5

Bus Y journey times are more consistent

b)

No, Bus X is only quicker on average

Its times vary more, so some journeys on Bus X will take longer than journeys on Bus Y

a) X quicker on average, Y more consistent b) no


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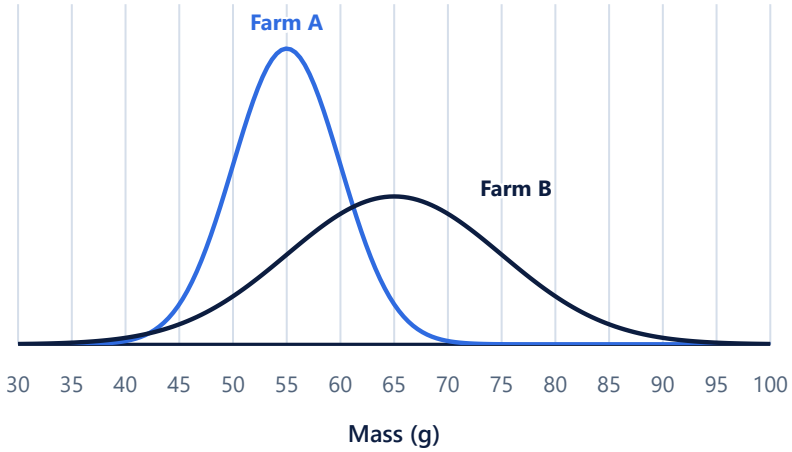
**2** The diagram shows the distributions of the masses of the eggs from Farm A and from Farm B. Both distributions are normal.

a. Which farm has eggs with the greater mean mass? Give a reason for your answer. (1)

b. Which farm has eggs with the greater standard deviation? Give a reason for your answer. (1)

c. A shop wants eggs that are all about the same mass. Which farm should the shop buy from? Give a reason for your answer. (1)

d. Almost all of the eggs from Farm A have a mass between 40 g and 70 g. Work out an estimate for the standard deviation of the masses of the eggs from Farm A. (1)




(4 marks)

a)

Farm B

The peak of its curve is further to the right

b)

Farm B

Its curve is wider, so the masses are more spread out

c)

Farm A

Its standard deviation is smaller,

so the masses are more consistent

d) Almost all values are within 3 sd of the mean

$6\text{ sd} = 70 - 40$

$6\text{ sd} = 30$

$\text{sd} = 5\text{ g}$

a) B b) B c) A d) 5 g


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**3** A magazine tests the battery life, $x$ hours, of 25 phones of Brand A. The results are summarised below.

$\Sigma x = 1500 \quad \Sigma x^2 = 91\,600$

a. Calculate the mean and the standard deviation of the battery life for Brand A. (3)

b. For 25 phones of Brand B, the mean battery life is 57 hours and the standard deviation is 12.5 hours. Compare the battery life of the two brands. (2)

(5 marks)

a)

$$\text{mean} = \frac{\text{sum of } x}{n}$$

$$\text{mean} = \frac{1500}{25}$$

$$\text{mean} = 60 \text{ hours}$$

$$\text{sd} = \sqrt{\left(\frac{\text{sum of } x^2}{n} - \text{mean}^2\right)}$$

$$\text{sd} = \sqrt{\left(\frac{91600}{25} - 60^2\right)}$$

$$\text{sd} = \sqrt{(3664 - 3600)}$$

$$\text{sd} = \sqrt{64}$$

$$\text{sd} = 8 \text{ hours}$$

b) Compare the means

60 is greater than 57

On average, Brand A batteries last longer

Compare the standard deviations

8 is less than 12.5

Brand A battery life is more consistent

a) mean 60, sd 8 b) A longer on average and more consistent

**4** Priya grows tomato plants using two fertilisers. The heights, in cm, after 4 weeks of the 5 plants grown with fertiliser P are

12 15 11 14 13

a. Calculate the mean and the standard deviation of these heights. Give the standard deviation correct to 2 decimal places. (3)

b. For the 5 plants grown with fertiliser Q, the mean height is 13.6 cm and the standard deviation is 3.2 cm. Compare the heights of the plants grown with the two fertilisers. (2)

(5 marks)

a)

$$\text{sum of } x = 12 + 15 + 11 + 14 + 13$$


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$$\text{sum of } x = 65$$

$$\text{mean} = 65 \div 5$$

$$\text{mean} = 13 \text{ cm}$$

$$\text{sum of } x^2 = 144 + 225 + 121 + 196 + 169$$

$$\text{sum of } x^2 = 855$$

$$\text{sd} = \sqrt{\left(\frac{\text{sum of } x^2}{n} - \text{mean}^2\right)}$$

$$\text{sd} = \sqrt{\left(\frac{855}{5} - 13^2\right)}$$

$$\text{sd} = \sqrt{(171 - 169)}$$

$$\text{sd} = \sqrt{2}$$

$$\text{sd} = 1.41 \text{ cm}$$

b) Compare the means

13.6 is greater than 13

On average, plants with fertiliser Q are slightly taller

Compare the standard deviations

1.41 is less than 3.2

Heights with fertiliser P are more consistent

a) mean 13, sd 1.41 b) Q taller on average, P more consistent

**5** Two machines cut metal rods. The target length is 50 cm. A rod is accepted only if its length is between 49 cm and 51 cm. The lengths of the rods from each machine are normally distributed.

| | Mean (cm) | Standard deviation (cm) |
|---|---|---|
| **Machine A** | 50.2 | 0.4 |
| **Machine B** | 50.0 | 1.1 |

a. For machine A, work out the two lengths between which the middle 95% of the rods lie. (2)

b. For machine B, work out the two lengths between which the middle 95% of the rods lie. (1)

c. Which machine should the factory use? Give reasons for your answer. (2)

(5 marks)

a) 95% of values are within 2 sd of the mean

$50.2 - 2 \times 0.4 = 49.4$

$50.2 + 2 \times 0.4 = 51$

Between 49.4 cm and 51 cm


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b)

$50.0 - 2 \times 1.1 = 47.8$

$50.0 + 2 \times 1.1 = 52.2$

Between 47.8 cm and 52.2 cm

c)

Machine A

Its mean is a little above the target

but its standard deviation is much smaller

At least 95% of its rods are between 49 cm and 51 cm

Many rods from machine B are outside 49 cm to 51 cm

a) 49.4 cm and 51 cm b) 47.8 cm and 52.2 cm c) machine A


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