GCSE Statistics: Grade 5

Worked solutions

GCSE Statistics practice

1 CUMULATIVE FREQUENCY DIAGRAMS

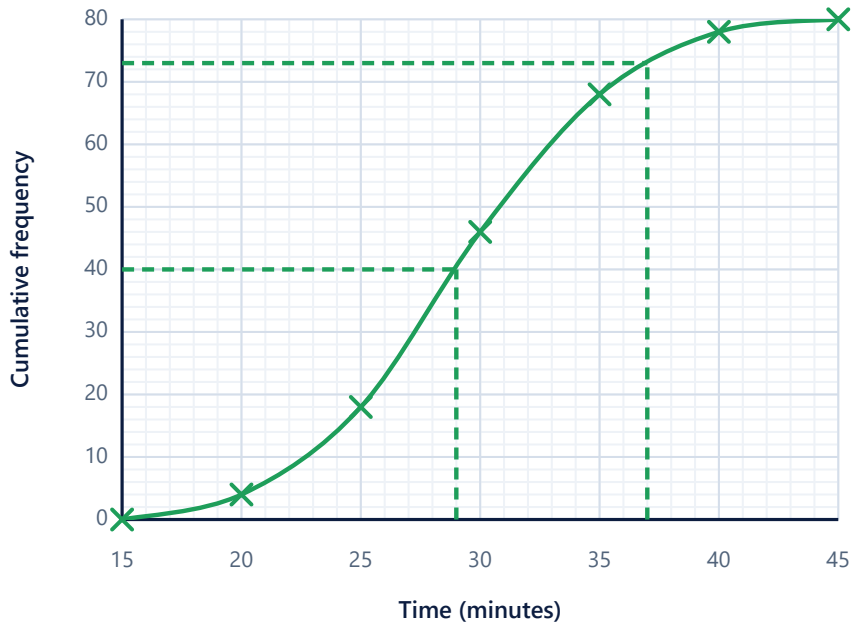
The cumulative frequency table shows the times, t minutes, taken by 80 runners to finish a 5 km run. No runner took 15 minutes or less.

Time, t (minutes)	**$t \leq 20$**	**$t \leq 25$**	**$t \leq 30$**	**$t \leq 35$**	**$t \leq 40$**	**$t \leq 45$**
Cumulative frequency	4	18	46	68	78	80

a. On the grid, draw a cumulative frequency diagram for this information. (2)

b. Use your diagram to find an estimate for the median time. (1)

c. Use your diagram to find an estimate for the number of runners who took more than 37 minutes. (2)



(5 marks)

a)

Plot each value at the top of its class.

Start at (15, 0) and join the points with a curve.

b)

80 ÷ 2 = 40

Across from 40 to the curve, then down, gives about 29

c)

Up from 37 to the curve, then across, gives about 73

80 - 73 = 7

a) curve drawn b) about 29 minutes c) about 7 runners

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2 **MEDIAN, QUARTILES AND INTERQUARTILE RANGE**

A call centre records how long, in seconds, each of 11 callers waits before their call is answered.

12 7 15 9 21 10 18 7 14 25 11

a. Find the median waiting time. (1)

b. Work out the interquartile range of the waiting times. (2)

c. At a second call centre the median waiting time is 12 seconds and the interquartile range is 15 seconds. Compare the consistency of the waiting times at the two call centres. (1)

(4 marks)

a)

Put the times in order

7, 7, 9, 10, 11, 12, 14, 15, 18, 21, 25

$(11 + 1) \div 2 = 6$

The 6th value is 12

b)

$(11 + 1) \div 4 = 3$

Lower quartile is the 3rd value, which is 9

Upper quartile is the 9th value, which is 18

$18 - 9 = 9$

c)

The first call centre has the smaller interquartile range ($9 < 15$).

So its waiting times are more consistent.

a) 12 s b) 9 s c) first centre is more consistent

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3 **BOX PLOTS AND COMPARING DISTRIBUTIONS**

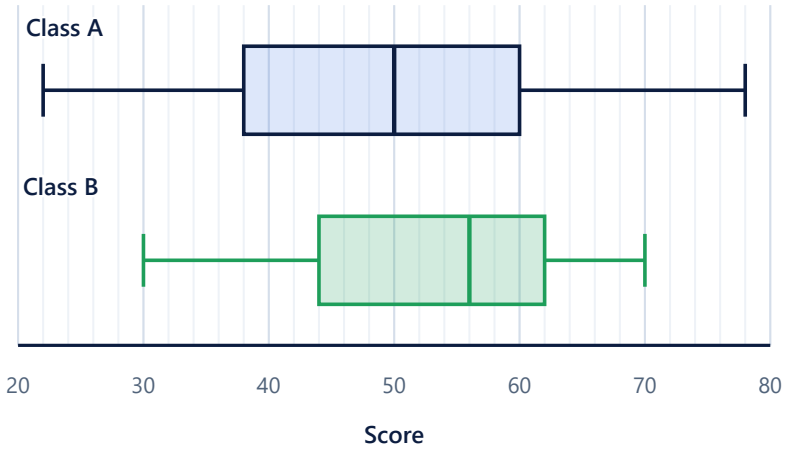
Class A and Class B sat the same statistics test. The box plot shows the scores for Class A. The table gives information about the scores for Class B.

Class B	Lowest score	Lower quartile	Median	Upper quartile	Highest score
Score	30	44	56	62	70

a. Work out the interquartile range of the scores for Class A. (1)

b. On the grid, draw a box plot for Class B. (2)

c. Compare the distributions of the scores for Class A and Class B. (2)



(5 marks)

a)

Lower quartile is 38 and upper quartile is 60

60 - 38 = 22

b)

Box from 44 to 62 with the median line at 56.

Whiskers out to 30 and to 70.

c)

Median for B is 56 and for A it is 50.

Class B scored higher on average.

IQR for B = 62 - 44

= 18

This is less than 22 for Class A.

The scores in Class B are more consistent.

a) 22 b) box plot drawn c) B higher, B more consistent

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4 **MOVING AVERAGES**

The table shows the amount of gas, in thousands of kWh, used by a school in each term of two school years.

School year	**Year 1**	**Year 1**	**Year 1**	**Year 2**	**Year 2**	**Year 2**
Term	Autumn	Spring	Summer	Autumn	Spring	Summer
Gas used (thousand kWh)	45	60	30	51	66	39

The first 3-point moving average is 45.

a. Work out the other three 3-point moving averages. (3)

b. Describe what the moving averages show about the trend in the amount of gas used. (1)

(4 marks)

a)

Add three terms in a row, then divide by 3

$(60 + 30 + 51) \div 3 = 141 \div 3$

$= 47$

$(30 + 51 + 66) \div 3 = 147 \div 3$

$= 49$

$(51 + 66 + 39) \div 3 = 156 \div 3$

$= 52$

b)

The moving averages go up each time.

The trend is upward.

The school is using more gas over time.

a) 47, 49, 52 b) upward trend, gas use is increasing

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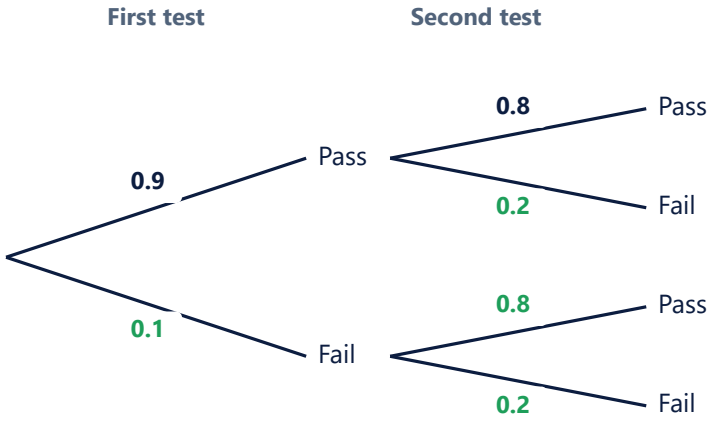
5 **TREE DIAGRAMS**

A factory tests each smoke alarm twice. The probability that an alarm passes the first test is 0.9. The probability that an alarm passes the second test is 0.8. The results of the two tests are independent.

a. Complete the probability tree diagram. (2)

b. Work out the probability that an alarm passes both tests. (1)

c. Work out the probability that an alarm passes exactly one of the two tests. (2)



(5 marks)

a)

P(fail first test) = 1 − 0.9

= 0.1

P(fail second test) = 1 − 0.8

= 0.2

The second test branches are 0.8 and 0.2 both times.

b)

0.9 × 0.8 = 0.72

c)

Either pass then fail, or fail then pass

P(pass then fail) = 0.9 × 0.2

= 0.18

P(fail then pass) = 0.1 × 0.8

= 0.08

0.18 + 0.08 = 0.26

a) 0.1, then 0.2, 0.8, 0.2 b) 0.72 c) 0.26

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6 CRUDE BIRTH AND DEATH RATES

In 2025, Town A had a population of 48 000. There were 600 births in Town A that year.

a. Work out the crude birth rate for Town A in 2025. (2)

b. In 2025, Town B had a population of 30 000 and a crude death rate of 11.5 per thousand. Work out the number of deaths in Town B in 2025. (2)

c. The crude death rate for Town A in 2025 was 9 per thousand. Give one possible reason why the crude death rate is higher in Town B than in Town A. (1)

(5 marks)

a)

Crude rate = number of births ÷ population × 1000

$$\frac{600}{48000} \times 1000 = 12.5$$

b)

11.5 deaths for every 1000 people

30000 ÷ 1000 = 30

11.5 × 30 = 345

c)

Town B may have a higher proportion of older people than Town A.

a) 12.5 per thousand b) 345 c) B has more older people

7 SYSTEMATIC, QUOTA AND CLUSTER SAMPLING

A factory makes 2400 phone cases each day. The quality manager wants to check a sample of 60 of the cases made in one day.

a. Describe how the manager could take a systematic sample of 60 phone cases. (2)

b. A researcher wants to know what people think of the phone cases. She stands in a town centre and interviews the first 20 men and the first 20 women who agree to talk to her. Write down the name of this sampling method. (1)

c. Give one disadvantage of the sampling method in part (b). (1)

(4 marks)

a)

2400 ÷ 60 = 40

Pick a random number from 1 to 40 for the first case.

Then take every 40th case after that one.

b)

Quota sampling

c)

It is not random.

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The researcher chooses who to ask,

so the sample may be biased.

a) random start, then every 40th b) quota c) may be biased

8 **CAPTURE-RECAPTURE**

Ecologists want to estimate the number of fish in a lake. They catch 40 fish, tag each one and release them back into the lake. One week later they catch 60 fish. 8 of these 60 fish have a tag.

a. Work out an estimate for the number of fish in the lake. (3)

b. Write down one assumption you made in part (a). (1)

(4 marks)

a)

Tagged share of the sample = tagged share of the lake

$$\frac{8}{60} = \frac{40}{N}$$

$$N = \frac{40 \times 60}{8}$$

$$N = \frac{2400}{8}$$

$$N = 300$$

b)

The number of fish in the lake did not change during the week.

(No births, deaths or fish moving in or out.)

a) 300 fish b) the population did not change

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