Quality assurance and control charts

Grade 8 | Worked solutions

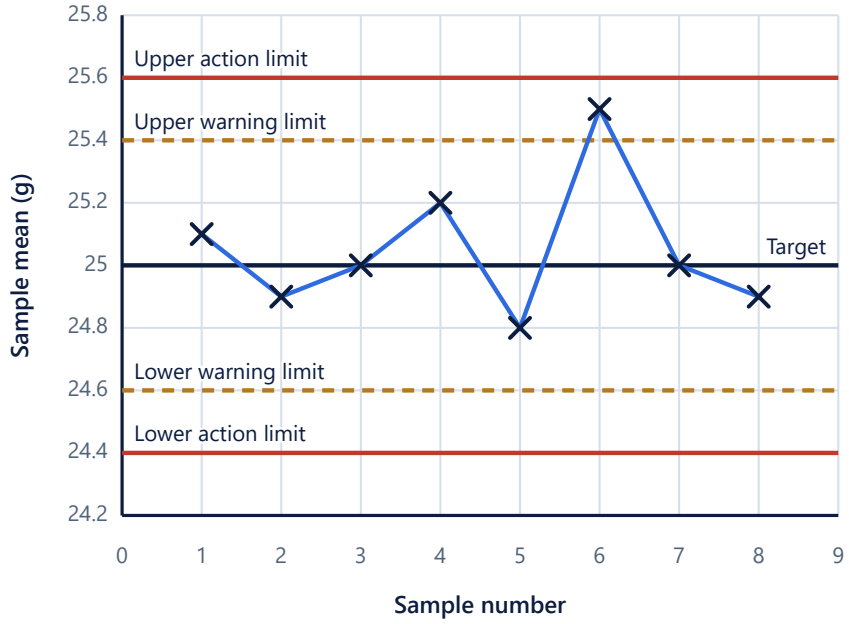
GCSE Statistics topic practice

1 A machine fills packets with crisps. The target mass is 25 g. Every 30 minutes a sample of packets is taken and the mean mass is plotted on the control chart. The chart shows the means of 8 samples.

a. Write down the number of the sample whose mean is outside the warning limits. (1)

b. Sample 7 was taken straight after that sample. Explain why the machine was then allowed to carry on running. (1)

c. Give one reason why samples are used instead of weighing every packet. (1)



(3 marks)

a)

Sample 6

Its mean (25.5 g) is above the upper warning limit

b) Sample 7 has mean 25.0 g

This is back inside the warning limits

So the process is under control

c)

Weighing every packet would take too long

Sampling is quicker and cheaper

a) sample 6 b) sample 7 is inside the limits c) quicker

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2 A factory makes chocolate bars. Every hour a sample of 5 bars is taken and the range of their masses is plotted on the control chart. The chart shows the ranges for the first 5 samples.

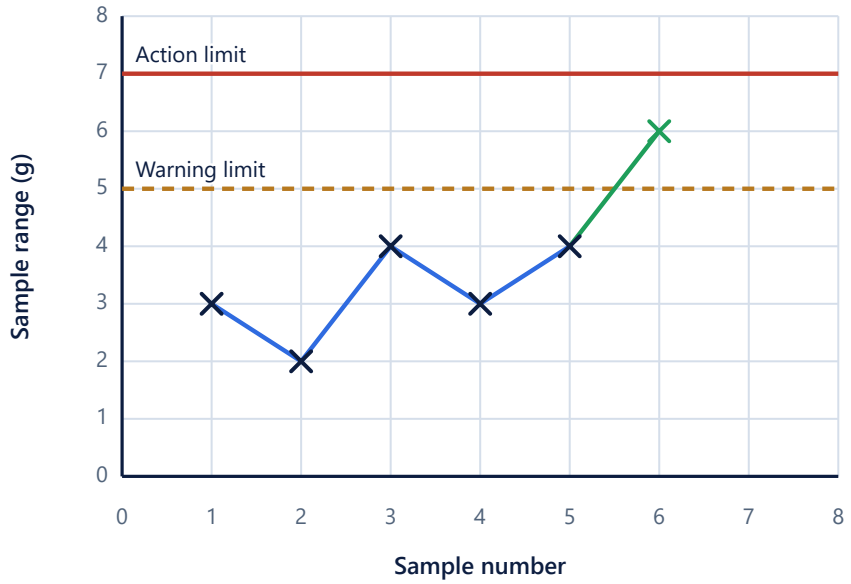
The masses, in grams, of the 5 bars in sample 6 are

48 51 46 52 50

a. Work out the range for sample 6 and plot it on the control chart. (2)

b. Describe what should be done after sample 6 is taken. Give a reason for your answer. (1)

c. Explain why this control chart does not need lower limits. (1)



(4 marks)

a) range = highest value - lowest value

range = 52 - 46

range = 6 g

Plot (6, 6)

b) 6 is between the warning limit (5) and the action limit (7)

Take another sample straight away

c)

A small range means the masses are consistent

This is what the factory wants, so no action is needed

a) 6 g, plotted b) take another sample c) low range is good

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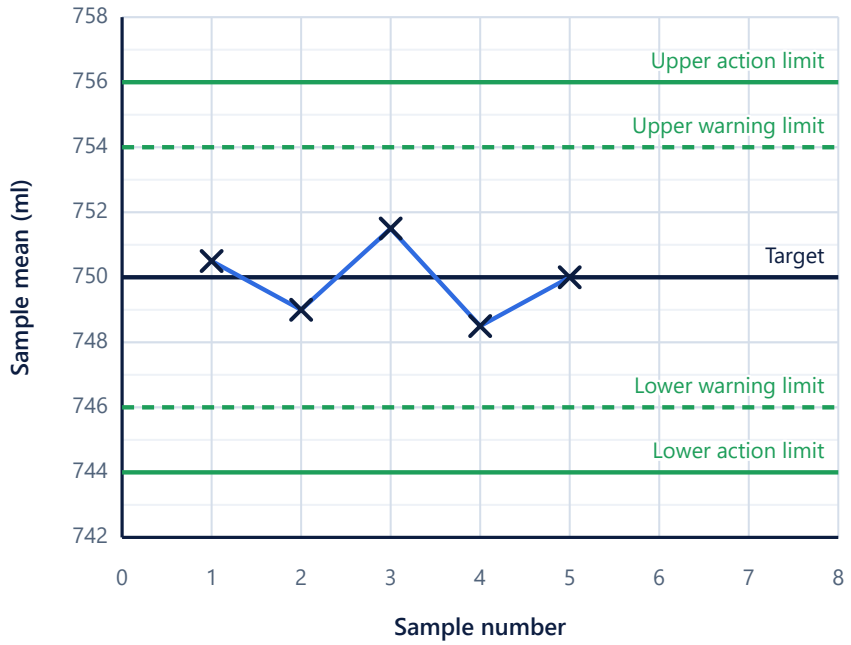
3 A machine fills tins with paint. When the machine is working correctly, the sample means have a target value of 750 ml and a standard deviation of 2 ml.

The warning limits are set 2 standard deviations from the target value. The action limits are set 3 standard deviations from the target value.

The control chart shows the target value and the means of the first 5 samples.

a. Work out the upper and lower warning limits and the upper and lower action limits. (2)

b. Draw and label the warning limits and the action limits on the control chart. (2)



(4 marks)

a) Warning limits are 2 sd from the target

750 + 2 x 2 = 754

750 - 2 x 2 = 746

Action limits are 3 sd from the target

750 + 3 x 2 = 756

750 - 3 x 2 = 744

Warning limits 746 ml and 754 ml

Action limits 744 ml and 756 ml

b)

Draw horizontal lines at 746 and 754 (warning limits)

Draw horizontal lines at 744 and 756 (action limits)

a) warning 746, 754 and action 744, 756 b) lines drawn

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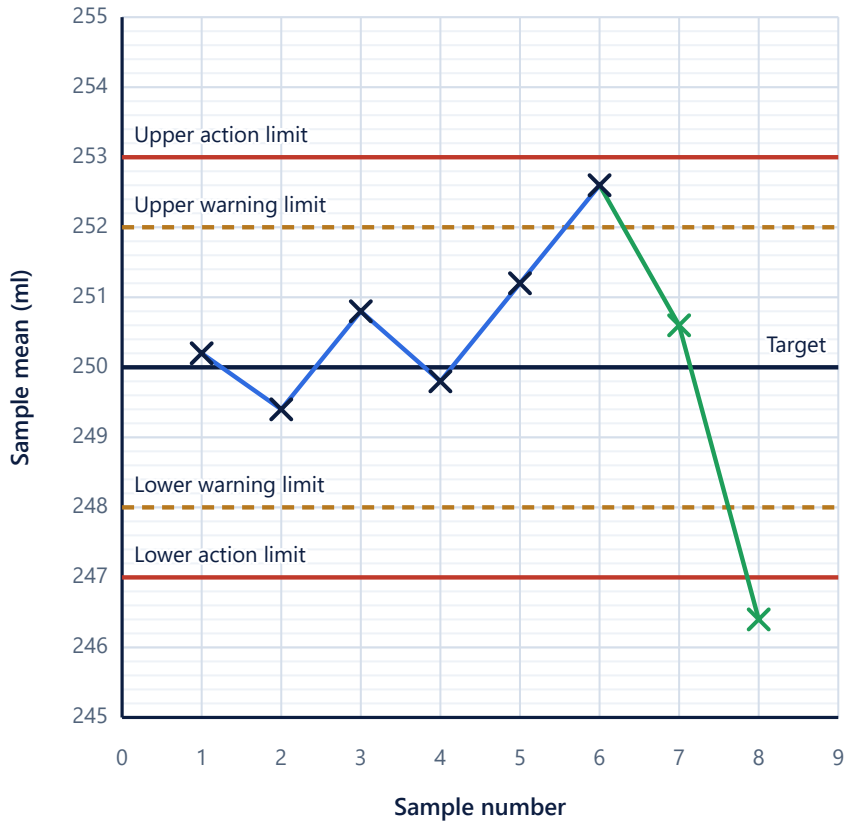
4 A machine fills bottles with juice. The target volume is 250 ml. Every hour a sample of 5 bottles is taken and the mean volume is plotted on the control chart. The chart shows the means of the first 6 samples.

The mean of sample 7 is 250.6 ml and the mean of sample 8 is 246.4 ml.

a. Plot the means of samples 7 and 8 on the control chart. (1)

b. Describe what should be done after sample 6 is taken. Give a reason for your answer. (2)

c. Describe what should be done after sample 8 is taken. Give a reason for your answer. (2)



(5 marks)

a)

Plot (7, 250.6) and (8, 246.4)

b) Sample 6 has mean 252.6 ml

This is between the upper warning limit (252)

and the upper action limit (253)

Take another sample straight away

If that is also outside the warning limits, stop the machine

c) Sample 8 has mean 246.4 ml

This is below the lower action limit (247)

Stop the machine and reset it

a) plotted b) take another sample c) stop and reset

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5 A machine makes bolts with a target diameter of 10.0 mm. Every hour a sample of 5 bolts is taken and the mean diameter is plotted on the control chart. The chart shows the means of the first 8 samples.

The diameters, in mm, of the 5 bolts in sample 9 are

10.5 10.9 10.6 10.8 10.7

a. After sample 8 the manager says, "All of the sample means are inside the warning limits, so there is nothing to worry about." Comment on the manager's statement. (2)

b. Work out the mean for sample 9 and plot it on the control chart. (2)

c. Describe what should be done after sample 9 is taken. Give a reason for your answer. (1)



(5 marks)

a)

The sample means show an upward trend

If this carries on, the means will soon be

above the upper warning limit

The manager is not right, the machine should be checked

b)

sum = 10.5 + 10.9 + 10.6 + 10.8 + 10.7

sum = 53.5

mean = 53.5 ÷ 5

mean = 10.7 mm

Plot (9, 10.7)

c) 10.7 is above the upper action limit (10.6)

Stop the machine and reset it

a) upward trend, check machine b) 10.7 mm c) stop and reset

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