Paper 2:   Sample Means
                  Quality Assurance
                  Normal distribution

**NORMAL DISTRIBUTION
CONDITIONS**

NOTATION

SHAPE
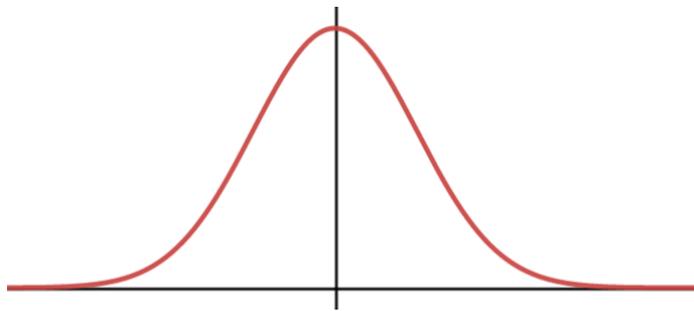
DISTRIBUTION OF DATA
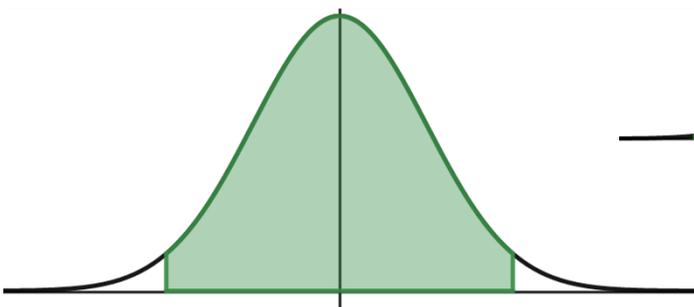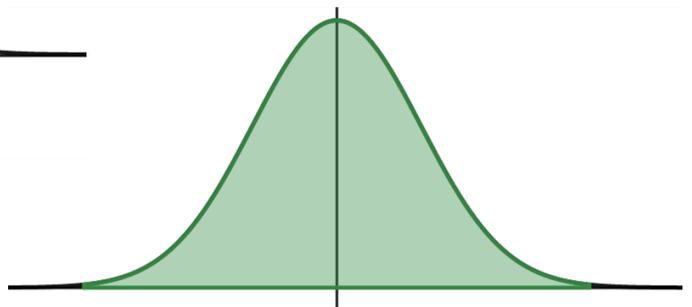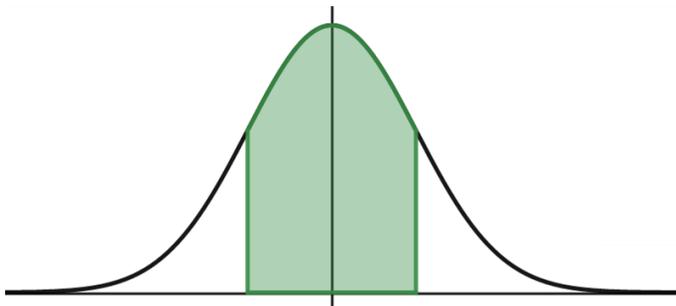
SAMPLE MEAN
DISTRIBUTION

QUALITY ASSURANCE
MEAN CONTROL CHART
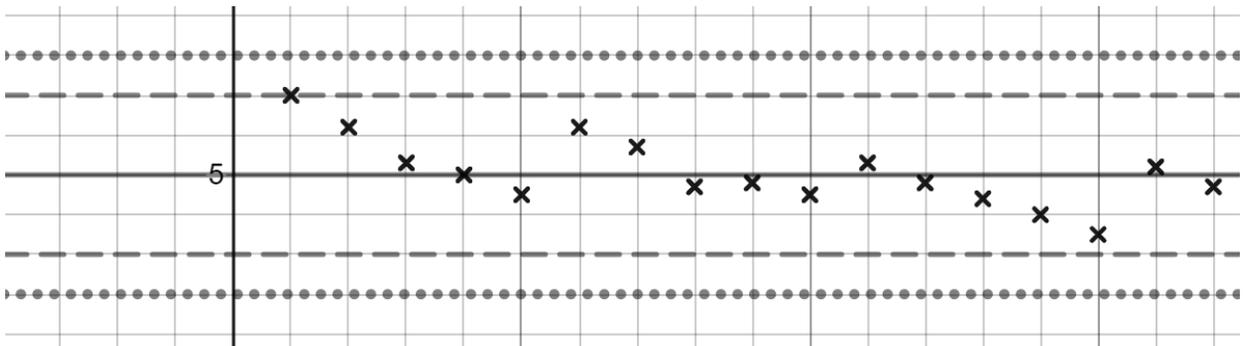
QUALITY ASSURANCE
RANGE CONTROL CHART
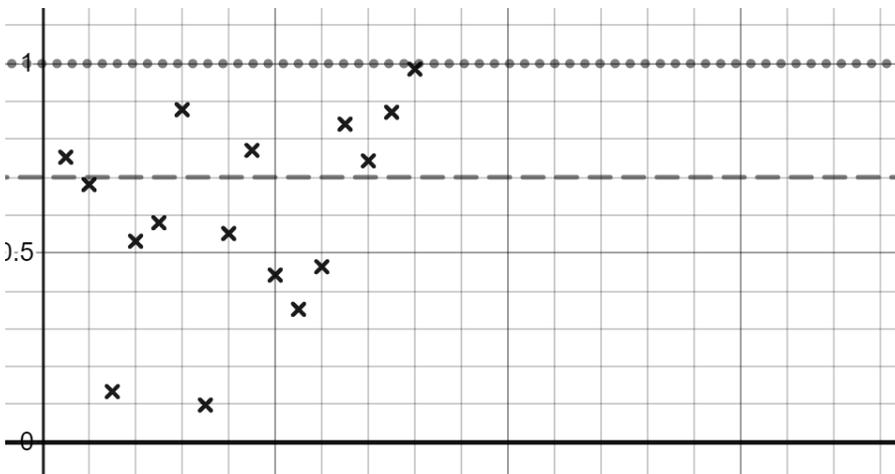
1

For each of the following Normal distributions fill in the table for the range of values for which you find:
(a) The middle 68% of the population
(b) The middle 95% of the population
(c) Almost all the population

Distribution	The middle 68% of the data	The middle 95% of the population	Almost all the population
$X \sim N(10, 2^2)$			
$X \sim N(15, 25)$			
$X \sim N(23.2, 0.09)$			

2

Calculate the standardised scores for the following:

Mean	Standard Deviation	Score	Standardised Score
10	2	6	
0.2	0.01	0.225	
6	1.5	6.2	

3 Which of these can be modelled by a Normal distribution?

Data	Mean	Median	Mode	Distribution Shape
Discrete	6	6	6	
Continuous	5	5	5	
Continuous	5.6	5	5	
Continuous	5	5	5	

3 Calculate the mean and standard deviation for the data set below

Height (cm)	Frequency				
$150 < h \le 160$	40				
$160 < h \le 170$	50				
$170 < h \le 175$	32				
$175 < h \le 180$	19				
$180 < h \le 190$	8				

By approximating the number of people with in 1 standard deviation, 2 standard deviations and 3 standard deviations of the mean explain if the normal distribution could be used to model this data.

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4

Mason and Ellie are taking part in the parkrun.
They want to compare their times.
Below are the mean and standard deviations for their age group and their finish times.

Explain who is the better runner.

Name	Time	Mean for age group	Standard deviation for age group
Ellie	32 minutes 40 secs	30 minutes	7 minutes 30 secs
Mason	29 minutes 18 secs	28 minutes	6 minutes 45 seconds

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5 Complete the following sentences.

The population mean is ....the mean of the sample means

The population standard deviation is ....the standard deviation of the sample means

6 A factory is producing cans of baked beans.

The filling process is set so that the average weight of the can after it has been filled is 405g, and the standard deviation is 1.5 g.

Draw the action and warning lines on this control chart.

Below is a mean control chart for a different canning machine in the same factory.

A sample of 10 cans is taken and the mean is calculated as 402.3g.

Explain what action is taken.

403

402

401

400

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8 Below is a range control chart for a machine which produces 10mm nails.

Explain in context what each of the action and warning lines are on the chart.

Explain why there are no lower action and warning lines

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