



The **topics** and **types of questions** examined in this Achievement Standard. Use this sheet to plan and organise your study so that you cover everything that is required.

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3.2 CONFIDENCE INTERVALS AS 90642

Calculate confidence intervals for population parameters

3.2 1. C.I. for population means and proportions A

- calculating confidence intervals for population means and proportions.

▶ A random sample of 60 'super' model batteries was tested by placing the batteries in a computer game device and running it until the batteries were flat.

The sample mean for the lifetime of these batteries was 3.72 hours and the sample standard deviation was 0.43 hours.

Find a 90% confidence interval for the mean lifetime of all 'super' batteries when they are run in the same type of computer game device as the one used in the test.

3.2 2. C.I. for the difference between population means A

- calculating confidence intervals for the difference between two population means

▶ The Council wanted to know if, for households supporting the Art Gallery project, there was a significant difference between the mean amounts that urban and rural households would donate to an Art Gallery Building Fund. The table summarises the data that was collected:

	Urban	Rural
Sample size (number of households surveyed)	147	90
Sample mean (dollars)	108.13	95.89
Sample standard deviation (dollars)	58.66	60.83

Let μ_1 be the mean amount that urban households supporting the Art Gallery project would donate, and let μ_2 be the mean amount that rural households supporting the project would donate.

Find a 90% confidence interval for $\mu_1 - \mu_2$.

3.2 3. Finding the sample size M

- calculating the sample size required to meet a pre-specified precision

▶ A researcher wants his estimate of the mean length of fish that were caught in Lake Ackland in the last season to be within 20 millimetres of the true mean length, with 95% confidence. Previous research has found that the standard deviation of lengths of fish that are caught in Lake Ackland is 80 millimetres.

What is the minimum sample size that is required to meet this condition?

3.2 4. Interpreting confidence intervals M

- justifying or refuting claims about a population parameter
- estimating population totals

▶ A company produces two different models of batteries: 'power' and 'super'.

(a) A quality analyst interviewed a random sample of 95 people who have used both 'power' and 'super' batteries, to find out which of the two models these people prefer to use in their torches.

Of the 95 people, 63 said that they prefer to use the 'power' model in their torches.

Find a 95% confidence interval for the proportion of all people who have used both 'power' and 'super' batteries and prefer to use the 'power' model of battery in their torches.

(b) The quality analyst's manager asked her to explain to him the meaning of the confidence interval that was found in part (a).

Write a clear description that gives the meaning of this confidence interval.

3.2 5. Understanding theory behind confidence intervals B

- effect of changing parameters on the precision or standard error
- application of the Central Limit Theorem
 - distribution of sample means
 - distribution of sample totals
 - use of probability including normal distribution

▶ A researcher completed a pilot survey using a sample of 30 fish that had been caught in Lake Crystal.

He calculated a 99% confidence interval for μ , the mean length (in millimetres) of fish caught, to be $414 < \mu < 486$

(a) What sample size would be needed in his final survey if the researcher wants the 99% confidence interval to be one-third $\left(\frac{1}{3}\right)$ of the width of the confidence interval obtained in the pilot survey?

Assume that the standard deviation of fish length determined in the pilot survey will also apply to the final survey.

(b) In part (a) above, the researcher wanted the width of the final confidence interval to be one-third $\left(\frac{1}{3}\right)$ of the width of the confidence interval that had been obtained in the pilot survey.

Suppose that, in general, the researcher wants the width of a confidence interval to be $\frac{1}{k}$ of the length of the 99% confidence interval that had been obtained using a pilot survey with a sample of size 30 (k is a positive integer).

Obtain a formula that would give the required sample size (n) for the final survey.

Give mathematical reasons for your answer.