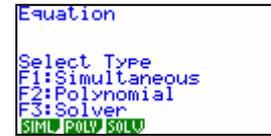


# Finding sample sizes for confidence intervals – 1S and 1P.

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Select EQUA icon (or press A)  
or by using the arrow keys to highlight  
and then press EXE.



Confidence interval and finding the sample size

**For sample statistic:**

$$x - k \sigma / \sqrt{n} \leq \mu \leq x + k \sigma / \sqrt{n}$$

As you want to work to some level of precision i.e.  $x - \mu$  is defined then only need to consider:

$$\mu - x = k \sigma / \sqrt{n} \quad \text{or} \quad x - \mu = k \sigma / \sqrt{n}$$

$\mu - x$  is  $\frac{1}{2}$  of the confidence interval width

'k' is the confidence level, ' $\sigma$ ' the standard deviation and 'n' the sample size.

**For proportions:**

$$p - k \sqrt{(p(1-p)/n)} \leq \pi \leq p + \sqrt{(p(1-p)/n)}$$

$$p - \pi = k \sqrt{(p(1-p)/n)} \quad \text{or} \quad \pi - p = \sqrt{(p(1-p)/n)}$$

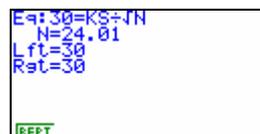
$\pi - p$  is  $\frac{1}{2}$  of the confidence interval width

'k' is the confidence level, 'p' the proportion statistic and 'n' the sample size.

**Example 1:** A researcher wants her estimate of the average length of fish caught in Lake Casio to be within 30 millimetres of the true average length, with 95% confidence. Previous research on the fish in this lake has found that the standard deviation of the lengths of fish to be 75 millimetres.  
What is the minimum sample size that is required to meet this condition?

**Answer:**  $\frac{1}{2}$  interval length is 30,  $\sigma = 75$ ,  $k = 1.96$   
Giving:  $30 = k \sigma / \sqrt{n}$

Enter into **SOLV**er [F3] type in the equation, as shown below, make sure that the cursor is highlighting the variable N (what is to be calculated) and then [F6] to solve.



This yields  $n = 24.01$

So,  $n \geq 25$  i.e. a sample size of 25 is the minimum size to get within 30 millimetres of the true mean for the fish in lake Casio.

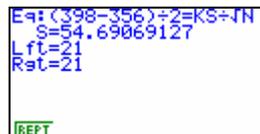
**Example 2:** A researcher completed a pilot survey using a sample of 45 fish that had been caught in Lake Graphic. The researcher had calculated a 99% confidence interval for  $\mu$ , the mean length, in millimetres, of fish caught, to be  $356 < \mu < 398$ .

What sample size would be needed in another survey if the researcher wants the 99% confidence interval to be one quarter (1/4) of the width obtained from the pilot survey?

[You can assume that the standard deviation of fish length determined in the pilot survey will be applied to the final survey.]

**Answer:** Need to find  $\sigma$  from the pilot survey, interval is  $(398 - 356)/2$ ,  $n = 45$  and  $k = 2.5758$ .

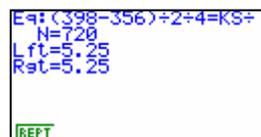
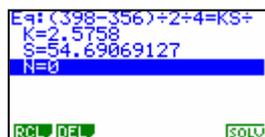
Enter into **SOLVER** [F3] type in the equation, as shown below, making sure that the cursor is highlighting the variable S (what is to be calculated) and then [F6] to solve.



This yields  $\sigma = 54.69069127$  for the pilot survey.

Then for 1/4 of the interval to be required for the final survey, we require:  $(398 - 356)/2/4 = k \sigma / \sqrt{n}$  and then solve for n.

Enter into **SOLVER** [F3] type in the equation, as shown below, making sure that the cursor is highlighting the variable N (what is to be calculated) and then [F6] to solve.



Yielding  $n \geq 270$  i.e. a sample size of 270 fish is required in the final survey to quarter the confidence interval width.

**Example 3:** A company is launching a new product. Some time after the launch, a survey was conducted to find the proportion of people who had heard of the new product. A sample of people were surveyed, 42% had said that they had heard of the new product. The survey results were to be within 3% of the true proportion for the population and to have been calculated to be 95% confident. What was the size of the sample taken to achieve this result?

**Answer:** Here  $\frac{1}{2}$  the confidence interval is 0.03,  $p = 0.43$  and  $k = 1.96$   
Giving  $0.03 = \sqrt{p(1 - p)/n}$

Enter into **SOLVER** [F3] type in the equation, as shown below, making sure that the cursor is highlighting the variable N (what is to be calculated) and then [F6] to solve.



Yielding  $n \geq 1046.195733$  i.e. a sample size of 1047 or larger is required.