

## CONCEPT: CONFIDENCE INTERVALS

A *confidence interval* is a specific interval estimate of a parameter determined by using data obtained from a sample.

- For example a 95% confidence interval means we are 95% confident the mean lies within a given interval.

$$\text{Confidence interval} = \bar{x} \pm \frac{ts}{\sqrt{n}}$$

\_\_\_\_\_ = Student's t  
\_\_\_\_\_ = standard deviation  
\_\_\_\_\_ = # of measurements  
\_\_\_\_\_ = average or mean

A *Student's t* is a statistical table used in our understanding of confidence intervals and in the comparative data from different experiments.

Degrees of freedom	Confidence Level (%)						
	50	90	95	98	99	99.5	99.9
1	1.000	6.314	12.706	31.821	63.656	127.321	636.578
2	0.816	2.920	4.303	6.965	9.925	14.089	31.598
3	0.765	2.353	3.182	4.541	5.841	7.453	12.924
4	0.741	2.132	2.776	3.747	4.604	5.598	8.610
5	0.727	2.015	2.571	3.365	4.032	4.773	6.869
6	0.718	1.943	2.447	3.143	3.707	4.317	5.959
7	0.711	1.895	2.365	2.998	3.500	4.029	5.408
8	0.706	1.860	2.306	2.896	3.355	3.832	5.041
9	0.703	1.833	2.262	2.821	3.250	3.690	4.781
10	0.700	1.812	2.228	2.764	3.169	3.581	4.587
15	0.691	1.753	2.131	2.602	2.947	3.252	4.073
20	0.687	1.725	2.086	2.528	2.845	3.153	3.850
25	0.684	1.708	2.060	2.485	2.787	3.078	3.725
30	0.683	1.697	2.042	2.457	2.750	3.030	3.646
40	0.681	1.684	2.021	2.423	2.704	2.971	3.551
60	0.679	1.671	2.000	2.390	2.660	2.915	3.460
120	0.677	1.658	1.980	2.358	2.617	2.860	3.373
∞	0.674	1.645	1.960	2.326	2.576	2.807	3.291

**EXAMPLE:** Construct a 95% confidence interval for an experiment that found the mean temperature for a given city in July as 103.5 °C with a standard deviation of 1.8 from 10 measurements.

### **PRACTICE: CONFIDENCE INTERVALS CALCULATIONS 1**

**EXAMPLE 1:** The barium content of a metal ore was analyzed several times by a percent composition process.

**0.010**

**0.011**

**0.004**

**0.011**

Calculate the mean, median and mode.

**EXAMPLE 2:** From EXAMPLE 1, calculate the standard deviation.

**PRACTICE:** From the examples given above, find the 90% confidence interval.