1. Battery Life Testing

A company tested the lifespan of 10 randomly selected batteries, recording an average time to failure of 9.5 hours with a standard deviation of 1.4 hours.

a) Determine a 95% confidence interval for the population mean time to failure.

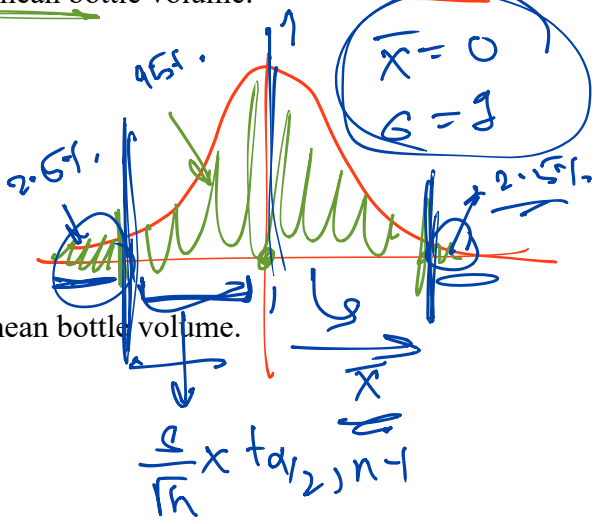
b) Determine a 99% confidence interval for the population mean time to failure.

---

2. Water Bottle Volume Testing

A water bottle company checks that each bottle holds approximately 500 ml of water. A random sample of 12 bottles yields the following volumes (in ml): 498, 502, 499, 500, 497, 504, 501, 498, 500, 503, 497, 496.

a) Determine a 95% confidence interval for the population mean bottle volume.



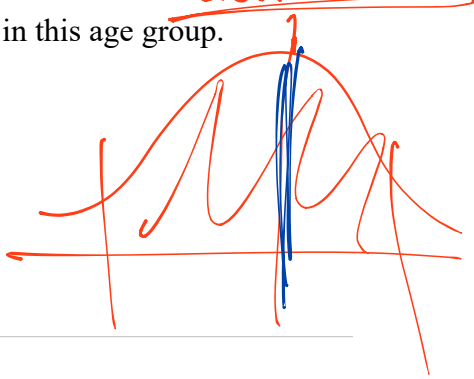
b) Determine a 98% confidence interval for the population mean bottle volume.

1. Heart Rate Measurement

A cardiologist records the resting heart rate of 300 randomly selected male patients aged 20-30. The sample shows an average heart rate of 72.3 beats per minute, with a standard deviation of 5.1.

a) Determine a 95% confidence interval for the average heart rate in this age group.

b) Determine a 99% confidence interval for the average heart rate in this age group.



2. Salary Survey

A survey aims to estimate the average annual salary of employees in a city. A random sample of 500 workers reveals a mean salary of $42,350 with a standard deviation of $5,300.

a) Determine a 95% confidence interval for the ~~average salary~~ of workers in this city.

b) Determine a 98% confidence interval for the ~~average salary~~ of workers in this city.

1. Machine Part Variation

A manufacturer measures the diameter of 15 randomly selected parts to estimate the variability in the production process. The sample data yields a mean diameter of 5.2 cm and a standard deviation of 0.3 cm.

a) Determine a 98% confidence interval for the population standard deviation of the part diameter.

$\Rightarrow n = 15$

$n - 1 = 14$

$\alpha = 0.01 \Rightarrow$

$\left[\sqrt{\frac{(n-1)s^2}{\chi^2_{\alpha, n-1}}} , \sqrt{\frac{(n-1)s^2}{\chi^2_{1-\alpha, n-1}}} \right]$

$\chi^2_{\alpha, n-1} = 29.1419$

$\chi^2_{1-\alpha, n-1} = 4.6604$

b) Determine a 95% confidence interval for the population standard deviation of the part diameter.

HW

2. Quality Control on Bottle Caps

A company inspects 18 randomly selected bottle caps and calculates the mean and standard deviation of their widths as 2.4 cm and 0.2 cm, respectively.

a) Determine a 99% confidence interval for the population standard deviation of the cap width.

b) Determine a 95% confidence interval for the population standard deviation of the cap width.

3. Customer Satisfaction Survey

A company conducts a customer satisfaction survey for its new product. Out of 1,200 surveyed customers, 780 report that they are satisfied with the product.

a) Determine a 90% confidence interval for the true proportion of satisfied customers.

$\hat{p} - z_{\alpha/2}$

b) Determine a 95% confidence interval for the true proportion of satisfied customers.

---

4. Confidence Intervals for Proportions with Various Sample Sizes

For each of the following sample sizes, determine a 95% confidence interval for the population proportion if the observed proportion ($\hat{p}$) is 0.75.

a) n = 500

b) n = 750

c) n = 1000

d) n = 1500

e) n = 2000