

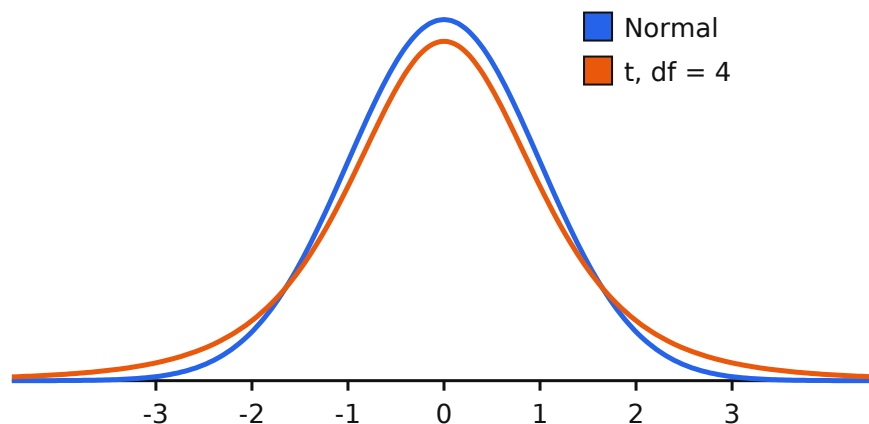
AP Statistics - t Intervals and t Tests for a Mean - Answer Key

Common Core AP STAT 7.1, AP STAT 7.2, AP STAT 7.3, AP STAT 7.4, AP STAT 7.5, HSS-IC.B.4 · maths-pdf.fr/en/

Each solution states the conditions, the degrees of freedom, the critical value or t statistic, and a conclusion in context. Values are rounded to three decimals for intervals and four for p-values.

AP Statistics · Common Core State Standards: **AP STAT 7.1, AP STAT 7.2, AP STAT 7.3, AP STAT 7.4, AP STAT 7.5, HSS-IC.B.4**

Exercise 1 - t versus normal



The t distribution has heavier tails than the normal; it approaches the normal as degrees of freedom grow.

The t curve is shorter in the middle and has more area in the tails.

Heavier tails and a lower peak; the t distribution depends on df and approaches the normal as df increases.

Exercise 2 - Degrees of freedom and t^*

$n = 21$: $df = 20$, $t^* = 2.086$. $n = 31$: $df = 30$, $t^* = 2.750$.

df 20, $t^* = 2.086$; df 30, $t^* = 2.750$.

Exercise 3 - Standard error

$$SE = \frac{1.4}{\sqrt{25}} = 0.28.$$

0.28 hours.

Exercise 4 - Compute an interval

$$df = 24, t^* = 2.064. ME = 2.064(0.28) = 0.578.$$

(6.622, 7.778) hours.

Exercise 5 - Interpret the interval

We name the parameter: the true mean battery life.

We are 95% confident that the interval from 38.96 to 41.75 hours captures the true mean life of all batteries of this type.

Exercise 6 - Check the Normal condition

The sample is small and has a strong outlier at 30.

No: with $n = 10$ and an outlier, the Normal condition is not satisfied, so a t interval is not appropriate.

Exercise 7 - Write hypotheses

Let μ be the true mean delivery time.

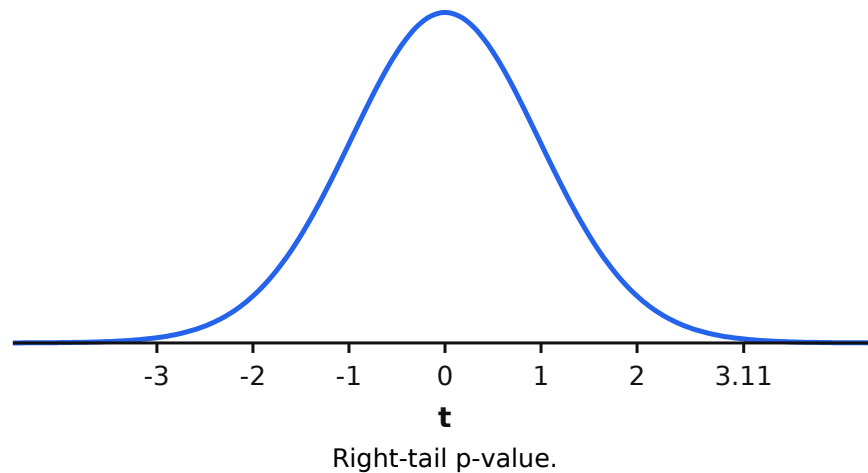
$$H_0: \mu = 30, H_a: \mu > 30.$$

Exercise 8 - Compute t

$$SE = \frac{6.5}{\sqrt{40}} = 1.028. t = \frac{33.2 - 30}{1.028} = 3.11.$$

$t = 3.11$.

Exercise 9 - p-value



$$P(t_{39} > 3.11) = 0.0017.$$

0.0017.

Exercise 10 - Conclusion

$$0.0017 < 0.05.$$

We reject H_0 . There is convincing evidence that the mean delivery time is greater than 30 minutes.

Exercise 11 - Two-sided t test

$$H_0: \mu = 98.6, H_a: \mu \neq 98.6. SE = 0.1833, t = -2.18, df = 35, \text{p-value} = 0.0361.$$

Reject H_0 : convincing evidence that the true mean differs from 98.6 degrees F.

Exercise 12 - Interval and test

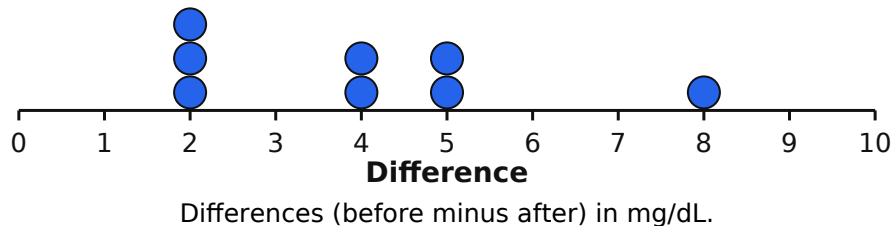
40 lies outside the interval.

Reject H_0 : there is convincing evidence that μ differs from 40.

Exercise 13 - Matched pairs differences

Differences: 4, 5, 2, 8, 2, 4, 5, 2.

Mean $\bar{x}_d = 4.000$; $s_d = 2.070$.



Mean difference 4.000; standard deviation 2.070.

Exercise 14 - Matched pairs interval

$$SE = \frac{2.070}{\sqrt{8}} = 0.732. \quad df = 7, \quad t^* = 2.365. \quad ME = 1.731.$$

(2.269, 5.731) mg/dL. The interval is positive, which suggests the diet lowers cholesterol.

Exercise 15 - Matched pairs test

$$t = \frac{4.000}{0.732} = 5.47, \quad df = 7, \quad p\text{-value} = 0.0005.$$

Reject H0: convincing evidence that the diet lowers mean cholesterol.

Exercise 16 - Effect of n

$$n = 16: 2.131(10/4) = 5.329. \quad n = 64: 1.998(10/8) = 2.498.$$

5.33 compared with 2.50: the larger sample has about half the margin of error.

Exercise 17 - Read output

$$SE = \frac{6.8}{\sqrt{20}} = 1.52. \quad t^* = 1.729, \quad ME = 2.628.$$

(49.672, 54.928) minutes.

Exercise 18 - Outlier warning

The extreme value is an outlier and the sample is small.

The Normal condition fails: the outlier inflates the mean and standard deviation, so the t interval would be misleading.

Exercise 19 - Left-tailed test

$H_0: \mu = 25$, $H_a: \mu < 25$. $SE = 0.552$, $t = -1.63$, $df = 49$, $p\text{-value} = 0.0548$.

Fail to reject H_0 : not convincing evidence that the mean is below 25 hours.

Exercise 20 - Multi-step

$df = 29$, $t^* = 2.756$, $SE = 32.86$, $ME = 90.58$.

(\$1,259.42, \$1,440.58). \$1,300 is inside the interval, so it is a plausible value for the mean rent.