dof controls shape as it ↑ $\sqrt{6}$
it comes close to normal.

**T-DISTRIBUTION:-**
→ has a symmteri and bell shaped curve like normal dist.
→ heavier tails (more prop in ext values)

let say we have a population that is normally distributed; with a sample drawn to be too small in size.

then we would follow the t-distribution. with N-1 degrees of freedom.

$$T = \frac{\text{mean}\{x\} - \text{popmean}\{x\}}{\text{stderr}\{x\}}.$$

the amount of probability mass at tails of t-dist is controlled by parametre v (df).

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$v \to \infty$ it becomes standard normal dist.
(least heavy tail)

Degree of Freedom: (df)
defined how many values are free to vary after we estimate something like mean.

e.g
Sample: $x_1 = 27$, $x_2 = 5$, $x_3 = 8$
Sample mean ⇒ 6.67
degree of freedom ⇒ 3-1 :-
(once we know two values the third is determined).

* df: helps to determine shape of t-dist; which is used for confidence intervals and hypothesis testing.

Question:- Why cannot we use Z-dist for smaller sample size?

(i) Z-dist assumes that the population std. deviation is known.

however in the smaller samples, the pop. std. deviation is not measured from un-biased estimator rather, the sample leading to more uncertainity. (from)
because small sample are more variable and less reliable for such estimates.

* CLT works better with $n > 30$

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## Confidence Interval for the mean;

$$\bar{X} + (t_{\alpha/2}) \frac{s}{\sqrt{n}}.$$

→ std deviation of sample.

t-critical values.

Example:-

$n = 8$.

sample mean ⇒ $0.26 + 0.03 \Rightarrow 0.29$.

std deviation of sample ⇒ $0.074$.

$CI = 99\%$.

$1 - \alpha \Rightarrow 1 - 0.99$

$\Rightarrow 0.01$

for two tails.

0.005     $0.005 + 0.99$.

0.005.     0.995

$t_{\alpha/2} \Rightarrow t_{0.005} \Rightarrow -2.898$.

$t_{0.995} \Rightarrow +2.898$.

Now using formula.

$$0.29 \pm (2.898)\frac{0.074}{\sqrt{8}}$$

$$\Rightarrow 0.29 \pm 0.05.$$