Parameter	Z - Test	t - test
1. $\boxed{\text{Mean}}$	$Z = \dfrac{\text{Sample Mean} - \text{Population Mean}}{\text{S.E. of Mean}}$ $Z = \dfrac{\bar{x} - \mu}{\frac{\sigma}{\sqrt{n}}}$ σ: s.d. of Population & known or $Z = \dfrac{\bar{x} - \mu}{\frac{s}{\sqrt{n}}}$ s: s.d. of sample when σ is unknown	$t = \dfrac{\text{Sample Mean} - \text{Population mean}}{\text{S.E. of Mean}}$ [with $n-1$ d.f.] $t = \dfrac{\bar{x} - \mu}{\frac{s}{\sqrt{n}}}$ where $s^2 = \dfrac{\sum_{i=1}^{n}(x_i - \bar{x})^2}{n-1}$ $\bar{x} = \sum_{i=1}^{n} x_i / n$
Note: N is given	$Z = \dfrac{\bar{x} - \mu}{\frac{\sigma}{\sqrt{n}} \cdot \sqrt{\frac{N-n}{N-1}}}$, N is finite no.	
2. $\boxed{\text{Diff. of Mean}}$	$Z = \dfrac{\text{Sample 1 Mean} - \text{Sample 2 Mean}}{\text{S.E. of diff. of Mean}}$ $Z = \dfrac{\bar{x}_1 - \bar{x}_2}{\sqrt{\frac{\sigma_1^2}{n_1} + \frac{\sigma_2^2}{n_2}}}$ If σ is known or $Z = \dfrac{\bar{x}_1 - \bar{x}_2}{\sqrt{\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}}}$ if σ is unknown or $Z = \dfrac{(\bar{x}_1 - \bar{x}_2) - (\mu_1 - \mu_2)}{\sqrt{\frac{\sigma_1^2}{n_1} + \frac{\sigma_2^2}{n_2}}}$	$t = \dfrac{\bar{x}_1 - \bar{x}_2}{\sqrt{\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}}}$ with d.f. $v = n_1 + n_2 - 1$ where $s_1^2 = \dfrac{\sum_{i=1}^{n}(x_i - \bar{x})^2}{n_1 - 1}$ & $s_2^2 = \dfrac{\sum_{i=1}^{n}(x_i - \bar{x})^2}{n_2 - 1}$ or $t = \dfrac{\bar{x}_1 - \bar{x}_2}{s\sqrt{\frac{1}{n_1} + \frac{1}{n_2}}}$

$$s^2 = \frac{\sum_{i=1}^{n}(x_{1i} - \bar{x})^2 + (x_{2i} - \bar{x})^2}{n_1 + n_2 - 2}$$ OR where $$s^2 = \frac{(n_1 - 1)s_1^2 + (n_2 - 1)s_2^2}{n_1 + n_2 - 2}$$

Parameter	Z - test	t - test
3. Proportion	$Z = \dfrac{\text{Sample Proportion} - \text{Population Proportion}}{\text{S. E. of proportion}}$	T-test for correlation coeffi.

$$= \frac{\hat{p} - P}{\sqrt{\frac{PQ}{n}}} \qquad Q = 1 - P$$

or

$$Z = \frac{\hat{p} - P}{\sqrt{\frac{PQ}{n}} \cdot \sqrt{\frac{N-n}{N-1}}}$$

N is finite no.

$$t = \frac{r \cdot \sqrt{n-2}}{\sqrt{1-r^2}}$$

r is observed correlation coeffi

ρ is population correlation coeffi.

Null Hypo: $\rho = 0$

$H_1: \rho \neq 0$ or $\rho > 0$ or $\rho < 0$

Here d.f. $\nu = n-2$

4. Diff. of Proportion

$$Z = \frac{(\hat{P}_1 - \hat{P}_2) - (P_1 - P_2)}{\sqrt{\frac{P_1 Q_1}{n_1} + \frac{P_2 Q_2}{n_2}}}$$

where $P_1 = \dfrac{x_1}{n_1} = \dfrac{\text{favourable}}{\text{Total}}$

$P_2 = \dfrac{x_2}{n_2}$

If $P_1 = P_2 = P$

Prob of success is equal for both object then

$$Z = \frac{\hat{P}_1 - \hat{P}_2}{\sqrt{\frac{P_1 q_1}{n_1} + \frac{P_2 q_2}{n_2}}} \quad \text{or} \quad Z = \frac{P_1 - P_2}{\sqrt{\frac{P_1 Q_1}{n_1} + \frac{P_2 Q_2}{n_2}}} = \frac{P_1 - P_2}{\sqrt{PQ\left(\frac{1}{n_1} + \frac{1}{n_2}\right)}}$$

where $P = \dfrac{n_1 P_1 + n_2 P_2}{n_1 + n_2}$

& $Q = 1 - P$

Parameter	Z - test
$\boxed{\text{Diff of S.D.}}$	$Z = \dfrac{s_1 - s_2}{\sqrt{\dfrac{s_1^2}{2n_1} + \dfrac{s_2^2}{2n_2}}}$
	or $Z = \dfrac{\sigma_1 - \sigma_2}{\sqrt{\dfrac{\sigma_1^2}{2n_1} + \dfrac{\sigma_2^2}{2n_2}}}$

~~(Fiducial limits)~~

Approximate Confidence Limits (large samples) (any distributions):

1 **For mean μ:**

95% confidence limits $= \bar{x} \pm 1.96\,(\text{SE of } \bar{x})$

$= \bar{x} \pm 1.96 \frac{\sigma}{\sqrt{n}}$

99% " " $= \bar{x} \pm 2.58\,(\text{S.E of } \bar{x})$

Almost sure limits $= \bar{x} \pm 3\,(\text{S.E. of } \bar{x})$

2 **For proportion P:**

95% confidence limits $= P \pm 1.96\,(\text{S.E. of } P)$

99% " " $= P \pm 2.58\,(\text{S.E. of } P)$

Almost sure limits $= P \pm 3\,(\text{S.E. of } P)$

3 **For Difference of Means: $(\mu_1 - \mu_2)$:**

95% confidence limits $= (\bar{x}_1 - \bar{x}_2) \pm 1.96\,(\text{S.E of } \bar{x}_1 - \bar{x}_2)$

99% " " $= (\bar{x}_1 - \bar{x}_2) \pm 2.58\,($ " $)$

Almost sure limits $= (\bar{x}_1 - \bar{x}_2) \pm 3\,($ " $)$

4. **For Difference of Proportions: $(P_1 - P_2)$:**

95% confidence limits $= (P_1 - P_2) \pm 1.96\,(\text{S.E. of } P_1 - P_2)$

99% " " $= (P_1 - P_2) \pm 2.58\,($ " $)$

Almost sure limits $= (P_1 - P_2) \pm 3\,($ " $)$

Very IMP:

The point estimation of population mean μ with sample mean $\bar{x}$ for a large sample $(n \geq 30)$, we can assert with probability $(1-\alpha)$ that the error $|\bar{x}-\mu|$ will not exceed $Z_{\alpha/2} \frac{\sigma}{\sqrt{n}}$.

i.e $(1-\alpha)100\%$ large sample confidence interval for point estimator is given by

$\pm Z_{\alpha/2} \cdot$ (std. error of the estimator)

where $Z_{\alpha/2}$ is the z value with an area $\alpha/2$ in the right tail of a std. normal distri.

∴ Sample size :

when α, E and σ are known

sample size $n = \left(\frac{Z_{\alpha/2}\, \sigma}{E}\right)^2$

when σ is unknown or $n < 30$

the maxi. error estimate

$$E = t_{\alpha/2} \frac{S}{\sqrt{n}}$$ with $(1-\alpha)$ prob.

where t distri. is with $(n-1)$ degree of freedom (d.f.)