Suppose we have two independent samples drawn from independent populations. While the sample average values are $\bar{x}\_{1}$ and $\bar{x}\_{2}$, the corresponding population means are $μ\_{1}$ and $μ\_{2}$. Also, suppose the null hypothesis is $H\_{0}:μ\_{1}-μ\_{2}=0$. In this case, the test statistic is given by $\frac{\left(\bar{x}\_{1}-\bar{x}\_{2}\right)-\left(μ\_{1}-μ\_{2}\right)}{SD},$ where SD denotes the standard deviation of $\bar{x}\_{1}-\bar{x}\_{2}$.

Suppose we are given three scenarios:

1. The population standard deviations are $σ\_{1}$ and $σ\_{2}$ and known.
2. The population standard deviations are unknown but assumed equal.
3. The population standard deviations are unknown and not assumed equal.

The possible values of SD are

* $\sqrt{s\_{p}^{2}\left(\frac{1}{n\_{1}}+\frac{1}{n\_{2}}\right)}$ with the pooled variance $s\_{p}^{2}=\frac{\left(n\_{1}-1\right)s\_{1}^{2}+\left(n\_{2}-1\right)s\_{2}^{2}}{n\_{1}+n\_{2}-2}$
* $\sqrt{\left(\frac{s\_{1}^{2}}{n\_{1}}+\frac{s\_{2}^{2}}{n\_{2}}\right)}$
* $\sqrt{\frac{σ\_{1}^{2}}{n\_{1}}+\frac{σ\_{2}^{2}}{n\_{2}}}$

Which of the above SD expressions correspond to Scenarios 1, 2, and 3?

The possible test statistics follow a

* *t* distribution with $n\_{1}+n\_{2}-2$ degrees of freedom
* *z* distribution
* *t* distribution with degrees of freedom given by $min\{n\_{1}-1,n\_{2}-1\}$

Which of the above test statistics correspond to Scenarios 1, 2, and 3?