Z-Test

| **Feature** | **Description** | **Default Value** |
| --- | --- | --- |
| axis | Axis along which to compute z-score | None (flatten) |
| ddof (degrees of freedom) | Denominator correction for std calculation (n−ddofn - ddof) | 0 |
| nan\_policy | Handling of NaNs in data ('propagate', 'omit', 'raise') | 'propagate' |

T-Test

| **Test Type** | **Compares...** | **Hypothesis Direction** |
| --- | --- | --- |
| Independent T-Test | Two unrelated groups | Two-tailed or one-tailed |
| Paired Sample T-Test | Same group, two measurements | Two-tailed or one-tailed |
| One-Sample T-Test | One sample vs known value | One-tailed or two-tailed |
| ↳ Two-Tailed | Any difference | μ ≠ μ₀ |
| ↳ Upper-Tailed | Greater than | μ > μ₀ |
| ↳ Lower-Tailed | Less than | μ < μ₀ |

## **When to Use Which T-Test?**

### **✅ 1. One-Sample T-Test**

**🧪 Use when:**

* You have **one group/sample**.
* You want to compare its mean against a **known value or population mean**.

**📌 Example Use Cases:**

* Is the average blood pressure of a group different from the national average?
* Do your students have an average IQ significantly higher than 100?

**✅ Choose:**

* **Two-Tailed** → If you're checking **any difference** (higher *or* lower).
* **One-Tailed (Upper)** → If you're only interested in whether it's **higher**.
* **One-Tailed (Lower)** → If you're only interested in whether it's **lower**.

### **✅ 2. Independent T-Test (Two-Sample T-Test)**

**🧪 Use when:**

* You have **two independent groups**.
* You're comparing their means.

**Key: The groups must not be related.**

**📌 Example Use Cases:**

* Compare average scores between **Class A and Class B**.
* Compare mean blood pressure between **males and females**.
* Compare average income between **two different cities**.

**✅ Choose:**

* **Two-Tailed** → If you just want to know if the means are different.
* **One-Tailed** → If you expect one group to have a **higher/lower** mean.

### **✅ 3. Paired Sample T-Test (Dependent T-Test)**

**🧪 Use when:**

* You have **two related sets of observations** (before-after, matched pairs).
* You're comparing **the same group measured twice** or **paired subjects**.

**📌 Example Use Cases:**

* Test scores **before and after** a training session.
* Blood sugar levels **before and after** medication.
* Heart rate **before and after** exercise.

**✅ Choose:**

* **Two-Tailed** → If you're checking for **any change** (increase or decrease).
* **One-Tailed** → If you're checking for a **specific direction** of change (e.g., did training **increase** scores?).

## **Summary Table**

| **Scenario** | **Sample Relationship** | **What You Want to Know** | **Recommended Test** |
| --- | --- | --- | --- |
| One group vs a known value | One sample | Mean is different from a specific value | One-Sample T-Test |
| Two separate groups | Independent samples | Whether their means differ | Independent T-Test |
| One group tested twice (e.g., before and after) | Paired samples | Whether there's a change | Paired Sample T-Test |

Do you have one group or two?

├── One group → One-Sample T-Test

│ ├── Check against population mean?

│ └── Use upper/lower/two-tailed as needed

└── Two groups

├── Are they related (before/after or matched)?

│ └── Yes → Paired T-Test

│ └── No → Independent T-Test