Normal Distribution

Quick-Reference Cheat Sheet · 2026

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FORMULAS

PDF

$f(x) = (1/\sigma\sqrt{2\pi}) \times e^{[-(x-\mu)^2/2\sigma^2]}$

Z-Score

$Z = (X - \mu) / \sigma$

CDF

$F(x) = \Phi((x-\mu)/\sigma)$

Mean

$E[X] = \mu$

Variance

$Var(X) = \sigma^2$

Std Error

$SE = \sigma / \sqrt{n}$

Skewness

0

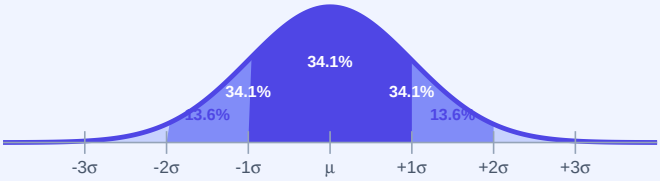
Kurtosis

3 (excess = 0)

EMPIRICAL RULE (68-95-99.7)

μ ± 1σ	68.27%
μ ± 2σ	95.45%
μ ± 3σ	99.73%
μ ± 4σ	99.994%
μ ± 6σ	99.9999998% (Six Sigma)

BELL CURVE



KEY PROPERTIES

- Mean = Median = Mode = μ
- Support: (−∞, +∞) — infinite tails
- Total area under curve = 1.0
- Symmetric about μ (left = right)
- Inflection points at μ ± σ
- Moment gen. fn: $M(t) = \exp(\mu t + \sigma^2 t^2/2)$

Normal Distribution

Cheat Sheet — Part 2: Examples, Tools & Z-Score Guide

FREE DOWNLOAD

Z-Score Worked Examples

Question	Given	Z-Score	Answer
IQ above 115?	μ=100, σ=15, X=115	`Z=(115-100)/15=1.00`	**15.87% above 115**
Score below 85?	μ=100, σ=15, X=85	`Z=(85-100)/15=-1.00`	**15.87% below 85**
Height above 76 in?	μ=70, σ=3, X=76	`Z=(76-70)/3=2.00`	**2.28% above 76 in**
Birth wt between 3-4kg?	μ=3.4, σ=0.5	`Z1=-0.8, Z2=1.2`	**57.3% in that range**

Excel · Python · R Quick Reference

Excel

```
=NORM.DIST(x, mean, sd, TRUE)       → CDF: P(X≤x)
=NORM.DIST(x, mean, sd, FALSE)      → PDF density at x
=NORM.INV(probability, mean, sd)    → Inverse CDF
=NORM.S.DIST(z, TRUE)               → Standard normal CDF
```

Python (SciPy)

```
from scipy import stats
stats.norm.cdf(x, loc=mu, scale=sigma)   → P(X≤x)
stats.norm.pdf(x, loc=mu, scale=sigma)   → density
stats.norm.ppf(p, loc=mu, scale=sigma)   → quantile
```

R

```
pnorm(x, mean=mu, sd=sigma)     → P(X≤x)
dnorm(x, mean=mu, sd=sigma)     → density
qnorm(p, mean=mu, sd=sigma)     → quantile
shapiro.test(data)              → normality test
```

LEARN MORE AT STATISTICS FUNDAMENTALS

- Z-Table: statisticsfundamentals.com/tables/z-table/
- T-Distribution Table: statisticsfundamentals.com/tables/t-distribution-table/
- Probability Calculator: statisticsfundamentals.com/calculators/probability/
- Hypothesis Testing: statisticsfundamentals.com/hypothesis-testing/