

The Normal Distribution

The normal distribution is a theoretical probability distribution based on an infinite population of continuous numerical data values. The equation that determines the shape of the distribution was developed by the German mathematician and astronomer Karl Gauss (1777-1855). In honor of Gauss, the distribution is sometimes referred to as the Gaussian curve. It's also informally called the "bell curve."

The normal distribution has the following characteristics:

1. The distribution is bell-shaped, unimodal, and symmetrical.
2. When the distribution of raw scores is converted to a distribution of z-scores, the mean (μ) of the z-scores is equal to 0 and the standard deviation (σ) of the z-scores is equal to 1.
3. The total area under the curve is 1.00.
4. 34.13% of the area under the curve lies between $z = 0$ and $z = 1.00$.
34.13% of the area under the curve lies between $z = 0$ and $z = -1.00$.

13.59% of the area under the curve lies between $z = 1.00$ and $z = 2.00$.

13.59% of the area under the curve lies between $z = -1.00$ and $z = -2.00$.

2.28% of the area under the curve lies in the upper tail beyond $z = 2.00$.

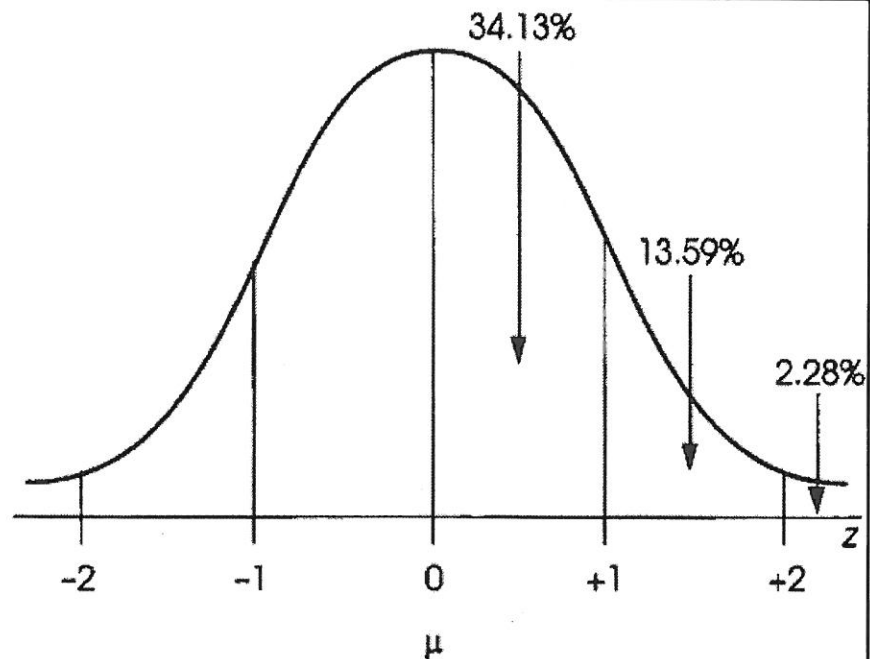
2.28% of the area under the curve lies in the lower tail beyond $z = -2.00$.

5. **The Rule of Thumb.** Approximately 2/3 rds (or 68% more precisely) of the area lies between $z = -1$ and $z = +1$.
Approximately 95% of the area lies between $z = -2$ and $z = +2$.
More than 99% (almost 100%) of the area lies between $z = -3$ and $z = +3$.
6. Area corresponds to the proportion (or percentage) of scores lying under a certain region of the curve.

The normal distribution. The exact shape of the normal distribution is specified by an equation relating each X value (score) to each Y value (frequency). The equation is

$$Y = \frac{1}{\sqrt{2\pi\sigma^2}} e^{-\frac{(X-\mu)^2}{2\sigma^2}}$$

(π and e are mathematical constants.) In simpler terms, the normal distribution is symmetrical, with a single mode in the middle. The frequency tapers off as you move farther from the middle in either direction.



APPENDIX B Statistical Tables

TABLE B.1 THE UNIT NORMAL TABLE*

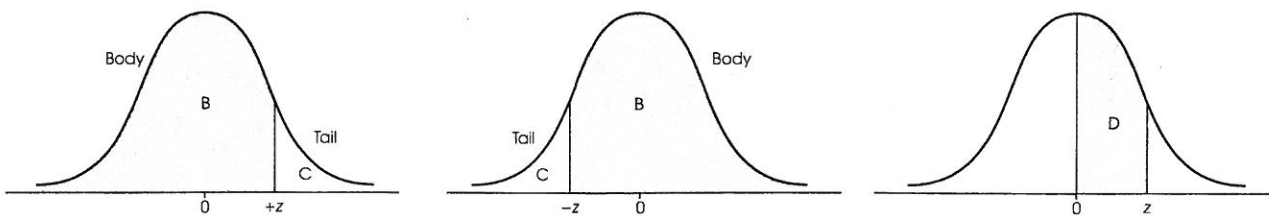
*Column A lists z -score values. A vertical line drawn through a normal distribution at a z -score location divides the distribution into two sections.

Column B identifies the proportion in the larger section, called the *body*.

Column C identifies the proportion in the smaller section, called the *tail*.

Column D identifies the proportion between the mean and the z -score.

Note: Because the normal distribution is symmetrical, the proportions for negative z -scores are the same as those for positive z -scores.



(A) z	(B) Proportion in Body	(C) Proportion in Tail	(D) Proportion Between Mean and z	(A) z	(B) Proportion in Body	(C) Proportion in Tail	(D) Proportion Between Mean and z
0.00	.5000	.5000	.0000	0.25	.5987	.4013	.0987
0.01	.5040	.4960	.0040	0.26	.6026	.3974	.1026
0.02	.5080	.4920	.0080	0.27	.6064	.3936	.1064
0.03	.5120	.4880	.0120	0.28	.6103	.3897	.1103
0.04	.5160	.4840	.0160	0.29	.6141	.3859	.1141
0.05	.5199	.4801	.0199	0.30	.6179	.3821	.1179
0.06	.5239	.4761	.0239	0.31	.6217	.3783	.1217
0.07	.5279	.4721	.0279	0.32	.6255	.3745	.1255
0.08	.5319	.4681	.0319	0.33	.6293	.3707	.1293
0.09	.5359	.4641	.0359	0.34	.6331	.3669	.1331
0.10	.5398	.4602	.0398	0.35	.6368	.3632	.1368
0.11	.5438	.4562	.0438	0.36	.6406	.3594	.1406
0.12	.5478	.4522	.0478	0.37	.6443	.3557	.1443
0.13	.5517	.4483	.0517	0.38	.6480	.3520	.1480
0.14	.5557	.4443	.0557	0.39	.6517	.3483	.1517
0.15	.5596	.4404	.0596	0.40	.6554	.3446	.1554
0.16	.5636	.4364	.0636	0.41	.6591	.3409	.1591
0.17	.5675	.4325	.0675	0.42	.6628	.3372	.1628
0.18	.5714	.4286	.0714	0.43	.6664	.3336	.1664
0.19	.5753	.4247	.0753	0.44	.6700	.3300	.1700
0.20	.5793	.4207	.0793	0.45	.6736	.3264	.1736
0.21	.5832	.4168	.0832	0.46	.6772	.3228	.1772
0.22	.5871	.4129	.0871	0.47	.6808	.3192	.1808
0.23	.5910	.4090	.0910	0.48	.6844	.3156	.1844
0.24	.5948	.4052	.0948	0.49	.6879	.3121	.1879