Normal Distribution: Probability Below, Above and Between

Probability that a normally distributed quantity is below a value, above it or between two values, from the mean and standard deviation, with the z-scores.

Method: Normal distribution Φ(z) = ½[1 + erf(z/√2)]

Input parameters

Unit system: SI

Parameter	Value	Unit
Mean	30.000	
Standard deviation	2.5000	
Lower value	26.000	
Upper value	34.000	

Calculated results

Parameter	Value	Unit
z-score of x_1	-1.6000	
Probability below x_1	5.4799	%
Probability above x_2	5.4799	%
Probability between	89.040	%

Formula and method

$$P(X < x) = \frac{1}{2}\left[1 + \operatorname{erf}\left(\frac{x-\mu}{\sigma\sqrt{2}}\right)\right]$$

Variables

μ	Mean	-
σ	Standard deviation	-
x_1	Lower value	-
x_2	Upper value	-
z_1	z-score of x_1	-
$P(X < x_1)$	Probability below x_1	-
$P(X > x_2)$	Probability above x_2	-
$P(x_1 < X < x_2)$	Probability between	-

Method and standards

Normal distribution.

Assumptions and limits

- Normal distribution. Tail probabilities are computed from the complementary error function, so very small tails (parts per million) keep their precision.

References

- Normal distribution Φ(z) = ½[1 + erf(z/√2)]

Report details

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Release checks	2 reference cases of this calculator, computed independently, are checked on every release

Results are for engineering estimation. Verify critical designs against the referenced standards and your own data.

This calculator online

https://calc.firecad.com/general/geometry/normal-distribution

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Reopens the calculator with the inputs of this report.