Z-Scores

What is a z-score?

A z-score tells us how far a value is from the mean, measured in standard deviations. Z-scores convert values from different distributions onto the same scale, making them easier to compare.

The formula to calculate z-scores is:

$$z = \frac{x - \mu}{\sigma}$$

where:
x = observed value
μ = mean
σ = standard deviation

Calculating a z-score

Steps	Example
1. Identify the variables	Exam scores have: • Mean = 70 • Standard deviation = 10 Find the z-score for a student who scored 85. $\mu = 70$ $x = 85$ $\sigma = 10$
2. Find the distance from the mean $(x - \mu)$	$x - \mu$ $85 - 70 = 15$
3. Divide by the standard deviation	$z = \frac{15}{10} = 1.5$
	∴ The student's score is 1.5 standard deviations above the mean.

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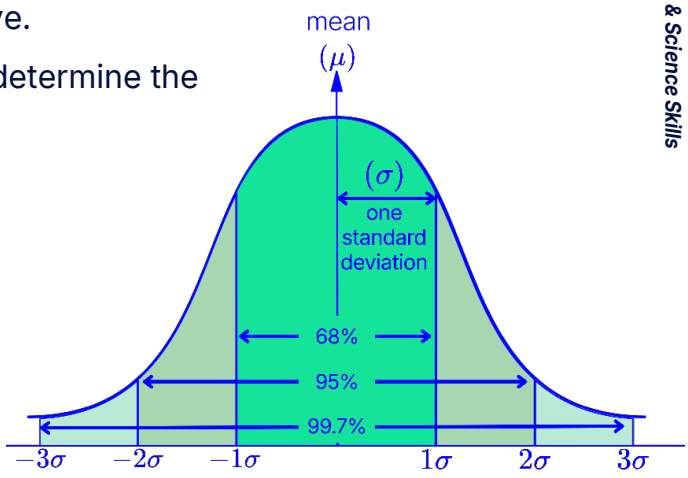
Interpreting a z-score

A z-score identifies a location on the normal curve.

That location can then be used with a z-table to determine the probability of observing that value.

In normal distributions:

Interval	Interpretation	Area
$z = 0$	Located at the mean	-
$-1 < z < 1$	± 1 standard deviation	68%
$-2 < z < 2$	± 2 standard deviation	95%
$-3 < z < 3$	± 3 standard deviation	99.7%



Comparing values

Z-scores allow values from different distributions to be compared fairly.

$$x = \mu + z\sigma$$

Once a z-score has been calculated, we use a **standard normal table (z-table)** to find the area under the curve.

Converting a z-score back to a value

If the z-score is known, the original value can be found using:

$$x = \mu + z\sigma$$

Example

$$P(Z < 2.5)$$

$$= 0.9938$$

99.38% of data lie below $z = 2.5$

Related helpsheets

- Calculating Z-Scores
- Normality in Jamovi

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