HOW TO ....
A PRACTICAL GUIDE TO PSYCHOMETRICS

A. Conversion of test scores from one scale to another

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How To: 1. Convert test scores into Z-scores

The formula for converting a test score into a Z-score is:

$$Z_x = \frac{(X - M_x)}{\sigma_x}$$

Z-scores have a mean of zero and a standard deviation of 1.0

Example. Somebody obtains an IQ of 125 on the WAIS III. What is the corresponding Z-score?

The Z will equal (125 – 100)/15 which is a Z of +1.67

Test yourself

If the IQ had been 70, what would the Z have been?

Answer

Z = -2.0

Note the minus sign. Negative Z-scores should always include it.

Want more? See Module 1 and Module 2

How to 2. Convert Z scores into test scores

The formula for converting a Z-score into a test score is:

$$X = Z_x \sigma_x + M_x$$

i.e. the test score equals the Z-score times the standard deviation of the test, plus the mean of the test

Means and standard deviations of commonly met scales are in this table

Scale	Mean	Standard deviation
Wechsler IQs	100	15
Wechsler subtests	10	3
T scores	50	10
Sten scores	5.5	2

Example. The WAIS III IQ corresponding to a Z of -.33 Z of -.33 will be: (-.33 x 15) + 100 which equals 95

Test yourself.

To what IQ will a Z of .67 correspond?

Answer. 110

Want more? See Modules 1 and 2 (LINKS)

How to 3. Convert a percentile into a Z-score

This conversion has to be done by using tables for the normal distribution. Finding the appropriate percentile point in the distribution tables tells you what the Z is.

A table for doing this is provided:

Table for converting percentiles to Z-scores

Percentile	Z-score	Percentile	Z-Score	Percentile	Z-Score
1	-2.33	34	-0.41	67	0.44
2	-2.05	35	-0.39	68	0.47
3	-1.88	36	-0.36	69	0.50
4	-1.75	37	-0.33	70	0.52
5	-1.64	38	-0.31	71	0.55
6	-1.55	39	-0.28	72	0.58
7	-1.48	40	-0.25	73	0.61
8	-1.41	41	-0.23	74	0.64
9	-1.34	42	-0.20	75	0.67
10	-1.28	43	-0.18	76	0.71
11	-1.23	44	-0.15	77	0.74
12	-1.17	45	-0.13	78	0.77
13	-1.13	46	-0.10	79	0.81
14	-1.08	47	-0.08	80	0.84
15	-1.04	48	-0.05	81	0.88
16	-0.99	49	-0.03	82	0.92
17	-0.95	50	0.00	83	0.95
18	-0.92	51	0.03	84	0.99
19	-0.88	52	0.05	85	1.04
20	-0.84	53	0.08	86	1.08
21	-0.81	54	0.10	87	1.13
22	-0.77	55	0.13	88	1.17
23	-0.74	56	0.15	89	1.23
24	-0.71	57	0.18	90	1.28
25	-0.67	58	0.20	91	1.34
26	-0.64	59	0.23	92	1.41
27	-0.61	60	0.25	93	1.48
28	-0.58	61	0.28	94	1.55
29	-0.55	62	0.31	95	1.64
30	-0.52	63	0.33	96	1.75
31	-0.50	64	0.36	97	1.88
32	-0.47	65	0.39	98	2.05
33	-0.44	66	0.41	99	2.33

Want more? See Module 1 and Module 2

How to 4. Convert a Z score into a percentile

Health Warning. This procedure will give seriously wrong answers with distributions other than the normal distribution.

Use this Table. Finding the appropriate Z will tell you what the percentile is. Click to use.

Converting Z-scores into percentiles

Z-score	Percentile	Z-Score	Percentile	Z-Score	Percentile
-2.33	1	-0.41	34	0.44	67
-2.05	2	-0.39	35	0.47	68
-1.88	3	-0.36	36	0.50	69
-1.75	4	-0.33	37	0.52	70
-1.64	5	-0.31	38	0.55	71
-1.55	6	-0.28	39	0.58	72
-1.48	7	-0.25	40	0.61	73
-1.41	8	-0.23	41	0.64	74
-1.34	9	-0.20	42	0.67	75
-1.28	10	-0.18	43	0.71	76
-1.23	11	-0.15	44	0.74	77
-1.17	12	-0.13	45	0.77	78
-1.13	13	-0.10	46	0.81	79
-1.08	14	-0.08	47	0.84	80
-1.04	15	-0.05	48	0.88	81
-0.99	16	-0.03	49	0.92	82
-0.95	17	0.00	50	0.95	83
-0.92	18	0.03	51	0.99	84
-0.88	19	0.05	52	1.04	85
-0.84	20	0.08	53	1.08	86
-0.81	21	0.10	54	1.13	87
-0.77	22	0.13	55	1.17	88
-0.74	23	0.15	56	1.23	89
-0.71	24	0.18	57	1.28	90
-0.67	25	0.20	58	1.34	91
-0.64	26	0.23	59	1.41	92
-0.61	27	0.25	60	1.48	93
-0.58	28	0.28	61	1.55	94
-0.55	29	0.31	62	1.64	95
-0.52	30	0.33	63	1.75	96
-0.50	31	0.36	64	1.88	97
-0.47	32	0.39	65	2.05	98
-0.44	33	0.41	66	2.33	99

Want more? See Module 1 and Module 2

How to 5. Convert test scores on one test scale to test scores on another without using Z-scores

Use this formula:

$$X_2 = \frac{\sigma_{x2}}{\sigma_{x1}}\left(X_1 - M_{x1}\right) + M_{x2}$$

Example. On Test A, which has a mean of 100 and a standard deviation of 10 somebody obtains a score of 95. What would their equivalent score be if the test had had a mean of 50 and a standard deviation of 6?

The answer is: $\dfrac{6}{10}\left(95 - 100\right) + 50 = 47$

BUT using Z scores has other advantages, as you will see.

How to 6. Normalise a test score distribution

The easiest way to do this is shown below. **BUT** please note however that simply converting the test scores to Z scores will not normalise them. The first step is essential if the procedure is to work. Each score has to be converted into a percentile and the Z-score found that corresponds to that percentile.

Step 1. Work out the percentile corresponding to each score in the distribution (if you do not know how to do this see Module 2).

Step 2. Convert each of the percentiles so found into a corresponding Z-score

Step 4. Convert the Z-scores into a scale with the mean and standard deviation that you desire

This procedure was/is often called T-scaling.