Percentiles From z-scores (and vice versa)

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Math 107-03, Spring 2020, Spelman College

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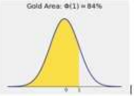
Moreover, there is a single lookup table for percentiles for Z.

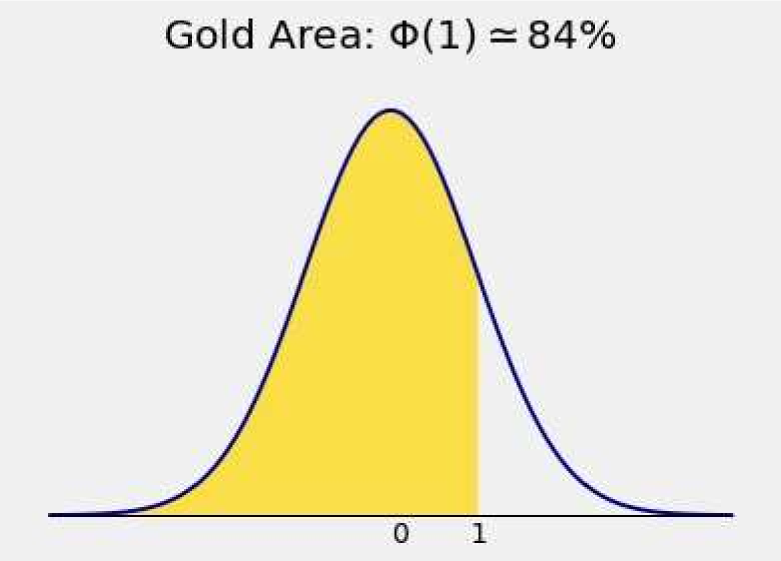
The Conversion Table

z-scores and percentiles



Z-score	Percentile	Z-score	Percentile	Z-score	Percentile	Z-score	Percentile
−3.5	0.02	−1.0	15.87	0.0	50.00	1.1	86.43
−3.0	0.13	−0.95	17.11	0.05	51.99	1.2	88.49
−2.9	0.19	−0.90	18.41	0.10	53.98	1.3	90.32
−2.8	0.26	−0.85	19.77	0.15	55.96	1.4	91.92
−2.7	0.35	−0.80	21.19	0.20	57.93	1.5	93.32
−2.6	0.47	−0.75	22.66	0.25	59.87	1.6	94.52
−2.5	0.62	−0.70	24.20	0.30	61.79	1.7	95.54
−2.4	0.82	−0.65	25.78	0.35	63.68	1.8	96.41
−2.3	1.07	−0.60	27.43	0.40	65.54	1.9	97.13
−2.2	1.39	−0.55	29.12	0.45	67.36	2.0	97.72
−2.1	1.79	−0.50	30.85	0.50	69.15	2.1	98.21
−2.0	2.28	−0.45	32.64	0.55	70.88	2.2	98.61
−1.9	2.87	−0.40	34.46	0.60	72.57	2.3	98.93
−1.8	3.59	−0.35	36.32	0.65	74.22	2.4	99.18
−1.7	4.46	−0.30	38.21	0.70	75.80	2.5	99.38
−1.6	5.48	−0.25	40.13	0.75	77.34	2.6	99.53
−1.5	6.68	−0.20	42.07	0.80	78.81	2.7	99.65
−1.4	8.08	−0.15	44.04	0.85	80.23	2.8	99.74
−1.3	9.68	−0.10	46.02	0.90	81.59	2.9	99.81
−1.2	11.51	−0.05	48.01	0.95	82.89	3.0	99.87
−1.1	13.57	−0.0	50.00	1.0	84.13	3.5	99.98

From z-scores to percentiles, visually



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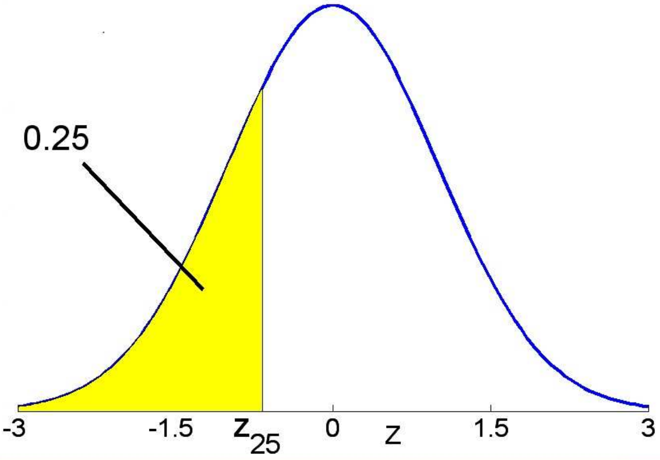
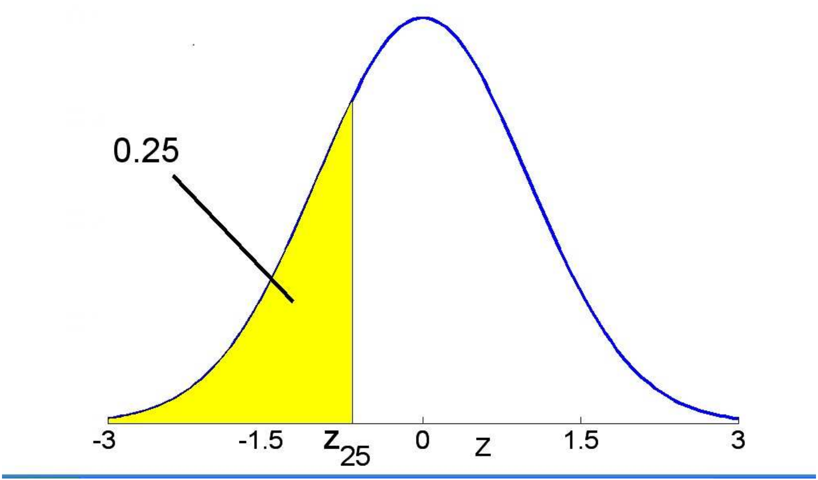


What z-score corresponds to the 25th percentile?

From percentiles to z-scores, visually



What z-score corresponds to the 25th percentile? This can also be read off the table, "by reading it backwards".

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Also, we won't always find in the table the numbers we want. Generally, we will have to settle for approximate answers, and occasionally average two numbers found in the table.

Using the table to find percentiles

If Bio test scores are B = N(75,5), and Chem test scores are C = N(80,4), then $z_B = \frac{b-75}{5}$ and $z_C = \frac{c-80}{4}$ are both N(0,1).

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What percentage of Bio test scores are (at or) below 78? Find $z_B = \frac{78-75}{5} = 0.6$

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What percentage of Bio test scores are (at or) below 82? Find $z_B = \frac{82-75}{5} = 1.4$ and the table says about 92%.

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What percentage of Bio test scores are (at or) below 82? Find $z_B = \frac{82-75}{5} = 1.4$ and the table says about 92%. Getting 8 on this Bio test puts one at the 92nd percentile!

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What percentage of Bio test scores are (at or) below 70?

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What percentage of Bio test scores are (at or) below 82? Find $z_B = \frac{82-75}{5} = 1.4$ and the table says about 92%. Getting 8 on this Bio test puts one at the 92nd percentile!

What percentage of Bio test scores are (at or) below 70? Find $z_B = \frac{70-75}{5} = -1$

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What percentage of Bio test scores are (at or) below 70? Find $z_B = \frac{70-75}{5} = -1$ and the table says 15.87% which agrees well with the 16% we would have said by using the 68% rule.

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What percentage of Bio test scores are (at or) below 70? Find $z_B = \frac{70-75}{5} = -1$ and the table says 15.87% which agrees well with the 16% we would have said by using the 68% rule. Getting 70 on this Bio test puts one at the 16th percentile.

Using the table to find percentiles

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What percentage of Bio test scores are betweeen 70 and 82? We are in luck: we just learned that 92% of the scores are at or below 82, whereas 16% are at or below 70. Hence, by subtracting, we see that $92\% - 16\% = 76\%$ of the Bio test scores are between 70 and 82.

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What percentage of Bio test scores are betweeen 69 and 72? We have to work with these numbers separately, and then substract. No prior work helps.

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What percentage of Bio test scores are betweeen 69 and 72? We have to work with these numbers separately, and then substract. No prior work helps. Find $z_B = \frac{69-75}{5} = -1.2$ and the table says about 11.5%.

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What percentage of Bio test scores are betweeen 69 and 72? We have to work with these numbers separately, and then substract. No prior work helps. Find $z_B = \frac{69-75}{5} = -1.2$ and the table says about 11.5%. (Getting 69 on this Bio test puts one at the 11 and a half-th percentile.) Also, find $z_B = \frac{72-75}{5} = -0.6$

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What percentage of Bio test scores are betweeen 69 and 72? We have to work with these numbers separately, and then substract. No prior work helps. Find $z_B = \frac{69-75}{5} = -1.2$ and the table says about 11.5%. (Getting 69 on this Bio test puts one at the 11 and a half-th percentile.) Also, find $z_B = \frac{72-75}{5} = -0.6$ and the table says about 27.5%. (Getting 72 on this Bio test puts one at the 27 and a half-th percentile.) Subtracting, $27.5\% - 11.5\% = 16\%$, we that about 16% of the Bio test scores are between 69 and 72.

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Question: What percentile corresponds to about 2/3 of a standard deviation below the mean?

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The table "read backwards" reveals that a z-score of 0.25 corresponds to the 60th percentile. Hence, the answer is 0.24 std dev above the mean price for the Audi, namely \$26K + \$1K = \$27K.

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So, $A - 26 = (0.25)(4)$

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The table "read backwards" reveals that a z-score of -0.85 corresponds to the 20th percentile. Hence, the answer is 0.85 std dev below the mean price for the Merc, namely \$35K - (0.85)\$3K = \$32.45K.

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Assume that in Georgia adult men's heights (in inches) are N(69.2,3.1) and that adult women's heights are N(64.5,2.6).

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4. What is the 70th percentile height for men?

5. What is the 8th percentile height for men?