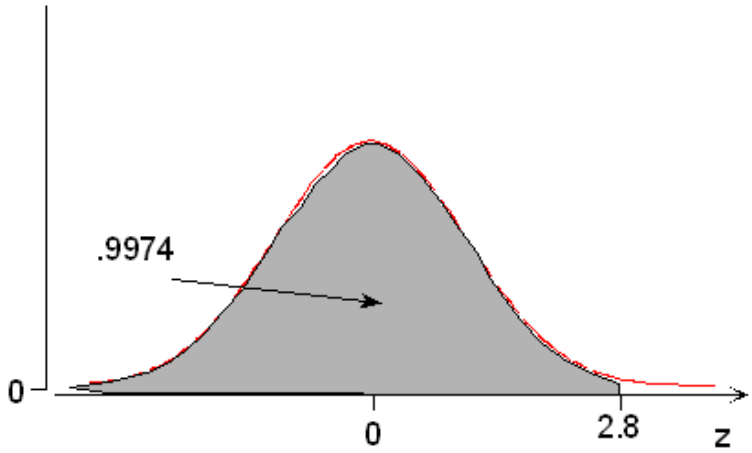
Standard Normal Table: Finding a Probability

Learning Objective: Find probabilities associated with the normal distribution.

Example

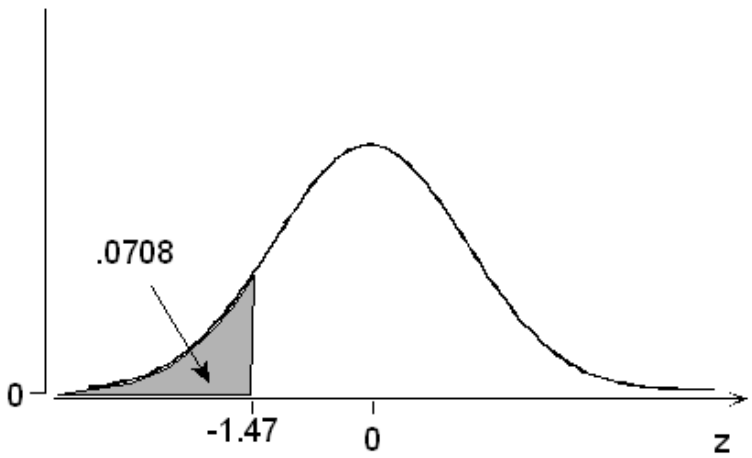
(a) What is the probability of a normal random variable taking a value less than 2.8 standard deviations above its mean? According to the table, $P(Z < 2.8) = 0.9974$ or 99.74%.

z	.00	.01	.02	.03	.04	.05	.06	.07	.08	.09
2.5	.9938	.9940	.9941	.9943	.9945	.9946	.9948	.9949	.9951	.9952
2.6	.9953	.9955	.9956	.9957	.9959	.9960	.9961	.9962	.9963	.9964
2.7	.9965	.9966	.9967	.9968	.9969	.9970	.9971	.9972	.9973	.9974
2.8	**.9974**	.9975	.9976	.9977	.9977	.9978	.9979	.9979	.9980	.9981
2.9	.9981	.9982	.9982	.9983	.9984	.9984	.9985	.9985	.9986	.9986
3.0	.9987	.9987	.9987	.9988	.9988	.9989	.9989	.9989	.9990	.9990



(b) What is the probability of a normal random variable taking a value lower than 1.47 standard deviations below its mean? P(Z < -1.47) = 0.0708, or 7.08%.

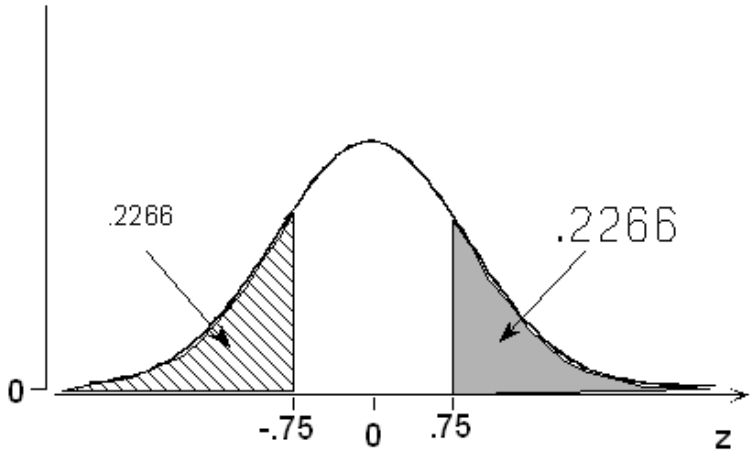
z	.00	.01	.02	.03	.04	.05	.06	.07	.08	.09
-1.5	.0668	.0655	.0643	.0630	.0618	.0606	.0594	.0582	.0571	.0559
-1.4	.0808	.0793	.0778	.0764	.0749	.0735	.0721	**.0708**	.0694	.0681
-1.3	.0968	.0951	.0934	.0918	.0901	.0885	.0869	.0853	.0838	.0823
-1.2	.1151	.1131	.1112	.1093	.1075	.1056	.1038	.1020	.1003	.0985



(c) What is the probability of a normal random variable taking a value **more** than 0.75 standard deviations above its mean?

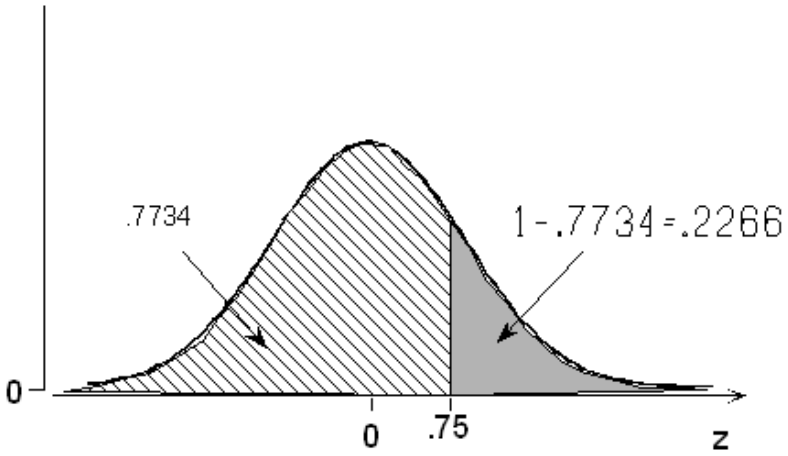
The fact that the problem involves the word "more" rather than "less" should not be overlooked! Our normal table, like most, provides left-tail probabilities, and adjustments must be made for any other type of problem.

Method 1: By symmetry of the z curve centered on 0, P(Z > +0.75) = P(Z < -0.75) = 0.2266.



Method 2: Because the total area under the normal curve is 1,

$P(Z > +0.75) = 1 - P(Z < +0.75) = 1 - 0.7734 = 0.2266.$

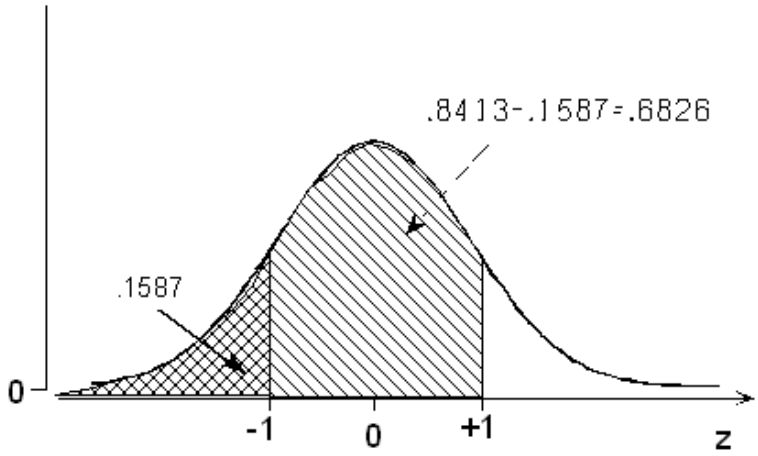


[**Note:** most students prefer to use Method 1, which does not require subtracting 4-digit probabilities from 1.]

(d) What is the probability of a normal random variable taking a value between 1 standard deviation below and 1 standard deviation above its mean?

To find probabilities in between two standard deviations, we must put them in terms of the probabilities below. A sketch is especially helpful here:

$P(-1 < Z < +1) = P(Z < +1) - P(Z < -1) = 0.8413 - 0.1587 = 0.6826.$



Did I Get This

1/1 point (graded)

What is the probability that a normal random variable will take a value that is less than 1.05 standard deviations above its mean? In other words, what is P(Z < 1.05)?

- (●) 0.8531 ✔
- ( ) 0.1468
- ( ) 0.9332
- ( ) 0.0668

Answer

Correct: Indeed, P(Z < 1.05) is just the table 's entry for z = 1.05, which is 0.8531.

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Did I Get This

1/1 point (graded)

What is the probability that a normal random variable will take a value that is between 1.5 standard deviations below the mean and 2.5 standard deviations above the mean? In other words, what is P(-1.5 < Z < 2.5)?

- ( ) 0.9938

- 0.0668
- 0.9270 ✔
- 0.0730

Answer
Correct: Indeed, P(-1.5 < Z < 2.5) = P(Z < 2.5) - P(Z < -1.5) = 0.9938 - 0.0668 = 0.9270.

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Did I Get This

1/1 point (graded)
What is the probability that a normal random variable will take a value that is more than 2.55 standard deviations above its mean? In other words, what is P(Z > 2.55)?

- 0.9945
- 0.9946
- 0.0055
- 0.0054 ✔

Answer
Correct: Indeed, P(Z > 2.55) = P(Z < -2.55) = .0054 or, P(Z > 2.55) = 1 - P(Z < 2.55) = 1 - .9946 = 0.0054.

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