

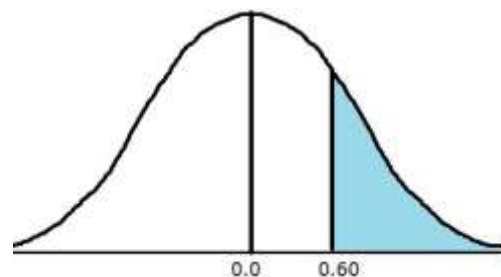
## Using the Standard Normal Curve Table

**What percentage of the scores in a normal distribution are (above/below) a given value of the score (mean and standard deviation provided)?**

The distribution of amount spent on lunch among students at Stinkstiefel University is normally distributed with a mean of \$3.74 and a standard deviation of \$1.25. Haley spent \$4.49 on lunch. What percentage of students at Stinkstiefel spend more than Haley did.

A. Convert score into z:  $z = \frac{Y - \mu}{\sigma} = \frac{4.49 - 3.74}{1.25} = 0.60$

B. Draw a normal curve. Draw a vertical line at the location of the mean. Draw another vertical line at the location of the z score. Shade the area of interest. The shaded area is smaller than the unshaded area, so you will use the "Smaller Portion" column in the normal distribution table.



C. Go to that table. Find 0.60 in a column labeled "z." Your answer will be in that row, in the smaller portion column to the right. In this case, the answer is 27.43%.

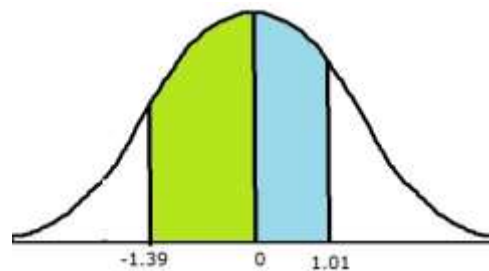
z	Mean to z	Larger Portion	Smaller Portion
<u>.60</u>	.2257	.7257	<u>.2743</u>

**What percentage of the scores in a normal distribution fall between Value 1 and Value 2 (mean and standard deviation provided)?**

What percentage of Stinkstiefel students spend between \$2 and \$5 for lunch?

A. Convert both scores to z scores.  $z_1 = \frac{2.00 - 3.74}{1.25} = -1.39$ ,  $z_2 = \frac{5.00 - 3.74}{1.25} = 1.01$ .

B. Draw a normal curve. Draw a vertical line at the location of the mean. Draw another vertical line at the location of the first z score and yet another at the location of the second z score. Shade the areas of interest.



C. Both shaded areas are between the z score and the mean, so you will be using the “Mean to z” column in the table. Find the row with  $z = 1.39$ . The “Mean to z” value is .4177. Find the row with  $z = 1.01$ . The “Mean to z” value is .3439. The total shaded area is  $.4177 + .3439 = 76.16\%$ .

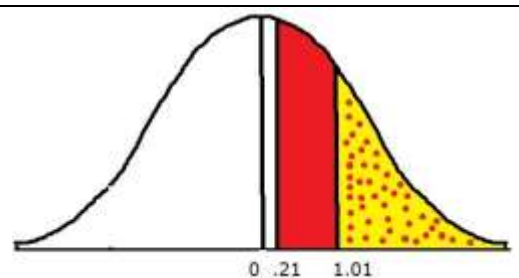
$z$	Mean to z	Larger Portion	$z$	Mean to z	Larger Portion
<u>1.39</u>	<u>.4177</u>	.9177	<u>1.01</u>	<u>.3438</u>	.8438

What percentage of Stinkstiefel students spend between \$4 and \$5 for lunch?

A. Convert both scores to z scores.

$$z_1 = \frac{4.00 - 3.74}{1.25} = .21, \quad z_2 = \frac{5.00 - 3.74}{1.25} = 1.01.$$

B. Draw a normal curve. Draw a vertical line at the location of the mean. Draw another vertical line at the location of the first z score and yet another at the location of the second z score. Shade the areas of interest.



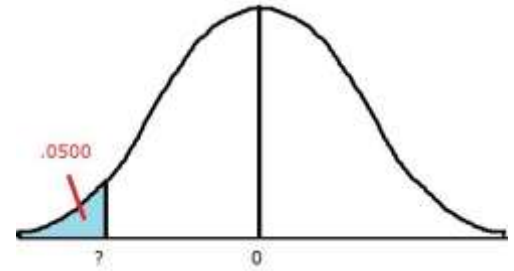
C. The “smaller portion” area for  $z_1$  is .4168. In the figure above that is represented by both the red area and the red-dotted yellow area. The “smaller portion” area for  $z_2$  is .1562, represented by the yellow area. These two areas overlap. The area of most interest (red) is equal to simple difference between the two overlapping areas – that is,  $.4168 - .1562 = 26.06\%$ .

$z$	Mean to z	Larger Portion	Smaller Portion	$z$	Mean to z	Larger Portion	Smaller Portion
<u>.21</u>	.0832	.5832	<u>.4168</u>	<u>1.01</u>	.3438	.8438	<u>.1562</u>

**Given the mean and standard deviation of a normal distribution, find the score value (above/below) which a given percentage of the scores fall.**

The mean [birth weight of boys](#) of European descent born at 38 weeks is 7.41 pounds with a standard deviation of 0.92 pounds. Those in the bottom 5% of the distribution of birth weights are considered to be of “low birth weight.” Find the weight below which 5% of birth weights fall. Assume that the distribution is normal.

A. Draw the normal curve, draw a vertical line at the mean and at the point that marks off the area of interest.



B. In the normal curve table, “Smaller Portion” column, find the value .0500, or as close to that as you can find. You will find the values .0505 and .0495. For these two values, the corresponding values in the z column are 1.64 and 1.65. You could use either of these, with only small differences in your solution, but since .0500 is exactly halfway between .0505 and .0495, I’ll use a z halfway between 1.64 and 1.65, that is, 1.645. Since the z is below the mean it is actually negative, that is, -1.645.

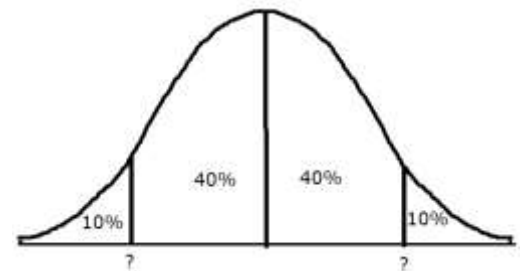
<b>z</b>	<b>Mean to z</b>	<b>Larger Portion</b>	<b>Smaller Portion</b>
1.64	.4495	.9495	.0505
1.65	.4505	.9505	.0495

C. You now know the z score, all that is left to do is convert the z score into pounds. Score = mean + z(standard deviation) = 7.41 + (-1.645)(.92) = 5.90 pounds.

**Given the mean and standard deviation of a normal distribution, find the values that mark off the middle given percentage of the scores**

A clothing designer in San Francisco is producing a new set of baby clothing with Carolina Panther or Denver Bronco icons on it. She wants the clothing to fit baby boys whose birth weight is in the middle 80% of the distribution of birth weights. What weights mark off that middle 80%?

A. Draw the normal curve. Draw vertical lines at the mean and at each end of the range of scores you seek. For each of the resulting 4 areas, enter the percentage of scores in the area. Since the normal curve is perfectly symmetric, half of the middle 80% will be below the mean, half above. That leaves 20%, split into 10% in the lower tail and 10% in the upper tail.



B. Go to the normal curve table. Find .10 in the smaller portion column, .90 in the larger portion column, or .40 in the “mean to z” column. The z score that will get closest to those values is z = 1.28.

<b>z</b>	<b>Mean to z</b>	<b>Larger Portion</b>	<b>Smaller Portion</b>
1.28	.3997	.8997	.1003

C. Multiply the standard deviation by the z score. Subtract  $z\sigma$  from the mean to get the lower limit. Add  $z\sigma$  to the mean to get the upper limit.  $7.41 \pm 1.28(.92) = 6.23$  pounds to 8.59 pounds.

[Karl L. Wuensch](#), February, 2017.