3.6 Use the sketch from Exercise 3.5 and shade in the appropriate areas to answer these questions. **(a)** A total of 99.7% of all upper arm lengths are within three standard deviations of the mean, or between 29.5 centimeters and 42.1 centimeters. **(b)** This is the area that is one or more standard deviations below the mean. Because the curve is symmetric and 100 – 68 = 32% of the area is more than one standard deviation away from the mean, 32%/2 = 16% of upper arm lengths are less than 33.7 centimeters.

3.7 **(a)** In 95% of all years, monsoon rain levels are between 688 and 1016 mm—two standard deviations above and below the mean: 852 ± 2(82) = 688 to 1016 mm. **(b)** The driest 2.5% of monsoon rainfalls are less than 688 mm; this is more than two standard deviations below the mean.

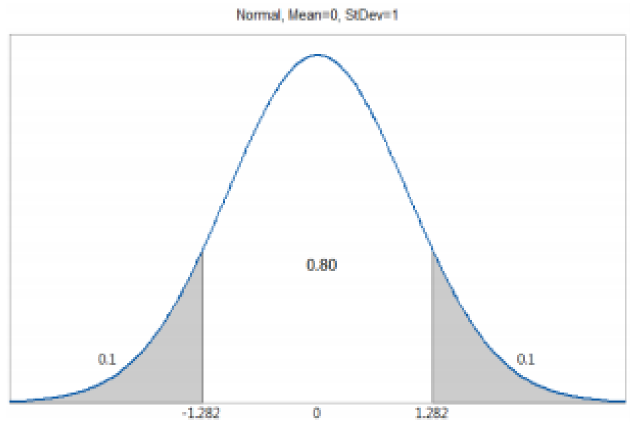
3.8 Idonna's standardized score is $z = \frac{670 - 514}{118} = 1.32$. Jonathan's standardized score is $z = \frac{26 - 20.9}{5.3} = 0.96$. Idonna's score is relatively higher than Jonathan's.

3.9 We need to use the same scale, so recall that 6 feet = 72 inches. A woman who is 6 feet tall has standardized score $z = \frac{72 - 64.2}{2.8} = 2.79$ (quite tall, relatively). A man who is 6 feet tall has standardized score $z = \frac{72 - 69.4}{3.0} = 0.87$. Thus, a woman who is 6 feet tall is 2.79 standard deviations taller than average for women. A man who is 6 feet tall is only 0.87 standard deviations above average for men.

3.11 Let x be the monsoon rainfall in a given year. **(a)** $x \leq 697$ mm corresponds to $z \leq \frac{697 - 852}{82} = -1.89$, for which Table A gives 0.0294 = 2.94%. **(b)** $682 < x < 1022$ corresponds to $\frac{682 - 852}{82} < z < \frac{1022 - 852}{82}$, or $-2.07 < z < 2.07$. This proportion is 0.9808 − 0.0192 = 0.9616 = 96.16%.

3.12 **(a)** Let x be the MCAT score of a randomly selected student. Then $x > 30$ corresponds to $z > \frac{30 - 25.3}{6.5} = 0.72$, for which Table A gives 0.7642 as an area to the left. Thus, the answer is 1 – 0.7642 = 0.2358, or 23.58%. **(b)** $20 \leq x \leq 25$ corresponds to $\frac{20 - 25.3}{6.5} \leq z \leq \frac{25 - 25.3}{6.5}$, or $-0.82 \leq z \leq -0.05$. Thus, using Table A, the area is 0.4801 – 0.2061 = 0.2740, or 27.4%.

3.14 (a) Because the Normal distribution is symmetric, its median and mean are the same. So the median MCAT score is 25.3. Now, following Example 3.11, the first quartile has $z = -0.67$, because the area under the curve to the left of the first quartile is 0.2500 (software gives $z = -0.6745$). Similarly, the third quartile has $z = 0.67$, because the area under the curve to the left of the third quartile is 0.7500. The first quartile is 25.3 – (0.67)(6.5) = 20.945, and the third quartile is 25.3 + (0.67)(6.5) = 29.655. Practically speaking, this means the quartiles are 21 and 30 (because scores are integers). **(b)** If we are interested in the central 80%, there is 10% in each of the two tails. Software tells us that the z-values corresponding to 10% in the tails are ±1.282 (From Table A, you'll find z = ±1.28 has cumulative area 0.1003 in each tail). The MCAT scores are then 25.3 ± 1.28(6.5), or 16.98 (really 17) to 33.62 (or 34).



3.15 (c) Economic variables, such as income and prices of houses, are usually right-skewed.

3.16 (a) Mean and standard deviation tell you center and variability, respectively, which is all you need for a Normal distribution.

3.17 (b) The curve is centered at 2.

3.18 (b) Estimating a standard deviation is more difficult than estimating the mean, but among the three options, 2 is clearly too small and 5 is clearly too large, so 3 seems to be the most reasonable for the standard deviation.

3.19 (b) 266 ± 2(16) = 234 to 298 days

3.20 (c) 130 is two standard deviations above the mean, so about 2.5% of adults have IQs of 130 or more.

3.21 (a) $z = \frac{132 - 100}{15} = 2.13$

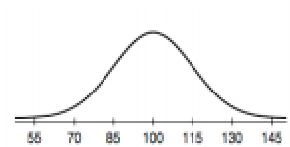
3.22 (b) 1 – 0.9265 = 0.0735

3.23 (b) 0.1056

3.24 (c) About 98%: As in Exercise 3.21, $z = 2.13$, and by Table A, the proportion below is 0.9834.

3.26 For each distribution, take the mean plus or minus two standard deviations. For mildly obese people, this is 373 ± 2(67) = 239 to 507 minutes. For lean people, this is 526 ± 2(107) = 312 to 740 minutes.

3.27 70 is two standard deviations below the mean (that is, it has standard score $z = -2$), so about 2.5% (half of the outer 5%) of adults would have WAIS scores below 70.



3.30 Let x be the length of a thorax for a randomly selected fruit fly. **(a)** $x < 0.6$ mm corresponds to $z < \frac{0.6-0.8}{0.078} = -2.56$. Thus, the area is 0.0052, or 0.52%. **(b)** $x > 0.9$ mm corresponds to $z > \frac{0.9-0.8}{0.078} = 1.28$. Thus, the area is 1 – 0.8997 = 0.1003, or 10.03%. **(c)** 0.6 mm < x < 0.9 mm corresponds to $-2.56 < z < 1.28$. Thus, the area is 0.8997 – 0.0052 = 0.8945, or 89.45%.

3.35 Cars with better mileage than the Beetle correspond to $x > 28$, which corresponds to $z > \frac{28-22.2}{5.2} = 1.12$. Thus, this proportion is 1 – 0.8686 = 0.1314, or 13.14%.

3.36 We need the proportion above our vehicle's mileage to be 0.05; this means 95% (0.9500) have worse mileage. Looking for 0.9500 as a left-tail area in the table finds z = 1.64 has 0.9495 to the left and z = 1.65 has 0.9505 to the left. If we use the average of these two (a commonly accepted value), that gives $z = 1.645$, so our vehicle would need mileage to be 22.2 + (1.645)(5.2) = 30.754 mpg. A car would need to have gas mileage of about 30.75 mpg or higher to be in the top 5% for all 2014 models.

3.37 The first and third quartiles have $z = -0.67$ and $z = 0.67$, respectively (use the symmetry of the Normal distribution to find one of these, for example, Q_1 with 0.2500 as the area to the left). Thus, the first quartile is 22.2 – (0.67)(5.2) = 18.72 mpg, and the third quartile is 22.2 + (0.67)(5.2) = 25.68 mpg.

which has proportion 1 – 0.9686 = 0.0314, or 3.14%.

3.41 If x is the height of a randomly selected woman in this age group, we want the proportion corresponding to $x > 69.4$ inches. This corresponds to $z > \frac{69.4-64.2}{2.8} = 1.86$,