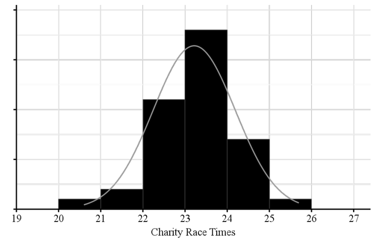
# Lesson 5.1.3

5-17. See histogram at right.
$\bar{x}$ = 23.2175 minutes, $s$ = 0.9729 minutes
The model has the same general shape as the histogram. The model does not go quite as high as the histogram but otherwise goes through the center of the bars pretty well.

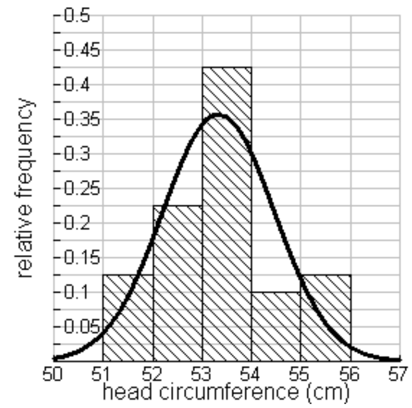



5-18. a. $P(22.5 < X < 24.5)$ =
normalcdf(22.5, 24.5, 23.22, 0.973) ≈ 0.676 or 67.6%

b. $P(20 < X < 25)$ = normalcdf(20, 25, 23.22, 0.973) ≈ 0.966 or 96.6%

c. $P(X < 26)$ = normalcdf(–10^99, 26, 23.22, 0.973) ≈ 0.998 or 99.8%

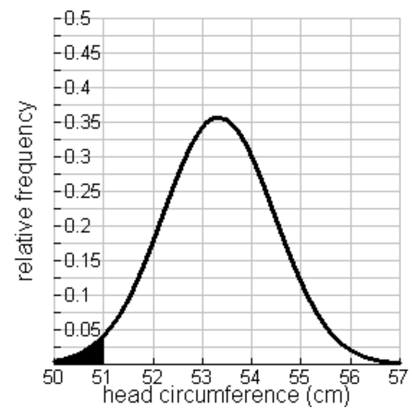
d. 50%; Yes, students should predict that half the women run faster than the mean, and half the women run slower than the mean. The mean and median are the same because of the symmetry of the normal distribution.




5-19. a. See histogram above right.

b. $\bar{x}$ = 53.3 cm, $s$ = 1.12 cm

c. See graph middle right.




d. See graph below right; the normal model predicts $P(51 < X < 52)$ = normalcdf(51, 52, 53.3, 1.12) ≈ 0.103 or 10.3%, a little less than the 12.5% observed in the sample.

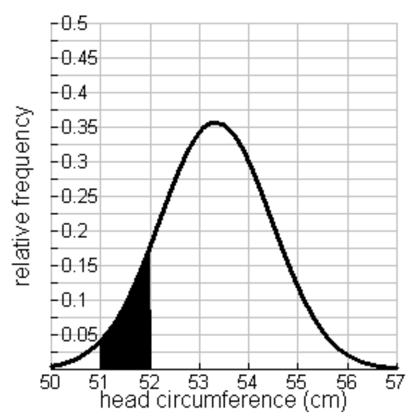
e. 0.103 · 775 ≈ 79.3 hats

f. $P(X < 51)$ = normalcdf(–10^99, 51, 53.3, 1.12) ≈ 0.0200, 0.0200 · 775 ≈ 15.5 racers; See graph middle right.

g. $P(X > 56)$ = normalcdf(56, 10^99, 53.3, 1.12) ≈ 0.0080, 0.0080 · 775 ≈ 6.2 racers;
$P(51 < X < 56)$ = normalcdf(51, 56, 53.3, 1.12) ≈ 0.9720, 0.9720 · 775 ≈ 753.3 racers

h. Yes. 15.5 racers under size 51, 753.3 racers between size 51 and 56, and 6.2 racers over size 56, sums to 775 racers in all.

i. 100%; Yes, 100% of the racers have a hat size between negative infinity and infinity.





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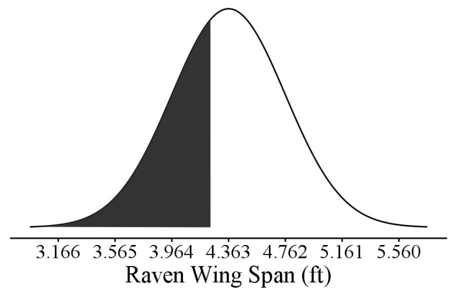
5-20. a. 0.135

b. 0.34

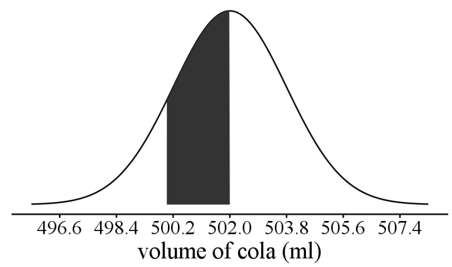
c. 0.0235

5-21 See sketch at right. $P(X < 4.236)$ = normalcdf(–10^99, 4.236, 4.363, 0.339) = 0.3540

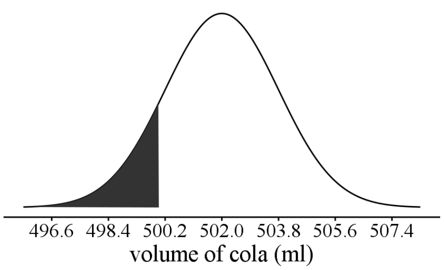



5-22. a. $P(X > 502)$ = normalcdf(502, 10^99, 502, 1.8) = 0.500. Students should recognize that 502 ml is the mean and half (0.500) of the probability in a normal distribution is always above and below the mean.

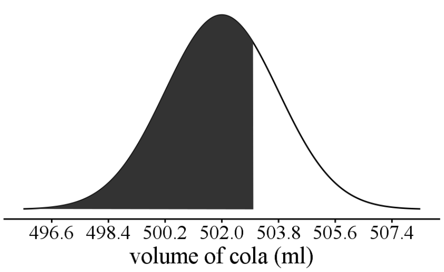
b. $P(500 < X < 502)$ = normalcdf(500, 502, 502, 1.8) ≈ 0.367. See diagram at right.



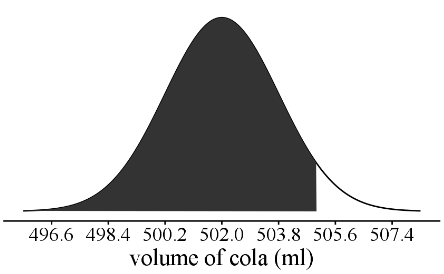

c. $P(X < 500)$ = normalcdf(–10^99, 500, 502, 1.8) ≈ 0.133. See diagram below.




d. $P(X < 503)$ = normalcdf(–10^99, 503, 502, 1.8) ≈ 0.711 or the 71$^{st}$ percentile. See diagram below.




e. $P(X < 505)$ = normalcdf(–10^99, 505, 502, 1.8) ≈ 0.952 or the 95$^{th}$ percentile. See diagram below.

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5-23. a. There appears to be a weak, positive, linear association between the parent rating and the kid rating.

b. The $y$-intercept is very close to five and the slope appears to be about $\frac{1}{4}$, so a reasonable line is $y = 5 + 0.25x$. The slope of 0.25 means that for every increase in the kids rating of 1 point, the parent rating increases by an expected 0.25 points.

c. *i.* True

*ii.* False

*iii.* True

*iv.* True

*v.* Not as true; closest example is the point at (9, 6) but a score of "6" does not seem like hatred on the parent end.

d. Correct answers will vary significantly, and no answer is right. One argument for Brussels sprouts is perhaps the point at (2, 6.2)—children stereotypically do not like bitter vegetables, but some adults really love them. A possible point for the mac and cheese is (9.1, 6.2); children often love the stuff, but parents have usually found they like many other foods better. The point (9.8, 7.9) could be something almost universally liked, like cheese pizza.

5-24. a. Start with a group of athlete volunteers and measure each athlete's vertical leap. Using a random number generator or picking names from a hat, assign each athlete randomly to one of two treatment groups: Coach Pham's program and a conventional agility program. Measure each athlete's vertical leap again after six weeks. Compare the average change in vertical leap between the two groups.

b. Yes, assuming a sufficient sample size, a controlled randomized experiment can show cause and effect because of the random assignment of subjects to the groups.


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