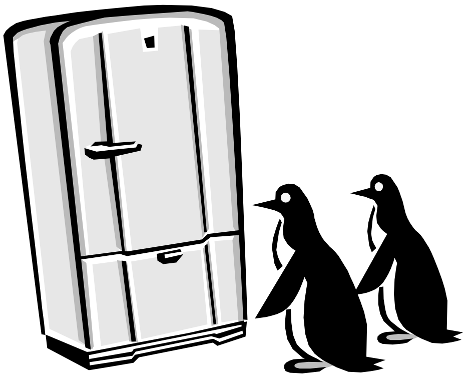
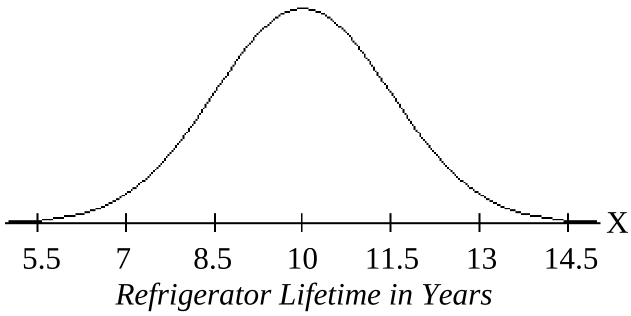
That old refrigerator… **KEY**



1) The lifetime of a refrigerator is a normal distribution with a mean of ten years and a standard deviation of 1.5 years.

a) Sketch the distribution of X which represents the lifetime of this particular brand of refrigerator.



b) What percentage of refrigerators last between 6.2 and 9.1 years?
normalcdf(6.2, 9.1, 10, 1.5) = 0.2686038705
About 26.86%.

c) What percentage of refrigerators last more that 12 years and 6 months?
normalcdf(12.5, 1E99, 10, 1.5) = 0.0477903304
About 4.78%.

d) What percentage of refrigerators last less than 5 years?
normalcdf(-1E99, 5, 10, 1.5) = 4.291165336E-4
About 4.29E-4 = 0.000429 = 0.0429%.

e) Would it be highly unlikely for a refrigerator to last less than five years? Justify your answer.
It is highly unlikely that a refrigerator lasts less than 5 years based on part d). You can also see this from the picture in part a). Only 0.04% break down during this time, or about 4 out of every 10,000 refrigerator breaks (recall 0.0004 is equal to 4 divided by 10,000).

f) How long does a refrigerator last if its lifetime is not in the upper 10%?
Invnorm(0.90, 10, 1.5) = 11.92232735
About 11.92 years or less.

g) How long does a refrigerator last if its lifetime is in the MIDDLE 50%?
We use Invnorm to find the upper bound of the middle 50%. Using the symmetry of the normal curve, we find that the area to the left of this upper bound is 50% + 25% = 75%. Therefore

upper bound = Invnorm(0.75, 10, 1.5) = 11.01173462 years

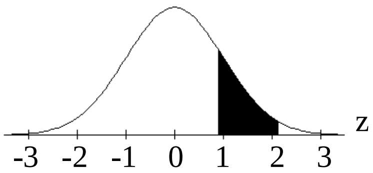
Furthermore

lower bound = Invnorm(0.25, 10, 1.5) = 8.988265376 years.

In conclusion, a refrigerator lasts between about 9 and 11 years if its lifetime is in the middle 50% of all refrigerator lifetimes.

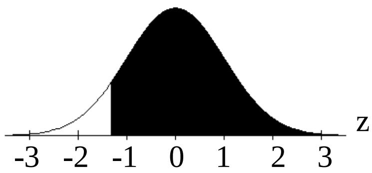
2) Sketch the area on the Standard Normal Curve that represents the probability of the following events and then determine with your calculator the probability.

a) $0.89 < Z < 2.11$



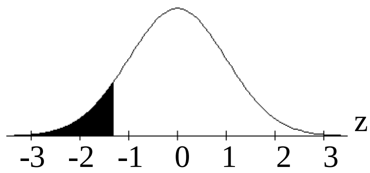
normalcdf(0.89, 2.11)
= 0.1693

b) $Z \geq -1.33$



normalcdf(-1.33, 1E99)
= 0.9082

c) $Z < -1.33$



normalcdf(-1E99, -1.33)
= 0.0918

3) A z-score tells us how many standard deviations a particular value is from the mean. Assume that exam scores are normally distributed. An instructor gives an exam where the mean is 78 and the standard deviation is 8.

a) Find the z-score for someone who makes 100 on the exam.

$$z = \frac{100 - 78}{8} = 2.75$$

b) Find the z-score for someone who makes a 70 on the exam.

$$z = \frac{70 - 78}{8} = -1$$

c) If you make a 90 on the exam, how many standard deviations above the mean are you?

By definition, this is the same as the z-score. $z = \frac{90 - 78}{8} = 1.5$

d) If I tell you that you are 2 standard deviations below the mean, what grade did you make?

Here the z-score is -2. So $-2 = \frac{x - 78}{8}$. Solving for x gives a grade of $x = 62$.

e) Use the z-score formula to verify that an exam score of 74 corresponds to a z-score of -0.5.

To verify this we plug all information into the z-score formula and arrive at a true statement.

$$-0.5 = \frac{74 - 78}{8}$$

$$-0.5 = \frac{-4}{8}$$

$$-0.5 = -0.5$$