6-3

Areas Under Any Normal Curve/
Inverse Normal Probability
Review: Finding areas under any normal distribution

The length of human pregnancies from conception to birth varies according to a distribution that is approximately normal with mean 266 days and standard deviation 16 days.

a) At what percentile is a pregnancy that lasts 240 days (that's about 8 months)?

\[ Z = \frac{240 - 266}{16} = -1.625 \]

b) What percent of pregnancies last between 240 and 270 days (between 8 and 9 months)?

\[ Z = \frac{270 - 266}{16} = 0.25 \]

\[ P(Z < 0.25) = 0.5987 \]

\[ P(Z < -1.625) = 0.0516 \]

\[ P(0.25 < Z < 1.625) = 0.5471 \]
We can use the table in reverse to find a z-score or data value that corresponds to a certain proportion or percentage.

Ex: Find the 90th percentile of the standard normal curve
Find the z-value from the standard normal distribution that satisfies each of the following conditions.

1. the 20th percentile

\[
\frac{-0.84}{0.2005}
\]

2. 45% of all observations are greater than z

\[
\frac{2 = 0.13}{0.5517}
\]
High levels of cholesterol in the blood increase the risk of heart disease. For 14-year-old boys, the distribution of blood cholesterol is approximately normal with mean 170 mg/dl and standard deviation 30 mg/dl. What is the first quartile of the distribution of blood cholesterol?

\[ X = \mu + Z \sigma \]
\[ X = 170 + (-0.67)(30) \]
\[ X = 149 \]
Recall the pregnancy example ($\mu = 266$ and $\sigma = 16$)

How long do the longest 20% of pregnancies last?

\[ Z = 0.84 \]

\[ X = 266 + 0.84(16) \]

\[ X = 279 \]
Scores on the Wechsler Adult Intelligence Scale (an IQ test) for the 20 to 34 age group are approximately normally distributed with mean 110 and standard deviation 25.

a) At what percentile is an IQ score of 150?

\[ Z = \frac{150 - 110}{25} = 1.6 \]

0.9452 \rightarrow 95.7%

b) What percent of people (aged 20-34) have IQs between 125 and 150?

c) MENSA is an elite organization that admits as members people who score in the top 2% on IQ tests. What score on the Wechsler Scale would an individual have to earn to qualify for MENSA?

\[ X = \mu + Z \sigma \]

\[ X = 110 + 2.05(25) \]

\[ X = 161 \]
HW: pg. 311-313 #2-22 e.o.e., 23, 24, 26, 28, 29