Normal Distribution (and Binomial)

Babies born in singleton births in the U.S. have weights that are approximately normally distributed with
mean 3.3 kg and standard deviation 0.6 kg. Regarding this population:

1. What is the probability of a baby weighing between 3 and 4 kg?

2. What is the weight of a baby in the 5th percentile? That is, find the weight such that 5% of babies weigh less.

3. Suppose babies lighter than the 5th percentile require special treatment for low weight. Suppose, further, that a hospital typically has ten newborn babies per day that may be regarded as randomly and independently chosen from the population. What is the probability that two of a day’s ten babies are lighter than the 5th percentile?

QQ Plots

Consider the following QQ Plots. They are built on the normal distribution quantiles. Which experimental data do you think may come from a normal distribution?
The Central Limit Theorem

1. Suppose that we know that the population mean weight for a particular variety of watermelon in farmer A’s field is 4.6 pounds with a standard deviation of 1. Further suppose that the weights across all melons in the field are normally distributed. What weight (quantile really) is large enough that there is a 66% chance that a randomly selected melon will weigh less than this threshold?

2. Suppose now that we are considering the watermelons grown in farmer B’s field. These melons also have a known mean weight of 4.6 pounds with a standard deviation of 1. However, due to a different growing environment, be believe that the distribution of weights might be skewed or otherwise non-normal. If we sample 100 melons, what is the probability that the sample average we obtain will be less than 5?

3. Suppose that, instead of 100 melons, we only sample 20 from farmer B’s field. Below are two qq-plots of melons weights we might obtain in such an experiment. For which data sets (none, one, or both) can we reliably calculate the probability that the sample average we obtain will be less than 5?