Continuous Probability Distributions

When the number of observations is large, we may describe the overall pattern of observations by a smooth curve.

Examples:

These curves are called *density curves*.

Examples:
The Normal Distribution

I. Introduction

One of the most important continuous distributions is the **normal distribution**. Normal distributions are characterized by two **parameters** \( \mu \) and \( \sigma \).

\[ \mu = \text{mean of the population} \]
\[ \sigma = \text{standard deviation of the population} \]

**Empirical rule** comes from the normal distribution.

Examples of the normal distribution:

1. Birth weights (oz) are normal with mean 120 and standard deviation 20.

2. The volume of air a person can expel in 6 seconds is called Forced Vital Capacity (FVC) and it is a standard measure of pulmonary function. For a given age and gender it has a normal distribution.

3. Measurement errors are normal with mean 0.
II. Standard Normal Distribution

a. A normal distribution with mean 0 and standard deviation 1 is called a standard normal distribution.

Examples of using the table of standard normal:
b. If $X$ has a normal distribution with mean $\mu$ and standard deviation $\sigma$, then

$$Z = (X - \mu) / \sigma$$

is standard normal.

**Example:** A state has 5 million students in public schools. A student is classified as gifted if his/her IQ is at least 130. A legislator has proposed providing schools with $200 extra for each gifted student under a new program. How much will this program cost the state?