Probability Examples:

Example: In a certain region it is known that the chances of finding oil is 0.01 (1%). There is a test that can be used to test in advance for oil. When there is oil the test will give a positive (i.e. correct) result 90% of the time. When there is not oil the test will give
a negative (correct) result 80% of the time.
If you perform the test for and the results are positive for oil, what is the probability that oil will actually be found?
The given information can be summarized as follows:
\[ P(o) = P(o|1) = 0.01 \]
\[ P(+) = 90\% = 0.90 \]
\[ P(-|o) = 80\% = 0.80 \]
\[ P(o|+) = ? \]

It is easy to solve this problem using only formulas and definitions.
However, when some of the given probabilities are conditional probabilities a tree is often a convenient tool for organizing the problem.
Use the definition of conditional probability and use the tree.
\[ P(0|+) = \frac{P(0 \cap +)}{P(+) \quad \text{get these from the tree.}} \]

\[ P(0+) = (0.01)(0.90) \quad \text{Incorrect result} \]

\[ P(+) = P(0 \text{ and } +) + P(\overline{0} \text{ and } +) \]
\[ = (0.01)(0.90) + (0.99)(0.20) \]

\[ P(0|+) = \frac{(0.01)(0.90)}{0.01(0.90) + (0.99)(0.20)} = 0.04348 \]

\[ P(0|+) \approx 4.9\% \quad \text{Should you drill for} \]
One way to interpret the probability is this: Under these conditions if you drill for oil 100 times you should expect to find oil only four times on average.

Example: A box has 20 red balls, 50 green balls, and 30 blue balls. (N = 100 balls)
Six balls are picked at random one at a time (w/o replacement) Find the Probability of getting (R, G, B, B, G, B) Order Matters.

Draw a picture (always a good thing to do).

\[
\begin{array}{c}
2^{\frac{3}{2}} \\
50 G + 48 R \\
30 B 2 \times 25
\end{array}
\]

\[N = \frac{30 \times 2 \times 25}{50} = 30 \times 2 \times 25
\]

\[= 1500
\]
P = \frac{20}{100}, \frac{50}{99}, \frac{30}{98}, \frac{29}{97}, \frac{49}{96}, \frac{28}{95}

= \underline{\phantom{0}} \text{ (finish the calculation)}