Probability: \[ P(A) = \frac{\# \text{Successes}}{\# \text{Total}} \]

Odds in Favor of an Event:  
Success : Failure

Odds Against an Event:
Failure : Success

**EXAMPLE 1** – Simple Probabilities
You pick a card from a standard deck of 52 playing cards. Find the following probabilities:

<table>
<thead>
<tr>
<th>a. An 8</th>
<th>b. A king</th>
<th>c. A red king</th>
<th>d. A black diamond</th>
</tr>
</thead>
<tbody>
<tr>
<td>[ \frac{4}{52} = \frac{1}{13} ]</td>
<td>[ \frac{4}{52} = \frac{1}{13} ]</td>
<td>[ \frac{2}{52} = \frac{1}{26} ]</td>
<td>[ \frac{0}{52} = 0 ]</td>
</tr>
</tbody>
</table>

Integers 1 through 20 are placed on ping pong balls and dropped in a bag. Find the probability of the given event:

<table>
<thead>
<tr>
<th>a. A 12</th>
<th>b. A perfect square</th>
<th>c. A factor of 30</th>
</tr>
</thead>
<tbody>
<tr>
<td>[ \frac{1}{20} ]</td>
<td>[ \frac{4}{20} = \frac{1}{5} ]</td>
<td>[ \frac{7}{20} ]</td>
</tr>
</tbody>
</table>

**EXAMPLE 2** – Using Permutations or Combinations with Probability
A new organic cookie company plans to put 5 new cookies on the market: chocolate chip, oatmeal, sugar, dried cherry, and peanut butter. The order in which the cookies are introduced will be randomly selected. Each cookie will have a different price.

a. You've taste tested three of the cookies. What is the probability that the first two cookies introduced are two that you've tasted before?

\[ \frac{3 \binom{2}{2}}{5 \binom{2}{2}} = \frac{3}{10} \]

All the days of the week are placed on a cube and put into a bag.

a. You reach into the bag and pull out two cubes. What is the probability that both of them start with the letter T?

\[ \frac{2 \binom{2}{2}}{7 \binom{2}{2}} = \frac{1}{21} \]

b. What is the probability that one of them starts with the letter T?

\[ \frac{2 \binom{1}{1} \cdot 5 \binom{1}{1}}{7 \binom{2}{2}} = \frac{2 \cdot 5}{21} = \frac{10}{21} \]

c. What is the probability that none of them start with the letter T?

\[ \frac{5 \binom{2}{2}}{7 \binom{2}{2}} = \frac{10}{21} \]
There are 37 NOW THAT'S WHAT I CALL MUSIC CDs released. 15 have a red cover, 12 have a blue cover, and 10 have a green cover.

a. You purchase 4 CDs at random. What is the probability that all 4 have red covers?
   \[
   \frac{15 \cdot C_4}{37 \cdot C_4} = \frac{1365}{60045} = \frac{13}{629}
   \]

b. You purchase 4 CDs at random. What is the probability that 3 have red covers and one green?
   \[
   \frac{15 \cdot C_3 \cdot 10 \cdot C_1}{37 \cdot C_4} = \frac{455 \cdot 10}{60045} = \frac{130}{1887}
   \]

c. You purchase 4 CDs at random. What is the probability that 3 have blue covers?
   \[
   \frac{12 \cdot C_3 \cdot 25 \cdot C_1}{37 \cdot C_4} = \frac{220 \cdot 25}{60045} = \frac{5500}{60045} = \frac{1160}{13209}
   \]

d. You purchase 4 CDs at random. What is the probability that they all have different colors?
   
   0  only 3 colors total!

EXAMPLE 3 – Multiple Events
A spinner is divided into tenths. The sections are numbered 1-10. If the spinner is spun, find the probability that the number is:

a. A 2  \[ \frac{1}{10} \]  
   b. A multiple of 4  \[ \frac{2}{10} = \frac{1}{5} \]  
   c. Between 0 and 30  \[ \frac{10}{10} = 1 \]  
   d. \( \frac{1}{2} \)

Two coins are tossed. Find the probability that:
   
   a. Both show heads  \[ \frac{1}{4} \]  
   b. The coins match  \[ \frac{2}{4} = \frac{1}{2} \]  
   c. There is at least one tail  \[ \frac{3}{4} \]

A bag contains 8 brown socks and 6 black socks. If two socks are randomly drawn, what is the probability that they match?
   \[
   \frac{8 \cdot C_2 + 6 \cdot C_2}{14 \cdot C_2} = \frac{28 + 15}{91} = \frac{43}{91}
   \]

EXAMPLE 4 – Finding Odds
A standard six-sided die is rolled. Find the odds of the following:

a. In favor of rolling a 6  \[ 1:5 \]  
   b. Against rolling an Odd  \[ 3:3 \]  
   c. In favor of 2 or 3  \[ 2:4 \]

A card is drawn from a standard deck of 52 cards. Find the odds of the following:

a. In favor of a 10  \[ 4:48 \]  
   b. Against a queen  \[ 1:12 \]  
   c. In favor of a heart  \[ 13:39 \]  
   d. In favor of a king  \[ 1:12 \]