General Counting Principle

Preliminaries
- Multiplication
- Rectangles

Objectives
- Count the number of ways to make a selection with multiple parts.

Kids Menu

<table>
<thead>
<tr>
<th>Main Dish</th>
<th>Side Dish</th>
<th>Drink</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hamburger</td>
<td>Yogurt</td>
<td>Milk</td>
</tr>
<tr>
<td>Hot Dog</td>
<td>Apple Slices</td>
<td>Juice</td>
</tr>
<tr>
<td>Pizza</td>
<td>Fries</td>
<td></td>
</tr>
<tr>
<td>Chicken Strips</td>
<td>String Cheese</td>
<td></td>
</tr>
<tr>
<td>Taco</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Total choices = 5 · 4 · 2 = 40

Another Kids Menu

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<tr>
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<tbody>
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Example 1

A standard deck of cards has four suits, Clubs (♠), Diamonds (♦), Hearts (♥), and Spades (♣), and thirteen ranks (K,Q,J,10,9,8,7,6,5,4,3,2, A). Each card is identified by its rank and suit, (for example 2♠ or 3♥). How many cards are in a standard deck?

Answer: There are 4 · 13 = 52 cards in a standard deck

Standard Deck of Cards

```
K♠  K♥  K♦  K♣
Q♠  Q♥  Q♦  Q♣
J♠  J♥  J♦  J♣
10♠ 10♥ 10♦ 10♣
9♠  9♥  9♦  9♣
8♠  8♥  8♦  8♣
7♠  7♥  7♦  7♣
6♠  6♥  6♦  6♣
5♠  5♥  5♦  5♣
4♠  4♥  4♦  4♣
3♠  3♥  3♦  3♣
2♠  2♥  2♦  2♣
1♠  1♥  1♦  1♣
```

Example 2

How many different outcomes are possible when rolling two standard six-sided dice, one red and one blue?

Answer: 6 · 6 = 36
Example 3 - 1947 Telephone Numbering Plan

Each telephone number in the United States and Canada was a ten-digit number with the following requirements:

Area Code: The first three digits were the area code. The first digit of the area code could not be a ‘0’ or a ‘1’. The second digit had to be a ‘0’ or a ‘1’. The third digit could be any digit form ‘0’ to ‘9’.

Exchange: The next three digits were the exchange. The first digit of the exchange could not be a ‘0’ or a ‘1’. The second digit could not be a ‘0’ or a ‘1’. The third digit could be any digit form ‘0’ to ‘9’.

The last four digits could be any digit form ‘0’ to ‘9’.

How many telephone numbers were possible?

Answer: \( 8 \cdot 2 \cdot 10 \cdot 8 \cdot 10 \cdot 10^4 = 1,024,000,000 \)