Each morning you must decide what to wear.
An outfit consists of a pair of shoes, a pair of pants, and a shirt.
You have the following to choose from:
5 pairs of shoes
8 pairs of pants
24 shirts

How many different outfits are possible?

$$5 \cdot 8 \cdot 24 = 960$$

Multiplication Counting Principle:

The total number of outcomes is found by multiplying the number of choices each step of the way.

A restaurant has the following menu choices:

| Appetizers | Wings, Potato Skins, Onion Rings, Cheese Sticks |
| --- | --- |
| Entrées | Chicken, Lamb, Steak, Burgers, Ham, Ribs |
| Desserts | Ice Cream Cone, Cake, Pie, Cupcake, Brownie, Ice Cream Sundae |

A dinner consists of one Appetizer, one Entrée, and one Dessert. Find the number of different dinners that are possible.

$$4 \cdot 6 \cdot 6 = 144$$

There are 5 people running a race. How many different ways can 1st through 5th place be awarded?

$$5 \cdot 4 \cdot 3 \cdot 2 \cdot 1$$
$$= 120$$

Factorial:  $5! = 5 \cdot 4 \cdot 3 \cdot 2 \cdot 1 = 120$

Factorial is usually used if you are arranging ALL of the available items.

Find each:

1. $7! = 5040$

2. $10! = 3,628,800$

3. $\dfrac{8!}{5!} = 336 \longrightarrow \dfrac{8 \cdot 7 \cdot 6 \cdot 5 \cdot 4 \cdot 3 \cdot 2 \cdot 1}{5 \cdot 4 \cdot 3 \cdot 2 \cdot 1}$

this becomes $8 \cdot 7 \cdot 6$

There are 12 people on a basketball team and only 12 uniform numbers to pass out.

1. How many different ways can all 12 uniform numbers be passed out to the players?    $12! = 479,001,600$

2. If there were 12 uniforms but only 10 players, how many ways could the uniforms be passed out?

$12 \cdot 11 \cdot 10 \cdot 9 \cdot 8 \cdot 7 \cdot 6 \cdot 5 \cdot 4 \cdot 3$

$239,500,800$

How many different four digit sequences can you create using the digits from 0 to 9 if digits can repeat?

$10 \cdot 10 \cdot 10 \cdot 10 = 10,000$

How many different four digit sequences can you create using the digits from 0 to 9 if digits CAN'T repeat?

$10 \cdot 9 \cdot 8 \cdot 7 = 5040$