

Lesson 9-5

Example 1

TRAVEL Suppose a minor league baseball team from Des Moines will travel on a road trip to Grand Rapids, Peoria and Battle Creek. They can go from Des Moines to Grand Rapids by car, train, bus or plane, then from Grand Rapids to Peoria by bus, car or plane, and from there to Battle Creek by car, bus or plane. Finally, from Battle Creek, they can either take a train, bus or plane back home. How many different routes are possible on this road trip?

Solution

Use the fundamental counting principle.

The 4 possible routes for the first leg of the trip are car, train, bus or plane. Then they have 3 possible routes for the second leg of the trip, 3 for the third leg of the trip and 3 for the return trip to Des Moines.

$$4 \cdot 3 \cdot 3 \cdot 3 = 108$$

One hundred eight different routes are possible.

Example 2

In how many different ways can you arrange your math, science, social studies, poetry, language arts, and foreign language books in a row on a shelf?

Solution

There are six books. Find the number of permutations of 6 items.

$$\begin{aligned} \text{number of permutations of six items} &= 6! \\ &= 6 \cdot 5 \cdot 4 \cdot 3 \cdot 2 \cdot 1 \text{ or } 720 \end{aligned}$$

There are 720 different ways to line up six books on a shelf.

Example 3

SPORTS Ten teams enter a tournament. How many different arrangements of first-, second-, and third-place winners are possible?

Solution

Use the formula: ${}_nP_r = \frac{n!}{(n-r)!}$

$$\begin{aligned}
 {}_{10}P_3 &= \frac{10!}{(10-3)!} \\
 &= \frac{10 \cdot 9 \cdot 8 \cdot 7 \cdot 6 \cdot 5 \cdot 4 \cdot 3 \cdot 2 \cdot 1}{7 \cdot 6 \cdot 5 \cdot 4 \cdot 3 \cdot 2 \cdot 1} \\
 &= 10 \cdot 9 \cdot 8 = 720
 \end{aligned}$$

There are 720 ways for teams to finish first, second, and third.

Example 4

How many different trio ensembles can be chosen from a pool of 10 musicians?

Solution

There are 10 people from which to pick, 3 at a time. So, $n = 10$ and $r = 3$.

Use the formula: ${}_nC_r = \frac{n!}{(n-r)! r!}$

$$\begin{aligned}
 {}_{10}C_3 &= \frac{10!}{(10-3)! 3!} \\
 &= \frac{10 \cdot 9 \cdot 8 \cdot 7 \cdot 6 \cdot 5 \cdot 4 \cdot 3 \cdot 2 \cdot 1}{(7 \cdot 6 \cdot 5 \cdot 4 \cdot 3 \cdot 2 \cdot 1)(3 \cdot 2 \cdot 1)} \\
 &= \frac{10 \cdot 9 \cdot 8}{3 \cdot 2 \cdot 1} \\
 &= \frac{720}{6} \\
 &= 120
 \end{aligned}$$

There can be 120 different trio ensembles.