Advanced Algebra Section 10.5 Day 2 More with Word Problems

Example 1:

A pizza restaurant has a menu that allows you to choose from 2 types of crust, 3 types of sauce, and 8 toppings. If you order a pizza with one type of crust, one sauce, and 3 toppings, how many different pizzas could you order?

$\underbrace{{}_2C_1}_{\text{crust}} \cdot \underbrace{{}_3C_1}_{\text{sauce}} \cdot \underbrace{{}_8C_3}_{\text{3 toppings from 8 choices}} = 336$ different pizzas.

Example 2: You borrow 5 books from your friend's home library, which has 12 mystery novels and 7 romance novels. If you plan to choose 3 mystery novels and 2 romance novels, how many different combinations of 5 books are possible?

$\underbrace{{}_{12}C_3}_{\text{\# of ways to choose 3 mystery from 12}} \cdot \underbrace{{}_7C_2}_{\text{\# of ways to choose 2 Romance from 7}} = (220)(21) = 4620$ combinations.

Example 3: A neighborhood party is planned, and the host asks her 7 neighbors to each bring 1 food item to share from the list she made of 12 food items. Assuming each member randomly chooses a food item to bring to the party, what is the probability that at least 2 of the 7 neighbors bring the same item?

What is the opposite of at least 2 of 7 neighbors bringing the same?

No one brings the same item.

$P(\text{no repeats}) = \frac{12 \cdot 11 \cdot 10 \cdot 9 \cdot 8 \cdot 7 \cdot 6}{12 \cdot 12 \cdot 12 \cdot 12 \cdot 12 \cdot 12 \cdot 12} = \frac{{}_{12}P_7}{12^7} = \frac{385}{3456}$

$P(\text{at least 2}) = 1 - P(\text{no repeats})$

$1 - \frac{385}{3456} = \boxed{\frac{3071}{3456}}$

Example 4: You are one of 8 contestants in a singing competition. The order of the performances is determined at random. The first 4 performers go on stage before the intermission.

a. What is the probability that you are the last performer before the intermission and your rival performs immediately before you?

$\underline{6}\ \underline{5}\ \underbrace{\underline{1}}_{\text{rival}} \cdot \underbrace{\underline{1}}_{\text{you}} \mid \underline{4}\ \underline{3}\ \underline{2}\ \underline{1}$ (intermission)

Total possible is $8!$

$\frac{6!}{8!} = \frac{1}{8 \cdot 7} = \frac{1}{56}$

Alternatively $P(\text{you last}) \cdot P(\text{rival 2nd to last}) = \left(\frac{1}{8}\right)\left(\frac{1}{7}\right) = 1/56$

b. What is the probability that you are NOT the first performer?

$P(\text{You are the 1st performer}) = \frac{1 \cdot 9 \cdot 8 \cdot 7 \cdot 6 \cdot 5 \cdot 4 \cdot 3 \cdot 2 \cdot 1}{10!} = \frac{1}{10}$

$P(\text{Not the 1st performer}) = 1 - P(\text{you are the 1st})$

$= 1 - \frac{1}{10} = \frac{9}{10}$