Foundations 12: Permutations and FCP Quiz

$${}_nP_r = \frac{n!}{(n-r)!}$$

Full credit will only be awarded for all work shown in a neat and organized manner.

$$n! = (n)(n-1)(n-2)\ldots(3)(2)(1)$$

1. Evaluate $\left(\frac{92!}{89!}\right)\left(\frac{13!}{15!}\right) =$

$$\left(\frac{92\times91\times90\times\cancel{89!}}{\cancel{89!}}\right)\times\left(\frac{\cancel{13!}}{15\times14\times\cancel{13!}}\right)$$

$$= \frac{92\times91\times90}{15\times14} = 3588$$

2. A sandwich shop has a lunch special where you can customize a sandwich. First, you choose between white, rye or whole wheat bread, then you choose beef, chicken, turkey or fish for filling, then you choose mayonnaise or mustard for sauce. How many sandwiches are possible?

$$\underset{\text{Bread}}{3}\times\underset{\text{Fill}}{4}\times\underset{\text{Sauce}}{2} = 24$$

3. A license plate is 3 letters followed by 3 digits. How many license plates are possible if:

a) no restrictions?

$$26\times26\times26\times10\times10\times10 = 17,576,000$$

b) the first digit cannot be zero, and no letter or number can be repeated?

$$26\times25\times24\times\underset{\text{no zero}}{9}\times\underset{\text{no repeat, include zero}}{9}\times8 = 10,108,800$$

4. A hockey lineup has 5 unique position: 3 different forward positions (left, centre and right) and 2 defense positions (left and right). A hockey team has 13 forward players and 9 defense players. How many different lineups are possible using:

a) the FCP

$$\underset{\text{L For}}{13}\quad\underset{\text{C For}}{12}\quad\underset{\text{R For}}{11}\quad\underset{\text{L Def}}{9}\quad\underset{\text{R Def}}{8}$$

$$= 123,552$$

b) the Permutation Formula (${}_nP_r$)

$${}_{13}P_3\times{}_9P_2 = 123,552$$

↑ 3 forwards ↑ 2 defense

Name: _____

5. Seven students are standing in line for the cafeteria (5 grade 10s, 2 grade 9s). How many different ways can they line up if:

a) there is a grade 10 on each end?

Gr10 Gr10

9 5 4 3 2 1 4

$= 2400$

b) Jimmy (grade 9) is at the front or at the end?

Front

1 6 5 4 3 2 1 $= 720$

End

6 5 4 3 2 1 1 $= 720$

total $= 720 + 720 =$ **1440**

c) Jimmy is next to Ingrid (grade 10)?

1 2 3 4 5 6

JI

6 things to arrange $= 6!$

JI ← $2!$ to rearrange

$6! \cdot 2! = 1440$

d) Jimmy is NOT next to Ingrid?

total $=$ JI + NOT JI

$7! = 1440 +$ NOT JI

NOT JI $= 7! - 1440$

$= 3600$

6. On a bookshelf I have the 7 different Harry Potter and the 3 different Lord of the Rings books.

a) how many different ways can I arrange all of the books?

10 books ⇒ $10! = 36,288,800$

b) how many ways can I arrange all the books if each series must be kept together and in order with the first book of each series on the left?

LotR: 123 HP: 1234567 ← order inside is fixed

2 groups

⇒ $2!$ ways to arrange $= 2$

c) how many ways can I arrange all the books if each series must be kept together but not necessarily in order?

LotR: 123 HP: 1234567 ← order inside is not fixed

2 groups

⇒ $2!$ ways to arrange

LotR: 123 — $3!$ ways to rearrange

HP: 1234567 — $7!$ ways to rearrange

$2! \cdot 3! \cdot 7! = 60480$