## Permutations

1. Simplify each of the following expressions:

   a. $\frac{8!}{5!}$ b. $5!-3!$ c. $\frac{4!5!}{3!7!}$ d. $\frac{4!5!}{3!(5-2)!}$

2. Simplify each of the following:

   a. $5P_2$ b. $8P_6$ c. $\frac{6P_2}{3P_2}$ d. $7P_5$

3. Simplify each of the following:

   a. $nP_2 = 20$ b. $nP_3 = 120$ c. $6P_n = 120$ d. $6P_n = 720$

4. Simplify each of the following:

   a. $\frac{n!}{(n+1)!}$ b. $\frac{(n-2)!}{(n+2)!}$ c. $\frac{(2n-1)!(n+1)!}{(2n+1)!(n-1)!}$ d. $\frac{n!-6(n-2)!}{(n-3)(n-2)!}$

5. How many ways can 5 students be selected to form a line from a class of 30?

6. 9 people are selected from a group of 20 to form 3 lines of 3. In how many different lines are possible?

7. A hotel has 80 rooms and 5 guests reserved 5 different rooms. In how many ways can the guests be assigned?

8. How many ways can 3 boys (A,B,C) and 3 girls (D, E, F) sit in a row if:

   a. There are no restrictions on where they sit in the row

   b. All the boys together and all the girls sit together

   c. Only the boys sit together and the girls can choose where they sit

   d. The boys must sit between 2 girls and the girls must sit between 2 guys

9. How many ways can 5 people A, B, C, D, and E sit in a row if A must be to the left of B but not neccessarily next to each other and C and D must stay next to each other?

10. How many ways can 5 couples sit in a row in a movie theatre if all couples must sit together?

11. How many ways can 5 people be seated around a round table so that the relative arrangements of the people in the group is different?

12. Mike drives 5 friends to the movies. Mike's car seats 3 in the front and 3 in the back. If Mike must drive, and his girlfriend, Jessica, must sit in front, how many seating arrangements are possible?

13. What is the probablity that a three-letter code made from 3 different letters is in alphabetical order?

14. How many ways are there to get a 7 digit phone number if there are only 5 area codes to choose from?

15. If the International Math Nerds Union (IMNU) needed to select 7 new recruits into each of their 3 groups from 300 applicants, how many ways are possible? There must be atleast one new recruit in each group.

16. Recently, the IMNU launched a debate club on which lottery had a better winning rate. The professor came up with a question to end this debate. To win super 7 lottery you must choose 7 numbers out of 47 and all 7 must match. To win 649 lottery, you must choose 6 numbers out of 49 and all 6 must match. Which is the better buy?

    b) Determine how many times more likely one is than the other, the first to win gets a free lottery ticket!

17. The IMNU recently filed bankruptcy due to overgambling at Las Vegas. If their are 250 hotels in Las Vegas to choose from, what is the probablity that they would be caught on camera if there were 80 paparazzies? 1 Paparazzi could only be at one hotel.

18. *BONUS* Assuming there are 30 boys and 30 girls at the IMNU. How many pairs of NERD KING and NERD QUEENS are there?