PGSS 2020 Discrete Mathematics

Problem Set 1: Due Friday, July 3

Instructions: Completely answer the following questions and submit your answers by some mysterious means through Canvas.

Include all of your work in a well organized fashion, and feel free to go beyond the question asked if you have an interesting observation. Always exhibit good academic etiquette by citing any collaborators and writing your final solutions in your own words.

Discrete Mathematics homework will be collected each Friday.

1. How many odd numbers with distinct digits and no leading zeroes can be constructed from the digits 0, 1, 2, 3, 4, 5, 6?
2. How many five digit numbers without repeated digits and no leading zeroes are there that include the pair of adjacent numbers 12 in that order?
3. Prove that $1^2 - 2^2 + 3^2 - 4^2 + \cdots + (-1)^{n-1} n^2 = (-1)^{n-1} \left(\dfrac{n(n+1)}{2} \right)$ for every positive integer n.
4. Prove that $3^n > n^2$ for $n \geq 1$.
   Hint: Do *two* base cases.
5. Prove that $\left(1 - \dfrac{1}{2}\right)\left(1 - \dfrac{1}{3}\right) \cdots \left(1 - \dfrac{1}{n+1}\right) = \dfrac{1}{n+1}$.
6. Guess a formula for $\dfrac{1}{1 \cdot 2} + \dfrac{1}{2 \cdot 3} + \dfrac{1}{3 \cdot 4} + \cdots + \dfrac{1}{n(n+1)}$ by considering the first few cases. Then prove that your formula is correct.

My website is: http://www.math.cmu.edu/∼rw1k

At the bottom of the page there are a number of links including one to PGSS Discrete Math which is a list of links designed to supplement the course.

I hope that you enjoy the course – and also learn some discrete math!