1
3 5
7 9 11
13 15 17 19
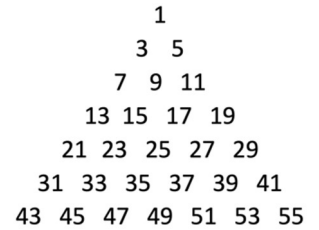21 23 25 27 29
31 33 35 37 39 41
43 45 47 49 51 53 55

1. The following statements all refer to the odd-numbered triangle (shown on the right).
Write "true" or "false" for each statement.

a) The sum of the first k odd numbers is k^2. _____

b) The sum of any two triangular numbers is a square number. _____

c) The sum of the nth row of the odd-numbered triangle is always a cube number. _____

d) The sum of the first k cube numbers is a square number. _____

e) The difference between the 1st term of the $(n + 4)^{th}$ row and the 1st term of the nth row is a square number. _____

2. Find the sum of each expression.

a) 30 + 34 + 38 + 42 + … + 150 =

b) The first 15 terms of the following series (just give an expression for the answer – you don't have to calculate the actual number by hand):

   81 + 54 + 36 + 24 + …

3. Simplify each as a single term, or single binomial coefficient.

a) $\binom{18}{0} + \binom{18}{2} + \binom{18}{4} + \binom{18}{6} + \cdots + \binom{18}{18} =$

b) $\binom{37}{37} + \binom{38}{37} + \binom{39}{37} + \binom{40}{37} + \cdots + \binom{82}{37} =$

c) $\binom{52}{7} + 3\binom{52}{8} + 3\binom{52}{9} + \binom{52}{10} =$

4. The first 5 rows of triangular pattern is shown below, where all terms are multiples of 5. For reference, the bolded "40" is the 2nd term of the 4th row, and is also the 3rd term of the 2nd column. The bolded "70" is the 4th term of the 5th row, and also the 2nd term of the 4th column.

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5
10  15
20  25  30
35  40  45  50
55  60  65  70  75
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a) What is the 6th term of the 6th row?

b) Term T is the 15th term of the 42nd column. In which row is term T?

c) Find an expression, in terms of k, for the 3rd term of the kth column. *This may be a challenge, so make sure you clearly label and organize your work, so that I can follow what you're doing and give partial credit!*

5. With Fibonacci numbers: $F_{400} = F_a F_{249} + F_b F_{248}$

Find a and b.

6. Express the following as a difference of two Fibonacci numbers. (hint: use telescoping!)

$$F_{73} + F_{75} + F_{77} + F_{79} + \cdots + F_{853} =$$