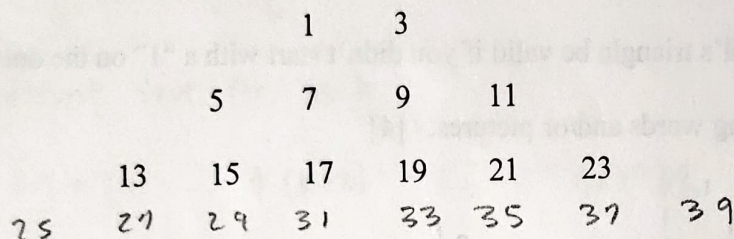


[30 points] (two points for writing your name and period so don't forget!)

Non TI n-spires ok but not necessary.

Since you aren't allowed a calculator, you can leave your answers in calculator ready form.

Consider the Pyramid below (with only odd numbers) starting from row 1.



1. Above, draw the 4th row. [2 points]

2. How many terms would be in the 81st row? $81 \cdot 2 = 162$ [2]

3. What would be the first term in the 81st row? Show the work that leads to your answer

$1, 5, 13, 25 \rightarrow$

$4 \quad 8 \quad 12$

$4 \quad 4$

$2 \cdot 81 \cdot 81 - 162 + 1$

$2 \cdot 6561 - 161$

$13122 - 161$

$a^2 + b^2 + c^2$

12961

12961 [4]

$2x^2 - 2x + 1$

4. $80 \cdot 81 / 2 + 1$

$= 12961$

Pascal's Triangle

$a + b + c = 1$

$4a + 2b + c = 5$

$9a + 3b + c = 13$

$3a + b = 4$

$5a + b = 8$

$2a = 4$

$a = 2$

$b = -2$

$c = 1$

Simplify the following. Leave your answer as a binomial coefficient, or a simplified number.

4. $\binom{k}{k} + \binom{k+1}{k} + \dots + \binom{k+m}{k} = \underline{\binom{k+m+1}{k+1}}$ [3]

$\binom{3}{3} + \binom{4}{3} + \binom{5}{3} \dots \binom{10}{3} = \binom{11}{4}$

$$5. \binom{80}{27} - \binom{81}{28} = \underline{-\binom{80}{28}} \quad [3]$$

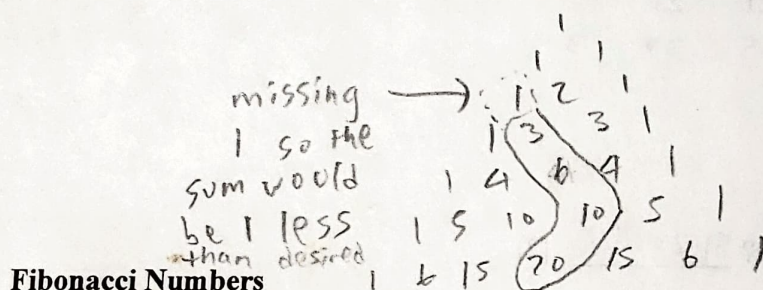
$$\binom{80}{27} - \binom{81}{28} = \binom{80}{27} - \binom{80}{27} - \binom{79}{27} + \binom{78}{27} = -\left(\binom{79}{27} + \binom{78}{27}\right) = -\binom{80}{28}$$

$$6. \binom{100}{0} + \binom{100}{1} + \binom{100}{2} + \dots + \binom{100}{99} + \binom{100}{100} = \underline{2^{100}} \quad [3]$$

$$= -\binom{80}{28}$$

7. Would the hockey stick pattern in Pascal's triangle be valid if you didn't start with a "1" on the outside?

NO y/n Briefly explain why using words and/or pictures. [4]



3/4

$$3 + 6 + 10 \neq 20$$

If you missed any values, such as the 1 on the diagram on the left, the sums would not match up.

8. For the Fibonacci numbers F_1, F_2, F_3, \dots

a) Express F_9 in terms of F_4 and F_5 $5F_5 + 3F_4$ [3]

$$F_9 = F_8 + F_7 = 2F_7 + F_6 = 3F_6 + 2F_5 = 5F_5 + 3F_4$$

1, 1, 2, 3, 5, 8, 13, 21, 34

$$34 = 5 \cdot 5 + 3 \cdot 3$$

b) Find t , given that $F_t = 5F_{317} + 3F_{316}$ Show the work that leads to your answer. [4]

$$5F_{317} + 3F_{316} = 2F_{317} + 3(F_{317} + F_{316})$$

$$t = \underline{321}$$

$$= 2F_{317} + 3(F_{318}) =$$

$$F_{318} + 2(F_{318} + F_{317}) =$$

$$F_{318} + 2F_{319} = F_{319} + F_{320} = F_{321}$$