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$$\frac{20}{22}$$

Analysis H
Chapter 1 Quiz 1
CALCULATORS OK

1. Simplify each expression. Write your answer as an exponent or as a binomial coefficient (not the actual number).

a. $\binom{67}{0}+\binom{67}{1}+\binom{67}{2}+\binom{67}{3}+\cdots+\binom{67}{67}= 2^{67}$ ✓

b. $\binom{824}{0}+\binom{824}{2}+\binom{824}{4}+\binom{824}{6}+\cdots+\binom{824}{824}= \boxed{2^{823}}$ ✓

c. $\binom{4}{4}+\binom{5}{4}+\binom{6}{4}+\binom{7}{4}+\cdots+\binom{379}{4}= \binom{380}{5}$ ✓

2. Write an explanatory proof about EITHER (a) or (c) from #1, for **why** the pattern works in general. Your proof must include words along with mathematical symbols. You may choose to include drawings as well.

Proof for part (circle one): a c

For a given number n, $\binom{n}{0}+\binom{n}{1}+\binom{n}{2}+\cdots+\binom{n}{n-1}+\binom{n}{n}$ will always be equal to 2^n.

1
1 1
1 2 1
1 3 3 1
1 4 6 4 1
1 5 10 10 5 1
1 6 15 20 15 6 1

In the Pascal's triangle, it starts with row 0, a single '1'. As you go down the rows, the sum of each row is double the sum of the previous row. This is because every number in a row will be summed twice to get the next row. ✓

1 3 3 1
1 (1+3) (3+3) (3+1) 1

The sum of row three is 1+3+3+1. The sum of the next row would then be 1+1+3+3+3+3+1+1, which is double the amount of 1+3+3+1. If row 0 adds up to 1, row 1 adds up to 2, row 2 adds up to 4, and so on, then each row would have a sum of 2^n. Row 67 would have the sum of 2^{67}.

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**For this page, you must show work in order to receive credit!
Don't just give an answer – show me how you arrived at the answer, along with any computations (even though you can use your calculator).**

3. For the pattern of numbers below, where the top row is row 1 and the bottom row shown is row 5…

1				2			
2			4	6			
3		8	10	12			
4		14	16	18	20		
5	22	24	26	28	30		
6	32	34	36	38	40	42	
7	44	46	48	50	52	54	56

a) What is the middle term of row 53?

n^2+1

$53^2+1=\boxed{2810}$ ✓

b) What is the first term of row 912?

n^2-n+2

$912^2-912+2=\boxed{830834}$ ✓

4. For the Fibonacci numbers $F_1, F_2, F_3, \ldots$ 1,1,2,3,5,8,13,21,34,55

a) Express F_9 in terms of F_4 and F_5.

$\boxed{F_9=3F_4+5F_5}$

b) Find t, given that $F_t = 5F_{317} + 3F_{316}$

$\boxed{t=321}$

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