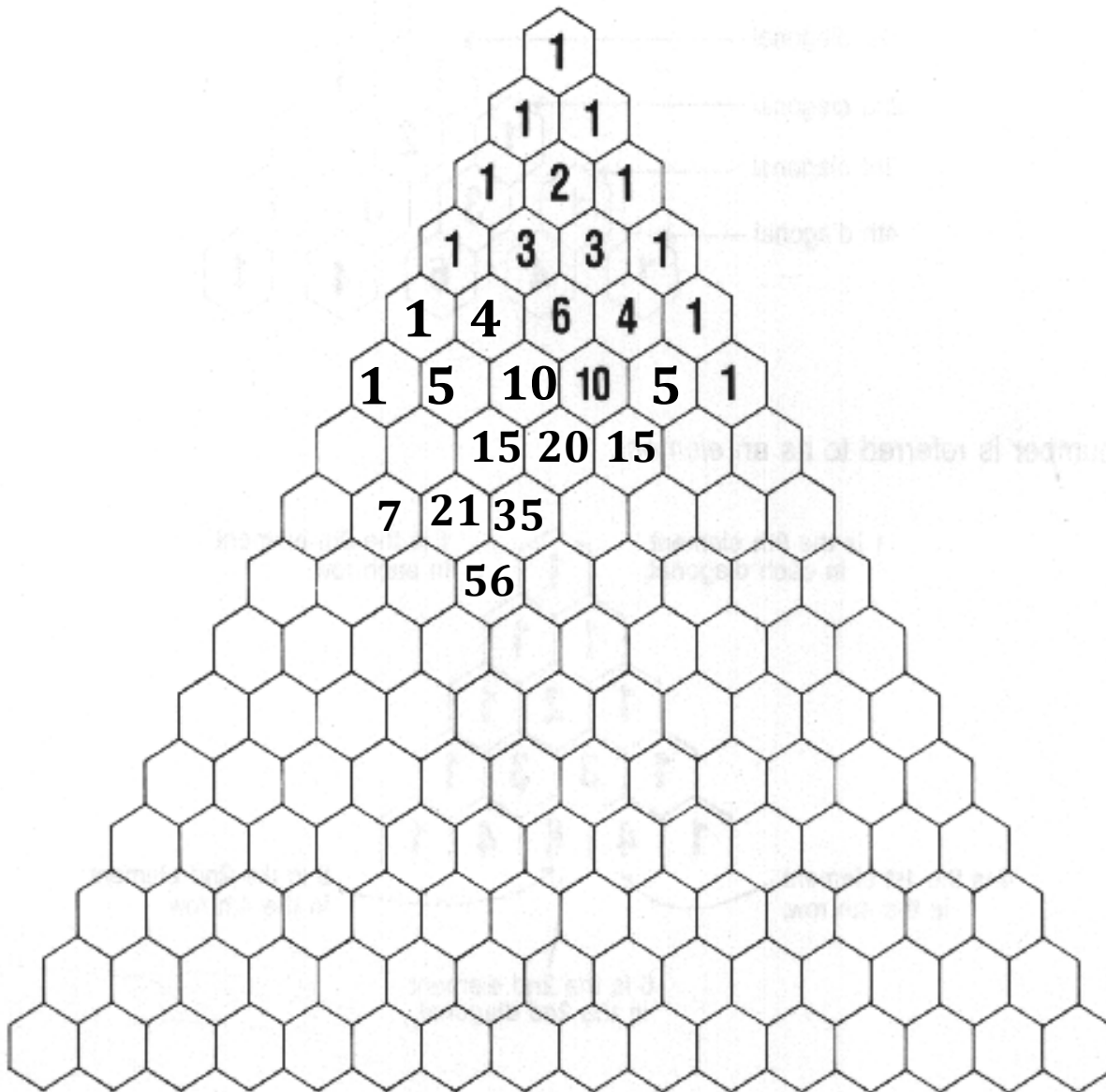# Pascal's Triangle

The following is a partially filled in version of Pascal's triangle, named after French mathematician Blaise Pascal who made significant contributions to mathematics (probability theory) and physics (fluids).
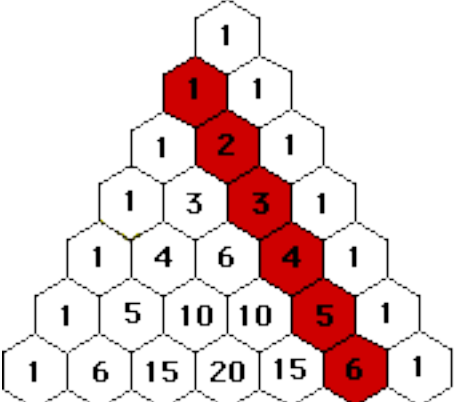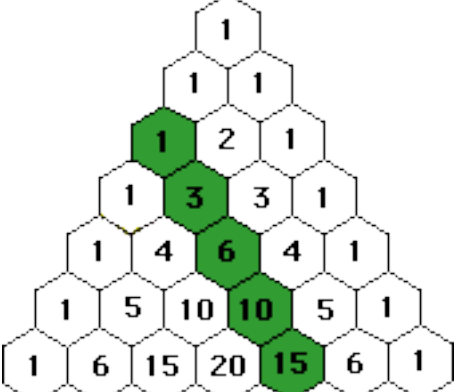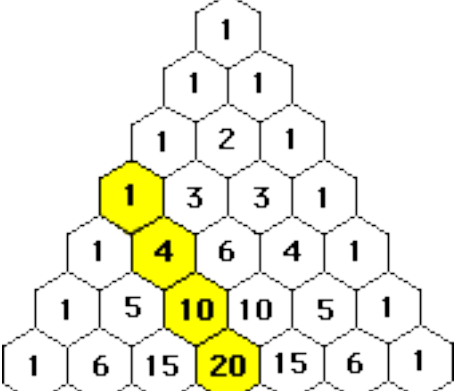
1. Figure out the pattern and fill in the remaining portion of the triangle.

```
                    1
                 1     1
              1     2     1
           1     3     3     1
        1     4     6     4     1
     1     5    10    10     5     1
          15    20    15
        7    21    35
           56
```

2. After filling in the remaining portion of the triangle, write down 3 patterns you found in Pascal's Triangle.
   I.
   II.
   III.

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3. There are many coincidental (and non-coincidental) connections between Pascal's Triangle and other areas of math, and even some items outside of math. One example of the latter deals with the holiday song "12 Days of Christmas." Observe the notes and answer the questions below:

	The first diagonal of Pascal's triangle indicates the numbers of new gifts given on that day of Christmas.
	    I. What new gift was given on the 7th day? (Ask a friend in class if you don't know!)
	
	    II. What new gift was given on the 11th day? (Ask a friend in class if you don't know!)

	The second diagonal of Pascal's triangle indicates the combined gifts given on that day of Christmas.
	    I. What were all the gifts given on the 3rd day?
	
	    II. How many gifts were given on the 10th day?

	The third diagonal of Pascal's triangle indicates the total number of gifts given on that day and the prior days.
	    I. How many gifts had been given **in total** after the 4th day?
	
	    II. How many gifts had been given **in total** after the 12th day (which is the entirety of the song)?

4. It can also be shown that the formula below will calculate the total number of gifts that had been given after the nth day of Christmas. Use it to verify that in the cell above you found the correct number of gifts that had been given **in total** after the 12th day of Christmas.

$$Total\ number\ of\ gifts\ given\ after\ the\ nth\ day = \frac{n(n+1)(n+2)}{6}$$