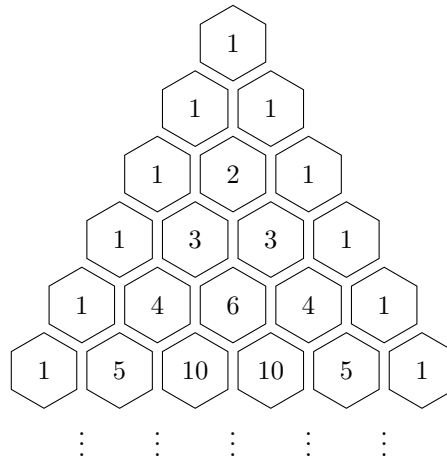


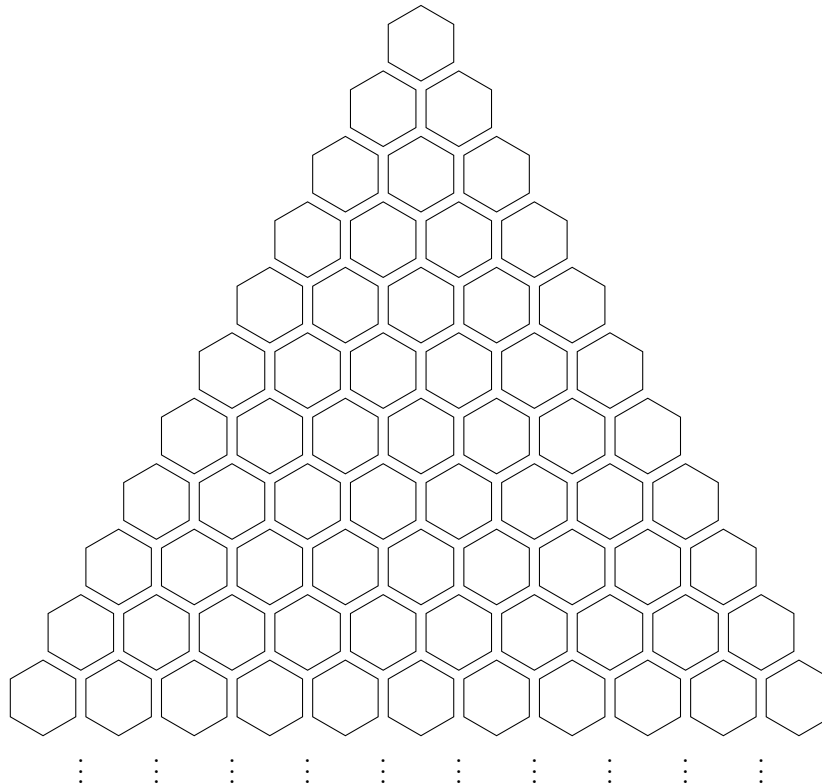
Week 2

This is Pascal's triangle:



The way to build Pascal's triangle is this: start with a 1 at the top, then each number is the sum of the two numbers above it (or the one number above it, if it's on the edge of the triangle).¹

Question 1. Fill in some more rows of the triangle!

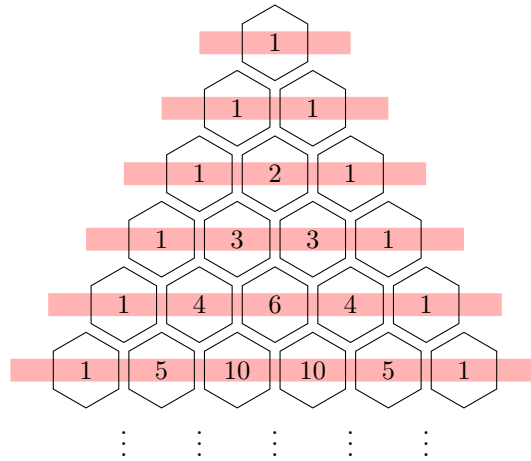


Question 2. What patterns do you notice?

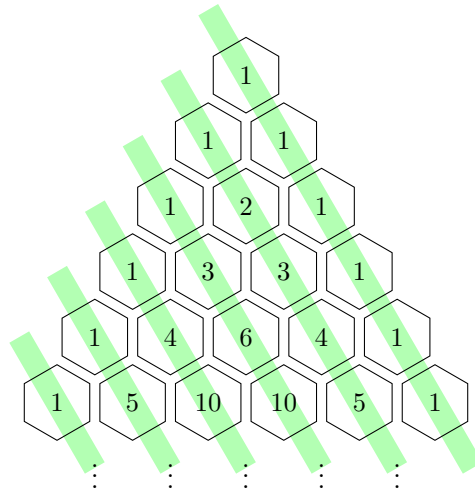
¹It's usually called Pascal's Triangle because it was studied by French mathematician Blaise Pascal in the 1600s, but it was known long before that — in China it was studied by Jia Xian in the 1000s and Yang Hui in the 1200s, the Persian mathematicians Al-Karaji and Omar Khayyám wrote about it in the 900s and 1000s, and the principles behind it were studied by Indian mathematician Pingala by 100 BCE!

Question 3. Are there any symmetries in this triangle? Why?

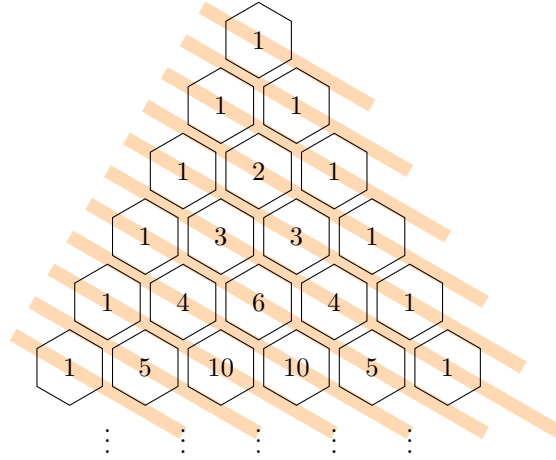
Question 4. What do you get if you add up all the numbers in each row? What patterns do you notice, and why do you think this pattern is there?



Question 5. What patterns do you notice among the diagonal lines? Can you explain why they happen?



Question 6. Look at these half-slanted diagonals:



What do you notice?

Question 7. What do you get if you shade all of the even numbers? Or all the numbers that are divisible by 3, or 4, or...?

Which rows contain only even numbers (apart from the 1s)?

Question 8. Where do the prime numbers appear?

Question 9. Can you find any other interesting patterns?

Question 10. What if we changed the rules for how we construct the triangle? Perhaps starting with a 2 at the top instead of a 1, or subtracting instead of adding? Invent a new triangle, and investigate it!