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1+1=2: The Beauty of Counting

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****Hand out a sheet of paper and a pen to each person, if they don't already have****

-Introduction: Name, year at Stanford, course title. SMILE.

-I LIKE MATH. Do you like math? Think it's useful? Believe math education can be improved?

-Course Objectives: Math IS important and omnipotent; school emphasizes too much algebra and rote memorization; Combinatorics is an interesting field; recognize patterns and problem solve; this isn't just math, it's *life*; hope you learn something new; my first time, hope I'll learn too.

$0+0=0$; $0+1=1$; $1+1=2$ --- this is boring. Let's turn it into something *beautiful*

****Life lesson: Looking at things differently!**

!!~**Pascal's Triangle** - Named after French mathematician Blaise Pascal, but discovered earlier in India, Iran, and China.

-Ask about familiarity of topics.

-Take some time, create rows 5, 6, 7.... and note any patterns you find.

-Consider expanding the polynomial $(x+y)^n$. These are called **binomial coefficients**.

****Life lesson: There's usually more than one solution! Does there exist another?**

-Get four Splash students. Ask one name and favorite sport. How many make the team with n open spots?

-Hard part: Getting them to visualize the formula $C(n, k) = \frac{n!}{k!(n-k)!}$. Arrange in a line and chop them off at intervals. Correcting for overcounting.

****Life lesson: Instead of finding a perfect solution, go big picture, then clean up.**

- Explain how counting is convenient and relevant

-Sum of the rows = 2^n . Think about either being in or out. Or $(1+1)^n$.

Tidbits:

-Pascal's Identity: $C(n-1, k-1) + C(n-1, k) = C(n, k)$

-Think about this as a group of n where 1 person is left out and then put back in.

-Fibonacci numbers: UBIQUITOUS.

-Sierpinski triangle: Fractal geometry. And you get to color stuff.

-Hockey stick identity: Kinda cool

-Pascal's petals: pretty!