Apples to Oranges

(1) Imagine you have 6 apples in a line.

You have a magic wand and can turn 2 of them into oranges.

$$\binom{n+(k-1)}{k-1}$$

How many different ways can you turn 2 apples to oranges?

(2) How many different ways can 6 be broken into 3 numbers, where order matters, and (*) we include zero? (consider doing together

(3) Remember when we paired things? Find a pairing between apple/orange diagrams and the sums you've written

(4) Try again, turning four apples into oranges.

(5) Predict a pairing of these with sums where (*) you break 2 into 4 pieces.

(6) Now, I give you a magic wand that turns all apples to oranges and oranges to apples.

Discuss with your groups why this magic wand is the key to (*) and (*) being the same?

Sums of Odd Numbers

① What is $1+3$? $1+3+5$? $1+3+5+7$?

② Do you notice something? what is it? Try a few more if you need more evidence.

③ Predict what $1+3+5+ \ldots +99$ is.

50th odd number

④ How would you <u>draw</u> the number 4^2? or 5^2?

⑤ How would you fit $1+3+5+7$ into your drawing of 4^2?

⑥ Write a <u>formula</u>, using n and your pictures, for the sum of the first n odd numbers.

"You had an idea for 50 odd numbers, all we are doing, really, is replacing '50' with a letter to say in very few words that this process can be done for ANY number."

⑦ (for the fast kids) Last week, we used a <u>shape</u> to visualize sums like

$1+2+3$
$1+2+3+4$
etc...

We used its area to compute the sum. This made calculations like $1+2+3+\ldots+50$ actually doable.

In the spirit of step ⑤, can we write a formula? (Replacing '50' with 'n')