JIGSAW ACTIVITY, TASK #1

Your job is to multiply and find all the terms in $(x+1)^4$.

Recall that this means $(x+1)(x+1)(x+1)(x+1)$.

Start by multiplying: $(x+1)(x+1)$. Write your answer in the space below.

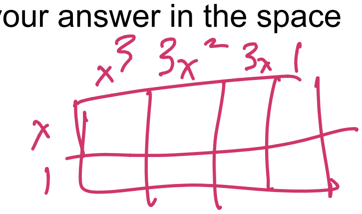
x^2+2x+1

Now, multiply this answer by $(x+1)$, combine like terms, write your answer in the space below.

$(x+1)(x^2+2x+1) = x(x^2+2x+1)+1(x^2+2x+1)$ $\quad x^3+3x^2+3x+1$

Finally, multiply this result by $(x+1)$, combine like terms, write your answer in the space below.

$1x^4+4x^3+6x^2+4x+1$



Make sure your answer in written in the correct order. Highest powers of x should come first, down to the lowest powers.

What are the coefficients of x in your answer? Write these coefficients in the boxes below.

1	4	6	4	1

QUESTIONS FOR CLASS DISCUSSION

1. Predict the number of terms in $(x+1)^5$

2. What do you think $(x+y)^4$ would look like, when expanded?

JIGSAW ACTIVITY, TASK #2

In how many ways can 4 coins be tossed? For example, one way is Tails, Heads, Heads, Tails. Using T's to represent tails, and H's to represent heads, write the sample space for this situation in the space below.

0 TTTT

1 TTTH
TTHT
THTT
HTTT

2 HTHT
HHTT
HTTH
THTH
THHT
TTHH

3 THHH
HTHH
HHTH
HHHT

4 HHHH

If 4 coins are tossed, how many ways are there to get 0 heads? 1

If 4 coins are tossed, how many ways are there to get 1 heads? 4

If 4 coins are tossed, how many ways are there to get 2 heads? 6

If 4 coins are tossed, how many ways are there to get 3 heads? 4

If 4 coins are tossed, how many ways are there to get 4 heads? 1

Write the answers to these questions, in order, in the boxes below.

1	4	6	4	1

QUESTIONS FOR CLASS DISCUSSION

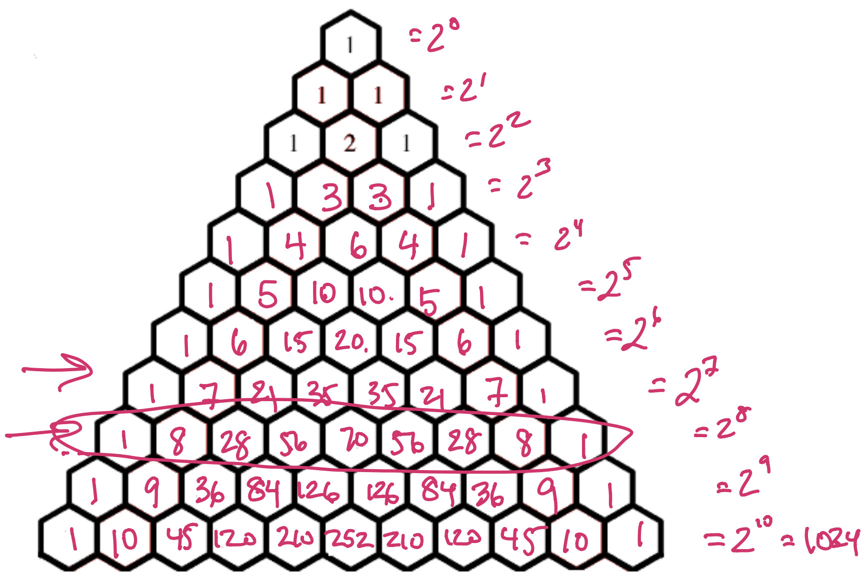
1. In how many ways can 5 coins be tossed? 6 coins?

2. If 5 coins are tossed, in how many ways can exactly 1 head appear? 2 heads?

JIGSAW ACTIVITY, TASK #3

Below is a blank version of a famous mathematical pattern, Pascal's Triangle. It has been studied for hundred of years by mathematicians and students and contains many interesting patterns. The concept behind the triangle is simple: each "cell" in the triangle is the sum of the two numbers above it. The first few rows have been filled in for you. Your job is to fill in the remaining rows of the triangle.

Question 1. What is the sum of the entries for each row of the triangle? Find each sum and write it at the end of the row. How are these numbers related?



Questions 2. What are the entries in row 4 of the triangle? Row 4 is the row which has 5 entries (note: the top row is considered row 0). Write your answer in the boxes below.

1	4	6	4	1

QUESTIONS FOR CLASS DISCUSSION

1. Describe patterns that exist along the different diagonals in the triangle.

2. Write a formula for the sum of the terms in any particular row.

JIGSAW ACTIVITY, TASK #4

CALCULATORS ARE BANNED FOR THIS TASK. WRITE OUT ALL FORMULAS

Practice computing combinations and permutations. Use the formulas you know to compute each of the following. You may use a scientific calculator to check your answers, but all work must be shown.

1. Find the value of each of the following: ${}_{20}C_2$ and ${}_{20}C_{18}$

$${}_{20}C_2 = \frac{20!}{2!(18!)}$$

$${}_{20}C_{18} = \frac{20!}{18!\,2!}$$

190 190

2. Find the value of each of the following: ${}_{16}C_4$ and ${}_{16}C_{12}$

1820

$$\frac{\cancel{16}\cdot \cancel{15}\cdot 14\cdot 13}{\cancel{4}\cdot \cancel{3}\cdot 2}$$

$4\cdot 5\cdot 7\cdot 13$

$20\cdot 91$

Develop a rule that demonstrates the pattern in problems 1 and 2.

3. Compute each of the following, writing your answers in the boxes below.

${}_4C_0$	${}_4C_1$	${}_4C_2$	${}_4C_3$	${}_4C_4$
1	4	6	4	1

$${}_4C_0 = \frac{4!}{0!(4-0!)}$$

4. What is the sum of the answers in problem 3?

16

5. Find the sum of ${}_5C_0, {}_5C_1, {}_5C_2, K, {}_5C_5$?

32

6. Find the sum of ${}_6C_0, {}_6C_1, {}_6C_2, K, {}_6C_6$?

64

Develop a rule that demonstrates the pattern in problems 5 and 6.

2^n

QUESTIONS FOR CLASS DISCUSSION

1. Name a combination that is equal to ${}_{15}C_2$.

2. What is the sum of all combinations where n = 12?

PROBABILITY AND STATISTICS, JIGSAW ACTIVITY, CONNECTIONS

Now that you have explored each task and discussed the results, take a step back and note the connections that exist between the tasks. With your group, write a sentence or two which describes the connections between each of the following:

1. Combinations and Pascal's triangle

$${}_7C_3 = 35$$

2. Coin flipping and Pascal's triangle

$${}_8C_4 =$$

3. Multiplying binomials and combinations

$$\frac{\overset{2}{\cancel{8}}\cdot 7\cdot \cancel{6}\cdot 5}{\cancel{4}\cdot \cancel{3\cdot 2}} = 70$$

4. Combinations and coin flipping

Use your new knowledge to explore the following questions.

1. 10 coins are tossed. What is the probability that exactly 5 of them are heads? That exactly 8 of them are heads?

2. Expand: $(x+1)^8$

$$x^8 + 8x^7 + 28x^6 + 56x^5 + 70x^4 + 56x^3 + 28x^2 + 8x + 1$$

$$(x+3)^8$$

$$1x^8 3^0 + 8x^7 3^1 + 28x^6 3^2 + 56x^5 3^3 + 70x^4 3^4 + 56x^3 3^5 + 28x^2 3^6 + 8x\,3^7 + 1\cdot 3^8$$

$$x^8 + 24x^7 + 252x^6 + 1512x^5 + 5670x^4 + 13{,}608x^3 +$$