Problem 1 – An introduction

On page 1.2, find the total number of diagonals in a hexagon by using the **Segment** tool to draw each diagonal.

- How many total diagonals are there?
  Check your answer by clicking twice on **diagonals = 1** and change the "1" to your result.

Problem 2 – Combinations

On page 2.2, hide all permutations that have the same two letters as another permutation. The ones that remain are *combinations*.

- Complete this sentence:

  There are _____ permutations and _____ combinations.

- Write a fraction (using permutation notation) to represent the number of combinations.

- What do you think the denominator represents?

On page 2.4, again hide all permutations that name the same group.

- Complete this sentence:

  There are _____ permutations and _____ combinations.

- Write a fraction (using permutation notation) to represent the number of combinations.

- What do you think the denominator represents?

- Follow your teacher's directions to derive the formula for finding the number of combinations of *n* objects taken *n* at a time.

  ${}_nC_r =$ _____

- Discuss how combinations are different from permutations.

- A teacher puts the names of 28 students into a hat and chooses 5 to be in a school parade. How many different groups are possible? _____
- A class has 7 boys and 8 girls. How many groups of 5 with 2 boys and 3 girls can be formed? _____
- From a standard deck of 52 cards, how many ways can a 7-card hand have exactly 6 red cards and 1 black card? _____

Problem 3 – Combinations and geometry

- Find the total number of diagonals in the hexagon using combinations. _____
- How many diagonals can be drawn in a 15-gon? _____

On page 3.3, eight points are drawn on a circle.

- How many triangles can be drawn if each vertex must be one of the eight points? _____
- How many quadrilaterals can be drawn this way? _____
- How many hexagons? _____

Extension

- Give two different explanations for why ${}_nC_n$ is always equal to 1.

- Find ${}_8C_2$, ${}_8C_6$, ${}_7C_3$, and ${}_7C_4$. Then determine a general rule.