**Session Segments Grade 11**

**Time Ankur: Michael: Jeff: Romina**

00:34:25 Ankur: Listening.

Michael: A researcher ask about toppings, so Michael explains again how this relates to Pascal’s Triangle with 1 indicating the presence of that topping.

Jeff: Listening. The researcher clarifies that she does not want to think of toppings, but nCr. She begins rewriting ‘1, 3, 3, 1’ as ‘3C0, 3C1, 3C2, 3C3,’ and Jeff and Michael state the nCr relationship as she writes.

Romina: Listening.

00:35:30 Ankur: Listening.

Michael: Michael asks if the triangle should be written the way the researcher wrote it; she notes after doing that, she would like to know the general rule. The researcher repeats the question, and Michael and Romina begin creating a new row. Michael writes this at the board.

Jeff: Jeff notes that 3C0=3C3. Jeff says he understands the question.

Romina: Listening.

00:36:05 Ankur: Someone off screen asks the researcher to ask the question one more time. Ankur asks about the height, and the researcher agrees with his x-high. The researcher notes Ankur understands.

Michael: Michael verifies the triangle should be rewritten top to bottom. He begins rewriting the triangle on the board while the researcher finishes the question.

Jeff: Writing on his paper and watching Michael work at the board.

Romina: Begins asking a question, but begins writing individually.

00:36:35 Ankur: Watching Michael. Asks Michael to write (a+b)^n next to the work.

Michael: Begins by noting ‘n-choose’...

Jeff: Jeff agrees with Ankur, and helps Michael fill in the rows at the board.

Romina: Romina suggests using n as the height.

00:37:10 Ankur: Ankur notes there are 2^tower height total towers.

Michael: Michael notes the next row is written as n choose zero through n, in order. Jeff repeats this idea.

Jeff: Begins describing the problem in terms of (a+b)^n, but does not manage to work out a formula.

Romina: Romina claims Jeff’s idea is wrong, noting his idea requires multiplying.

00:37:50 Ankur: Notes that n represents the height of the tower, which Romina agrees with.

Michael: Michael agrees he understand Jeff.

Jeff: Jeff notes their work at the board makes sense, and repeats n choose zero through n. Michael and Ankur challenge his explanation, so he provides examples by writing and sharing.

Romina: Romina asks about rewriting using multiplication.

00:38:40 Ankur: Watching.

Michael: Erases the board to clarify.

Jeff: The researcher checks whether Jeff is using a division sign, but he notes he was creating a divider.

Romina: Discusses with Jeff how to write her work; researcher notes ‘0, 1, 2, 3, ...n,’ and asks for an example of n choose r.

00:39:20 Ankur: Not visible. Researcher notes the group chose n choose x.

Michael: Confused by the question.

Jeff: Jeff tries to clarify the question, asking about finding nC3, or nCr.

Romina: Begins explaining the question, interrupted by Jeff who explains n choose any number.

00:39:40 Ankur: Watching.

Michael: Studying the board. Michael points out their formula solves for only one of the nCr values, and is different from their list of nCr.

Jeff: Asks if any choice would be n choose for any selected r value less than n. Jeff repeats his question after Michael’s statement.

Romina: Watching.

00:40:15 Ankur: Ankur asks if ‘that equals that,’ pointing to their explicit formula to calculate nCr and Pascal’s Triangle?

Michael: Seems to agree with Ankur.

Jeff: Researcher points out the group’s progress: wrote out three rows and nth row of Pascal’s Triangle. Asks how far Jeff should write. Does not seem to receive an answer. Researcher tries to clarify Jeff, who agrees he said there is a n choose r on their nth row. Researcher prompts them to write their work nicely, which Jeff offers to do when she verifies she does want them to rewrite at the board.

Romina: Seems to agree with Ankur.

00:42:45 Ankur: Not visible.

Michael: Helps clarify the row with threes to the fifth row. When Jeff hesitates, Michael helps demonstrate where the arrows should be placed. Jeff: “Is that all you want?”

Jeff: Researcher asks Jeff to show an addition rule from the fourth to fifth row. He points to verify. Jeff points to 3C1 and 3C2 in response to the researcher’s question.

Romina: Not visible. Researcher: “Show me that three plus three is six, which ones would it be?”

00:43:15 Ankur: Watching. Researcher verifies the group agrees; they all agree.

Michael: Comments before Ankur the solution of 5C3, and then asks if he is right. Jeff and Ankur agree.

Jeff: Helps complete the researcher’s question: 3C1+3C2=4C2. She then asks 4C2+4C3. Jeff immediately points to the two locations and states five choose...

Romina: Romina is watching, and the researcher notes “I don’t know if Romina is convinced.”

00:43:45 Ankur: Watching.

Michael: Michael explains to Jeff, and repeats for researcher that the origin entry on the left must gain a topping, and the origin entry on the right must not gain a topping, so the destination nCr must be equal to the toppings of the one on the right with one added to ‘n.’

Jeff: Jeff repeats the question, “why is it five choose three?”

Romina: Watching.

00:44:35 The researcher asks Jeff to explain again to Brian, who arrives. The video cuts to Jeff’s explanation.

00:44:55