Description: Night Session – Pascal's Identity, Clip 5 of 7: Another way to write Pascal's Triangle **Parent Tape: Night Session – Pascal's Identity** **Date: 1999-05-12** **Location: David Brearley High School** **Researcher: Professor Carolyn Maher**	**Authors: Uptegrove, Elizabeth B.** **Verified: Poprik, Brad** **Date Transcribed: 2003** **Page: 1 of 7**

Line	Time	Name	Transcript	Coding and Explanation
1.	00:00	R1:	I remember.	
2.		Michael:	You remember.	
3.		R1:	I remember this. But now I don't want to think of the numbers in that triangle, I want to think of those as chooses. So for example, let's just take this row. One, three, three, one.	
4.		Michael:	Mm hm.	
5.		R1:	All right. If I wrote these as chooses the way you're writing them-	
6.		Michael:	Three choose zero, three choose one.	
7.		R1:	This is three choose zero.	
8.		Michael:	Yeah.	
9.		R1:	This is three choose one.	
10.		Jeff:	Choose one. Same thing.	
11.		R1:	Three choose-	
12.		Michael:	Two and three choose, then three choose, three choose three.	
13.		R1:	Right.	
14.		Jeff:	So that's how you get it. It's like the same thing, cause like three and zero is like three and three, right? And then three two.	
15.		R1:	OK, so-	
16.		Michael:	You want us to write the triangle looking like that?	
17.		R1:	I would, I would, I would like you to do that and then tell me what the general rule is.	
18.		Jeff:	All right.	
19.		R1:	With this notation. Do you understand my question? I'll leave you to work on that. So, so I'd like you to write out some of the rows with the triangle, and then I'd like-	
20.		Michael:	So to use it like, like that. Like the next one would be, uh, four choose zero.	
21.		Jeff:	Yeah and-	
22.		Romina:	Four choose -	
23.		Michael:	The four choose zero then //four choose one, four choose two-	
24.		Jeff:	//Four choose one, four choose two.	

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Line	Time	Name	Transcript	Coding and Explanation
25.		Ankur:	Four choose three.	
26.		Michael:	We're in a bad place.	
27.		R1:	Right. You probably want to use this.	
28.		Michael:	Yeah.	
29.		R1:	So that people can read it.	
30.		Michael:	Um.	
31.		Alex:	Ask them your question one more time.	
32.		R1:	OK, so I'd like you to rewrite your triangle if you like.	
33.		Michael:	From top to bottom?	
34.		R1:	Top to bottom.	
35.		Romina:	Do you want the ones and like-	
36.		Jeff:	All right. So what-	
37.		R1:	I want everything-	
38.		Jeff:	What would-	
39.		R1:	I want everything written in this form. Do you understand?	
40.		Ankur:	Uh-huh. [Ankur nods.]	
41.		Michael:	That's, that's easy.	
42.		R1:	And then I would like the general row.	
43.		Jeff:	Is that one?	
44.		R1:	What would the general row look like? Where you have towers?	
45.		Romina:	That's a zero, no that's zero choose zero	
46.		Ankur:	X high.	
47.		R1:	Something like that.	
48.		Jeff:	All right, well that's [Inaudible]	
49.		R1:	Ankur understands. So he can tell you.	
50.		Romina:	See, like that?	
51.		Michael:	So it would be, um, like N over, not two over.	
52.		Ankur:	Well, it would be-	
53.		Michael:	N choose-	

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Line	Time	Name	Transcript	Coding and Explanation
54.		Ankur:	It would be-	
55.		Romina:	Well, and N, make N like your height or something.	
56.	02:00	Jeff:	All right, so say-	
57.		Romina:	N equals height.	
58.		Jeff:	Well that would-	
59.		Ankur:	Well, write the X. Write *a* plus *b* to the whatever it is next to it.	
60.		Jeff:	Yeah.	
61.		Ankur:	You know what I mean?	
62.		Jeff:	Yeah. So right. That would be *a* plus *b* to the-	
63.		Michael:	This would be nothing, you know, it would be adding.	
64.		Jeff:	Yeah, zero, one, two. So *a* plus *b* to the second.	
65.		Romina:	Well, it'd be like *N* over N minus, but what?	
66.		Jeff:	Yeah, well, *a* plus *b* to the second, so it would be if, or *a* plus *b* to the n^{th}.	
67.		Romina:	To the-	
68.		Ankur:	No, all you need is like-	
69.		Romina:	*n* is factorial.	
70.		Jeff:	It'd be *n*, *n* over-	
71.		Michael:	*n*, fa-	
72.		Jeff:	*n* mi-	
73.		Romina:	No, that's just like- No, it's not right. I'm just saying like-	
74.		Jeff:	It would be-	
75.		Romina:	You would have to multiply it.	
76.		Jeff:	*n* over-	
77.		Michael:	Well, if you had an *n*, it would be, uh-	
78.		Ankur:	To the height of the tower which is *n*, right?	
79.		Michael:	You'd have a bunch of *n*'s.	
80.		Jeff:	Yeah, and it'd be over, just z-	
81.		Michael:	There'd be *n* plus one *n*'s going this way.	
82.		Jeff:	Yeah. If-	
83.		Michael:	All right?	

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Line	Time	Name	Transcript	Coding and Explanation
84.		Jeff:	it would be *n* over 0.	
85.		Michael:	So if *n* was three, you'd have four *n*'s going this way.	
86.		Jeff:	Yeah.	
87.		Michael:	And the bottom numbers would be just going from 0 to-	
88.		Jeff:	Just-	
89.		Michael:	To-	
90.		Jeff:	Yeah. Well, yeah.	
91.		Michael:	0 to *n*.	
92.		Jeff:	Exactly.	
93.		Michael:	To *n*.	
94.		Jeff:	To *n*. Whatever *n* equals.	
95.		Romina:	Is there a way to write that, you know how to write over times [Inaudible.]?	
96.		Ankur:	I guess.	
97.		Jeff:	Yeah, so how do you, yeah, wait, now that makes sense but, so it would be *n* over 0 to the n^{th}. And whatever-	
98.		Michael:	Zero, what are you talking about?	
99.		Jeff:	Wherever you're looking for.	
100.		Ankur:	What are you talking about, 0 to the *n*?	
101.		Michael:	0 minus *n*? That would be negative.	
102.		Jeff:	No, not minus, like that's to whatever *n* is. *n* over 0, *n* over 1.	
103.		Romina:	1.	
104.		Jeff:	Not divided by like *n*, 1, *n*, uh, 2, *n*, 3.	
105.		Michael:	That was-	
106.		Jeff:	All the way until *n* could be over *n*. You know what I'm saying?	
107.		Michael:	Yeah.	
108.		Jeff:	Not, not divided by. I was using bad, uh, bad looking things there. But-	
109.		Michael:	Each of those would be a number-	
110.		Jeff:	Yeah, it's what, 0 to *n*.	
111.		Ankur:	And *n* represents the height of the tower?	
112.		Romina:	The height of the tower, yup.	

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113.		Michael:	Yeah, *n*, *n* represents-	
114.		R1:	Do you want that divided sign here?	
115.		Michael:	No.	
116.		R1:	On that one?	
117.		Jeff:	No.	
118.		Ankur:	No. Cross that off.	
119.		Romina:	No.	
120.		Jeff:	I was using it to separate, and that was, that's a habit of mine, it looks bad.	
121.	03:59	Michael:	Oh, sorry about that. It would be, uh, as many, it's like height of the tower with two colors. You have two numbers.	
122.		Jeff:	Yeah. How do you, how are you, can you write that to get this?	
123.		Romina:	Like that's what I meant. Like I didn't mean factorial. I meant like when we used four first and like three first. I don't know how to write that, though.	
124.		R1:	So you go 0, 1, 2, 3, dot, dot, dot, up to *n*.	
125.		Jeff:	Yeah.	
126.		Michael:	Mm hm.	
127.		R1:	Can we get one in the middle there, like *n* choose *r*?	
128.		Jeff:	Like how would you just go right to *n* choose 3? Or *n* choose *r*? Like what- [Researcher 1 nods.]	
129.		Michael:	What are you talking about?	
130.		Romina:	Like instead of using 0, 1, 2, 3.	
131.		Jeff:	*r* being any number on the bottom.	
132.		R1:	Because you said *n* choose *x* up there.	
133.		Jeff:	Yeah.	
134.		R1:	//I just picked what I wanted-	
135.		Michael:	//Oh, you want uh, you want to do that.	
136.		Jeff:	Yeah, so, so it would be-	
137.		Michael:	Um-	
138.		Ankur:	*n* choose-	
139.		Michael:	It would be *n*.	

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140.		Jeff:	Wouldn't that just be *n* choose *r* for whatever *r* you wanted? Whatever number you wanted up to, as long as it didn't exceed *n*?	
141.		Michael:	This, this is different than that. Isn't it? Like this, these are just like a list of numbers. That's, that's just giving you one of these numbers.	
142.		Jeff:	Uh, you know all that, but I'm saying, if you wanted to write *n* choose to get a certain number, wouldn't it just be *n* choose *r*? Like that? And then as long as *r* doesn't exceed *n* or it's less than 0 like *r*-	
143.		Ankur:	Wouldn't that equal that?	
144.		Romina:	Yeah, wouldn't it?	
145.		Michael:	I guess you could write one of those.	
146.		Romina:	Yeah. Isn't it supposed to equal that?	
147.		Michael:	Right there.	
148.		Ankur:	That's- that is.	
149.		Romina:	It's the same thing.	
150.		Ankur:	That does.	
151.		Michael:	You could do that. It's a lot of-	
152.		R1:	OK, so you've written out three rows and then you wrote out the n^{th} row.	
153.		Michael:	The reason why, 0, 1, 2, 3 is that number is always going to be that number. It's not, it's never going to change.	
154.		R1:	[Researcher 1 walks to the board.] OK. I'll buy that. But something in here could be an *n* choose *r*. Right? Something in here could be an *n* choose *r*.	
155.		Romina:	Mm hm.	
156.		R1:	That's what I heard you say, Jeff?	
157.		Jeff:	Yes.	
158.		R1:	Sort of a general one in here, *n* choose *x*.	
159.		Jeff:	That's what-	
160.		R1:	Whatever you choose to use.	
161.		Jeff:	Yeah, that's what that is. So, yeah.	
162.	06:01	R1:	OK. OK, so this is my question to you. You've written out two rows and you have the third one there.	

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163.		Jeff:	Mm hm.	
164.		R1:	Maybe somebody will come up here and write these up nicely.	
165.		Jeff:	Is that what you want?	
166.		R1:	Yes. Because then I want to ask, I want; after you do that I have a question to ask you. Thanks.	
167.		Michael:	You want to erase those?	
168.		Jeff:	You want to make that the line so bad. I know.	
169.		Michael:	No, don't do that.	
170.		Ankur:	How far do you want him to go?	
171.		Michael:	One more.	
172.		Jeff:	I want to, uh. You want one more for good measure?	
173.		Michael:	No. Don't worry about it.	
174.		R1:	Go to the n^{th} one, then.	
175.		Jeff:	Wouldn't that just be-	
176.		R1:	Dot, dot, dot.	
177.		Jeff:	N zero	
178.		Michael:	Dot, dot, dot, N to the N.	
179.		R1:	And the last one, Jeff. Is the last one N N?	
180.		Michael:	Yeah.	
181.		Romina:	Mm hm.	
182.		Jeff:	Yeah.	
183.		R1:	Do you want to put it at the end?	
184.		Michael:	Yeah, put it at the end, make it nice.	
185.	07:41	R1:	What's the middle one there? What would you, how would you show the middle one?	
186.		Jeff:	Uh, actually, you could put N, X.	
187.		R1:	OK. N choose X, N choose N.	
188.		Jeff:	Those are dots because you can't really make a dot. Now you can.	