Description: Finding a general direct "rule" for the number of Unifix towers, selecting from two colors, for any height **Parent Tape: Early Algebra Ideas About Binomial Expansion, Stephanie's Interview Seven of Seven** **Date: 1996-04-17** **Location: Union Catholic** **Researcher: Professor Carolyn Maher**	**Transcriber(s): Aboelnaga, Eman** **Verifier(s): DeLeon, Christina** **Date Transcribed: Spring 2009** **Page: 1 of 7**

1	R1	Right. I mean to keep track. Um. I know that uh do you remember a few years ago um Dr. Davis was in and you were dealing with the Tower of Hanoi?
2	Stephanie	Yes.
3	R1	That was – you have these towers and you were looking at moves
4	Stephanie	Yeah.
5	R1	and trying to predict, right? - how many moves it would take to move the towers, right?
6	R2	(inaudible)
7	R1	Um. And then I remembered, I, you all were coming up with it trying to come up with a procedure for doing it. I think we have a video tape of that. Of um - and your procedure was like um sorta this idea – that you could predict the next row if you knew the row before.
8	Stephanie	Um hm.
9	R1	And what I'm asking you to think about is the way of – you know, if you know the one before you could do the next one. It was like um predicting how many towers you can build twenty tall.
10	Stephanie	Um hm.
11	R1	Do you remember that?
12	Stephanie	(inaudible)
13	R1	There was a point that you said you had to know nineteen before you could do twenty. Or eighteen before you could do nineteen. And then you came up with a kind of theory about it. Do you

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		remember that?
14	Stephanie	Yeah. For the tower – just tower problems?
15	R1	Yeah.
16	Stephanie	Yeah.
17	R1	Do you remember what the theory was?
18	Stephanie	Yeah. It was multiply the number of the last one by two.
19	R1	Right. But what if you didn't know the last one? What if all you knew was how tall the tower was? Suppose the tower was twenty tall. And you didn't know nineteen tall. We want to know how many towers you can make that are twenty tall that are different.
20	Stephanie	Um hm.
21	R1	Alright. So you know them from – how many can you make two tall?
22	Stephanie	How many can I make two tall?
23	R1	Well, one tall.
24	Stephanie	One tall? I can make one – two. Um. Am I using – oh! For two colors, I can make two.
25	R1	Two tall?
26	Stephanie	I can make four.
27	R1	Three tall?
28	Stephanie	I can make eight.

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29	R1	Four?
30	Stephanie	Sixteen. Thirty-two. And it just keeps going like that.
31	R1	Right? But can you do this in a general way? So this would be – this is the height, right?
32	Stephanie	Um hm. Yeah.
33	R1	And this is the total. Is there another way to write this? With exponents?
34	Stephanie	Oh!
35	R1	Remember that?
36	Stephanie	Well. Yeah. Um. The first one, just two to the first. Two to the second. To the third. Fourth. Oh! Two to the twentieth.
37	R1	Okay. So
38	Stephanie	Oh! Well, or
39	R1	Twenty would be two to the twentieth.
40	Stephanie	[*at the same time*] Two to the twentieth.
41	R1	And *n* would be
42	Stephanie	Two to the *n*.
43	R1	Two to the *n*..
44	Stephanie	Yeah.
45	R1	Right.

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46	Stephanie	Um hm.
47	R1	We were sort of playing with that idea. And so zero tall would be?
48	Stephanie	Zero tall? It would be zero.
49	R1	It would be two to the zero and that’s one.
50	Stephanie	Yeah.
51	R1	But it almost doesn’t make any sense.
52	Stephanie	It doesn’t. It makes
53	R1	But if you wanted to make your nice pattern
54	Stephanie	no sense.
55	R1	to – but you want your pattern to work.
56	Stephanie	Yeah. But that’s not – that’s not fair. ‘Cause everything else has to make perfect sense except for that.
57	R1	But this is what – why they make certain definitions.
58	Stephanie	Hm.
59	R1	You don’t like that.
60	Stephanie	No.
61	R1	It’s sort of really hand waving.
62	R3	There was a big discussion in Dr. Davis’ class about why *a* to the zero is one.
63	R1	This is exactly Stephanie’s point.

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64	R3	I think that I think I remember it – that it was uh – I mean you have to define the terms and if you think about um dividing -
65	R1	[*R1 chuckles as the camera focuses on Steve causing him to stumble over his words.*] Now you know what Stephanie feels like.
66	R3	If you think about dividing by different things like uh maybe you have uh if we if we define two to the negative two as one over two squared
67	R1	Um hm.
68	R3	Then if you take two squared, okay?
69	R1	Um hm.
70	R3	Divided by two squared or two squared times two to the negative two, we know that's four divided by four which we know is one. So two squared times two to the negative two – what we do there is we add the exponents. Two minus two is zero and we get two to the zero and since we know four over four is one, we have two to the zero has to be one. So I mean I think that sometimes its just like
71	R1	Consistency?
72	R3	Right. And having a definition for it.
73	Stephanie	Hmm.
74	R1	So. Do you see what he's saying?
75	Stephanie	Yeah.
76	R1	That we know that this is one. Two squared divided by two squared is one.

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77	Stephanie	Yeah.
78	R1	Right. We know that when you divide you're supposed to subtract exponents. Right?
79	Stephanie	Um hm.
80	R1	So you better make that zero or the whole system is going to flop.
81	Stephanie	Hmm.
82	R1	It's convenient. And it sorta works. But you can't always have a um a physical model
83	Stephanie	Yeah.
84	R1	to represent it. That we know of. Not with this. I mean there might be a more sophisticated abstract models that mathematicians and physicists have. Good. Thank you. That's very good.
85	R3	You could just look at a graph.
86	R1	What do you mean?
87	R3	Hm.
88	R1	What do you mean by looking at the graph?
89	R3	Well, um.
90	R1	*y* equals two to the *x*?
91	R3	Well, *y* equals *a* to the *x*.
92	R1	Okay. So if you plot these points on a graph, where would you want that to be? That's interesting. Do – do you do anything much

		with graphs?