

Description: Clip 4 of 9: Building the first layer of $(a+b)$ cubed Parent Tape: Early Algebra Ideas About Binomial Expansion, Stephanie's Interview Four of Seven Date: 1996-02-21 Location: Harding Elementary School Researcher: Professor Carolyn Maher	Transcriber(s): Aboelnaga, Eman Verifier(s): Yedman, Madeline Date Transcribed: Fall 2010 Page: 1 of 8
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0:00	1	R1	It really is great. You're doing great. Okay, I'm curious, now, and I've never had to do this as a student before- I'm curious now- you also said that a plus b times a plus b times a plus b is a squared plus $2ab$ plus b squared, that quantity, times a plus b . And then when you simplified it, you got a cubed, plus $3a$ squared b , plus $3ab$ squared, plus b cubed.
	2	Stephanie	Yeah.
	3	R1	Right, and before that you got all these terms before you simplified.
	4	Stephanie	Mhm.
	5	R1	I think it's important to think about what you did before you simplified them too, because you see here [<i>pointing at paper with square representation of $(a + b)^2$</i>] you had an ab and a ba , and they each had different regions.
	6	Stephanie	Mhm.
	7	R1	Even though it simplified to $2ab$ when you actually built your model, they had different regions representing each of these components before you simplified them. So, it may very well be these 1, 2, 3, 4, 5, 6. It may be six pieces. It may not be, I don't- I- I've never done this before. I haven't done it with these pieces. [<i>Rearranges Algebra blocks from earlier</i>] And I don't if, um, Ethel did this to us to distract us, give us more pieces than you need. I don't know what she did. She's a teacher, teachers do sneaky things.
	8	Stephanie	Uh huh.
	9	R1	And- Or she expects us to use all of them? [<i>Stephanie nods</i>] Or, um, she thinks we can model it that way [<i>Stephanie nods</i>]. Um, you can ask her anything you want, but I'm kind of curious to see if we can see these components [<i>pointing at paper</i>] in building the model. Um, she's here. I don't think she's gonna tell us too much, 'cause she's not allowed to, but she might tell us the basics.
	10	Stephanie	I don't- I don't know.
	11	R1	W- What can we start with? [<i>Picks up some of the Algebra blocks</i>] I don't know.
	12	Stephanie	[<i>Picks up blue piece</i>] Well if that's a plus b by a plus b , if you're- if you're saying that this is a plus b squared, and that

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			this is a plus b high, [<i>picks up white piece</i>] it's the s - I can- I can just explain it the same way.
	13	R1	Mhm.
	14	Stephanie	That I explained it with this [<i>10x10x10 cube</i>] and this [<i>10x10x1 flat</i>].
	15	R1	Mhm.
	16	Stephanie	You know?
	17	R1	Mhm.
	18	Stephanie	I don't know...
	19	R1	But suppose if you wanted to... [<i>rearranges Algebra blocks to resemble $(a+b)^2$ model in drawing, sighs</i>] funny little one in there... Um.
	20	Stephanie	[<i>coughs</i>] Um.
	21	R1	You like that funny little one in there?
	22	R2	[<i>off screen</i>] I like that 'cause it matches up with what she's shown us.
	23	R1	'Cause I'm looking at what you did here, [<i>points to drawing</i>] in terms of a plus b .
	24	Stephanie	Mhm. Oh...
	25	R1	Is that-
	26	Stephanie	Oh-
	27	R1	I don't know, does that do it? Is that the way?
	28	Stephanie	Oh [<i>mumbling</i>], if you wanted to- [<i>rearranges to model drawing exactly</i>] that's how it's drawn.
	29	R1	Is that like what you drew?
	30	Stephanie	Yeah.
	31	R1	How does that work?
	32	Stephanie	[<i>Points to pieces in model</i>] a squared.
	33	R1	What's a and what's b ?
	34	Stephanie	This is a and this is b .
	35	R1	That's a and that's b ? Oh, okay, this is a squared...
	36	Stephanie	[<i>Points to pieces in model</i>] a squared, a plus b , err- ab
	37	R1	Okay-
	38	Stephanie	b squared-
	39	R1	Okay-
	40	Stephanie	ab .

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	41	R1	Oh, okay, that's neat. Now, I'll buy that.
	42	Stephanie	Okay.
	43	R1	Now, how would we show a plus b quantity cubed?
	44	Stephanie	Oh, it'd have to be, like, more, it'd have to be three dimensional. I couldn't-
	45	R1	Okay-
	46	Stephanie	'Cause it doesn't have three parts, I couldn't, like, say, well I... [<i>pauses, picking up small cube</i>]
	47	R1	Okay, let's leave this.
	48	Stephanie	I guess if I...
	49	R1	That's interesting. We have all these pieces here. If I were doing it I'd give you more than- I don't know what she had in mind, but we... We need to show [<i>pauses, points to parts of paper</i>] this is a [<i>pointing to small cube</i>], and this is b [<i>pointing to cubes</i>]. We need to show this [<i>pauses</i>] right?
	50	Stephanie	Yeah.
	51	R1	Up now [<i>indicating height</i>].
	52	Stephanie	Yeah.
	53	R1	a plus b . Is that right? [<i>Stephanie looks off screen</i>] Don't look at her, she's not going to tell us. [<i>Stephanie laughs</i>]
	54	Stephanie	Um.
	55	R1	Right?
	56	Stephanie	I don't-like, if you want me to show you, like...
	57	R1	How can we make a cube? Now, we have the- we have a square, right? [<i>Stephanie nods</i>] With area a squared plus $2ab$ plus b squared.
	58	Stephanie	Mhm.
	59	R1	Okay, that's an interesting puzzle. Now we wanna make a cube, so we have to go up a plus b .
	60	Stephanie	Yes.
	61	R1	What- what's a plus b ?
	62	Stephanie	[<i>points to model already assembled</i>] That right there.
	63	R1	[<i>Picks up the pieces modeling the side length</i>] This is a plus b , right?
	64	Stephanie	Yes.
	65	R1	So we wanna go up a plus b .

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	66	Stephanie	[<i>coughs</i>] But there's not enough pieces.
	67	R1	Oh, I don't know. [<i>Places a block vertically</i>] But that's up a plus b.
	68	Stephanie	Oh. Oh. Alright.
	69	R1	Isn't it?
	70	Stephanie	Well, yeah.
	71	R1	No?
	72	Stephanie	Well, yeah. I just- I didn't think of it like that. So, do you like-
	73	R1	So we know a plus b up-
	74	Stephanie	Yeah.
	75	R1	Okay.
	76	Stephanie	So... What do you want me to show? Like...
25:00-29:59	77	R1	Okay, so now when we have a cube, we know [<i>picking up blue piece</i>] right? What do we know about all these? Any- all- of these components? [<i>pauses</i>] Okay, [<i>points at paper</i>] is there an a cubed any place?
	78	Stephanie	[<i>pauses</i>] I don't- [<i>sighs</i>]
	79	R1	Is there an a squared b any place?
	80	Stephanie	I- guess-
	81	R1	Where's there an ab?
	82	Stephanie	An ab? Is right here [<i>points at set of green cubes</i>], well, no. An ab is like, is this piece right here? Or this piece?
	83	R1	Okay, so it's a [<i>pointing to one side of piece</i>] b [<i>pointing to other side</i>]. So this piece is a and this piece is b.
	84	Stephanie	Yes.
	85	R1	So where would a, ab squared be? I wonder...
	86	Stephanie	ab squared? Is that what you said?
	87	R1	Yeah. [<i>pause</i>] This is b. [<i>points to side green piece on model</i>] Think about this, it's so easy ...
	88	Stephanie	[<i>Sighs</i>] Um, I guess...
	89	R1	Here, maybe we can make a picture with this, like we did here [<i>collects papers</i>]-
	90	Stephanie	Can we go like-
	91	R1	That might help.
	92	Stephanie	Alright.
	93	R1	If we trace it, right? I'll let you do it this time. We're up to

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			page what... This was such a nice one. [<i>referring to paper from earlier, picks up blank sheet</i>] This is two, why don't you label this is two, this three [<i>shuffles paper</i>] and then we'll make that one four. [<i>Stephanie traces around blocks in $(a+b)^2$ model</i>] You know what confuses me in this? Um, I don't know if it bothers you, Stephanie, I'm gonna tell you where I get confused...
	94	Stephanie	Where?
	95	R1	I'll tell you after you draw it.
	96	Stephanie	I can't trace...
	97	R1	It's not going to be any worse than what I would have done, I promise you that.
	98	Stephanie	Okay. [<i>finishes tracing</i>]
	99	R1	See, you know what might help? To mark off on- see- [<i>indicating on paper</i>], because this already has the height, okay, so let's pull it apart and-
	100	Stephanie	And mark off where- [<i>pointing to edge of Algebra block</i>]
	101	R1	Yeah-
	102	Stephanie	Yeah where each thing is. [<i>marks on paper where each block comes together</i>]
	103	R1	Make it two dimensional, right. So where's your a ? That's right. Put a line, like a line there. Okay-
	104	Stephanie	Okay.
	105	R1	Okay. So let's mark off the components [<i>Stephanie marks off next piece</i>] you can do that, you know what a is...
	106	Stephanie	[<i>rearranging pieces, tracing</i>] Alright. [<i>pulls each component apart</i>]
	107	R1	So, let's mark it exactly [<i>places Algebra block back on tracing as guide</i>]
	108	Stephanie	Oh, you want me to like, label it?
	109	R1	Yeah.
	110	Stephanie	Okay. [<i>labels each component of $(a+b)^2$ model</i>] Okay.
	111	R1	Okay, now, we wanna really be fussy about this. This is a squared and this is ab ...
	112	Stephanie	Mhm.
	113	R1	Alright, but that's this and this [<i>indicating side lengths</i>] now

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			we're going up [<i>indicating height</i>]. How many times have you gone up now?
	114	Stephanie	Here? [<i>Pointing at yellow piece on model</i>] This piece? You went up, like, a .
	115	R1	Mhm.
	116	Stephanie	So like, this piece here, wouldn't it be a cubed?
	117	R1	Hmm. Okay, that piece is a cubed.
	118	Stephanie	And this piece, what was this [<i>moving green piece of model</i>], a plus b , ab ? So... I don't know if this is like...
	119	R1	So if you went up a , this is a cubed [<i>indicating yellow piece</i>]
	120	Stephanie	Yeah.
	121	R1	Okay. Now how much did you go up over here?
	122	Stephanie	You went up ab .
	123	R1	How-how much did you go- Tell me how you decided you went up a here [<i>indicating yellow piece</i>]
	124	Stephanie	Well, 'cause this is an a piece, this is an a .
	125	R1	What's the a ?
	126	Stephanie	This yellow piece [<i>points at yellow piece</i>].
	127	R1	No, the piece isn't an a .
	128	Stephanie	Oh, well, like...
	129	R1	What's the a ?
	130	Stephanie	This is a [<i>indicating side length</i>], like the unit.
	131	R1	Okay, the length-the side of this is an a .
	132	Stephanie	Yes.
	133	R1	Okay, 'cause this thing [<i>picking up a^3 piece</i>] is not an a squared, it's -
	134	Stephanie	Going up-
	135	R1	Going up, it's an a cubed. So you went up a .
	136	Stephanie	Yeah.
	137	R1	How much did you go up here? [<i>pointing to green piece</i>]
	138	Stephanie	You went up- you went up a .
	139	R1	You went up a here, okay. So you went up a -
	140	Stephanie	Yeah.
	141	R1	And how much were you down? [<i>pointing to tracing on paper</i>] What's the area of this little piece?
	142	Stephanie	The area of that little piece was ab .

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30:00-34:59	143	R1	But you went up- You did ab , a times.
	144	Stephanie	So it would be a squared b ?
	145	R1	Does that make sense?
	146	Stephanie	Yeah. So, can I like write that on the side?
	147	R1	Whatever you want. 'Cause they're getting interesting. [Stephanie labels a^3 , a^2b around edge of traced diagram] Okay, so this is a cubed, and we're saying this piece is a squared b . What about this piece? [blue piece]
	148	Stephanie	Hm- You still went up a .
	149	R1	Okay.
	150	Stephanie	So it would be ab squared?
	151	R1	Does that make sense?
	152	Stephanie	Yes. And this one you went up a , [indicating other green piece], so it would be a squared b ? I guess? 'Cause it's the same as that one [indicating other first green piece].
	153	R1	Okay. But we only went up a , remember we're supposed to go up a plus b . [laughs]
	154	Stephanie	Okay, so-
	155	R1	Isn't that interesting?
	156	Stephanie	So now we have to go up two more?
	157	R1	I don't know, I'm gonna let you think about that. I'm not gonna- I think maybe this is something to think about some more, right? 'Cause we've only gone up a .
	158	Stephanie	Mhm.
	159	R1	Remember like here, um, when we went up ten, [indicating $10 \times 10 \times 10$ cube from earlier] we could've gone up four and six? We wanna do a , this is a [indicating yellow piece's height], now we wanna go up b . Do we know what b is? Do we know the length of b any place?
	160	Stephanie	b ?
	161	R1	We wanna go up a plus b .
	162	Stephanie	Is like this [picking up green block vertically] So I guess we'd have to go up this much more [placing green block on top of

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			<i>yellow block vertically</i>].
	163	R1	That's interesting. [<i>pause</i>]
	164	Stephanie	So a cubed would be- I don't know, a squared- a cubed b ?
	165	R1	Well, I don't think it's fair to have you think about this right now, but I think this is something you could be thinking about.
	166	Stephanie	Okay.
	167	R1	Does it give you a direction to think?
	168	Stephanie	Yeah.