Description: Clip 6 of 7: Expanding (a+b) cubed algebraically **Parent Tape: Early Algebra Ideas About Binomial Expansion, Stephanie's Interview Three of Seven** **Date: 1996-02-07** **Location: Harding Elementary School** **Researcher: Professor Carolyn Maher**	**Transcriber(s): Aboelnaga, Eman** **Verifier(s): Yedman, Madeline** **Date Transcribed: Fall 2010** **Page: 1 of 9**

0:00	1	R1	My next question to you then is: Is there – what you did here – right –distributed the three plus seven to all of these,
	2	Stephanie	Um hm.
	3	R1	can that be applied here? [*to the abstract case*]
	4	Stephanie	Yeah. I guess. Except they're like *a*'s and *b*'s, but yeah.
	5	R1	Okay. So if you were to write – let's – let's start all over again then. [*R1 takes a new sheet of paper.*] Why don't we write *a* plus *b* cubed. What it means and try to take it to the step and distribute it and see what all that comes out to be.
	6	Stephanie	*a* plus *b* cubed. And so you want me to write that equals that and then
	7	R1	Yeah. Right. Um hm.
	8	Stephanie	[*Stephanie writes.*] Equals. You want me to write that one, too? Oh, sorry.
	9	R1	Yeah.
	10	Stephanie	Okay.
	11	R1	I would – you know what – you might for format don't put the equals here.
	12	Stephanie	Put it here?
	13	R1	Yeah. [*Stephanie writes.*]
	14	Stephanie	Oh.
	15	R1	And you know where this came from.
	16	Stephanie	Yes.
	17	R1	You really know this. You believe this. You're absolutely convinced?
	18	Stephanie	Yes.
	19	R1	No doubt in your mind?
	20	Stephanie	We worked it out.
	21	R1	That's always true?
	22	Stephanie	Yes.
	23	R1	You've proved it. Okay.
	24	Stephanie	And then it would be
	25	R1	You're going to need more space. You may want to start here rewriting it.
	26	Stephanie	Oh. Yeah. Okay. Well – equals – *a*
	27	R1	Do it your way.

	28	Stephanie	*a* squared *b*. Okay.
	29	R1	That's fine. You're doing well.
	30	Stephanie	And it's – yeah – *a* plus – two *ab* [*Stephanie continues working.*] Okay.
	31	R1	Okay. Do you know enough algebra to to actually do each of these little problems?
	32	Stephanie	Um.
	33	R1	Have you learned how to multiply *a* squared times *a* plus *b*?
	34	Stephanie	We might've. I'm just – I doubt I could do it like correctly. Um.
	35	R1	I mean 'cause – what I'm what I'm suggesting that you think about here is think of this as one special problem. Just this little piece.
	36	Stephanie	Um hm.
	37	R1	What does that mean?
	38	Stephanie	That means like – *a* squared times *a* plus *a* squared times *b*.
	39	R1	Why don't you write that down?
	40	Stephanie	Oh. Okay.
	41	R1	Underneath. [*Stephanie writes those values on the paper.*]
	42	R1	Now you said *a* squared times *a*.
	43	Stephanie	Oh. Yeah.
	44	R1	And you didn't write *a* squared times *a*. [*Stephanie makes the correction.*]
	45	Stephanie	Yeah.
	46	R1	Put a dot. *a* squared times *a*. That might help you.
	47	Stephanie	*a* squared times *a* and then
	48	R1	Um hm.
	49	Stephanie	Plus *a* squared times *b*.
	50	R1	Neat. Okay. So we did this piece. Why don't you put an equal?
	51	Stephanie	Okay.
	52	R1	The reason I'm covering it now – we have plus
	53	Stephanie	Plus
	54	R1	Now can you do this piece?
	55	Stephanie	Oh, God. Two *ab*
	56	R1	You gotta write small.
	57	Stephanie	times *a* plus two *ab* times *b* plus *b* squared times *a* plus *b* squared times *b*.

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	58	R1	Cool.
	59	Stephanie	Okay.
	60	R1	Are any of these you can simplify?
	61	Stephanie	Can I simplify that?
	62	R1	(inaudible)
	63	Stephanie	Can't I make that *a*
	64	R1	Equal
	65	Stephanie	to the *a* cubed?
	66	R1	You believe it's *a* cubed?
	67	Stephanie	Well, it's another *a*.
	68	R1	Okay. So that means you have *a* three times.
	69	Stephanie	Yeah.
	70	R1	You believe that? Right?
	71	Stephanie	Yeah.
	72	R1	See in a sense um that was like my three times three squared
	73	Stephanie	Um hm.
	74	R1	became a three cubed or twenty-seven. Isn't that right?
	75	Stephanie	Um hm.
	76	R1	You can think of twenty-seven as three cubed.
	77	Stephanie	Yes.
	78	R1	Okay.
	79	Stephanie	Okay. This I can't – well
	80	R1	Okay, so you can leave it.
	81	Stephanie	[*Stephanie continues working.*]
	82	R1	Now what's this piece say?
	83	Stephanie	It says two *ab* like two *a* times *b*
	84	R1	It says two
	85	Stephanie	times *a* times *b*
	86	R1	*a* times *b* times
	87	Stephanie	*a.*
	88	R1	Can that be simplified?
	89	Stephanie	*[pause]* Could it be – um – there'd be another *a*, right? So could I make it like three *a* times two *b*?
	90	R1	Okay. Let's look at this piece. Okay. Let's try to think of what you did. I want to go back to this *a* squared times *a*.
	91	Stephanie	Okay.

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	92	R1	I better use this pen.
	93	Stephanie	Oh.
	94	R1	This *a* squared times *a*, right?
	95	Stephanie	Um hm.
	96	R1	You said could be *a* cubed.
	97	Stephanie	Yes.
	98	R1	Why?
	99	Stephanie	Because you're multiplying it by itself again.
	100	R1	Okay. Um. So – another way I think about it is – here you have – when there's no exponent – that means you have one of them.
	101	Stephanie	Yeah.
	102	R1	Right?
	103	Stephanie	Um hm.
	104	R1	Okay. That means you have one factor *a*.
	105	Stephanie	Um hm.
	106	R1	And here you have two factors of *a*.
	107	Stephanie	Yes.
	108	R1	So that means you have three
	109	Stephanie	Three.
	110	R1	So *a* cubed.
	111	Stephanie	Um hm.
	112	R1	So that was sorta like my – if I go back to my three story down here – three times nine could be thought of as three times three squared.
	113	Stephanie	Um hm.
	114	R1	Right. Or three squared times three if we write it the squared term first.
	115	Stephanie	Um hm.
	116	R1	And that tells you we have three factors of three.
	117	Stephanie	Yeah.
	118	R1	Isn't that right?
	119	Stephanie	Yes.
	120	R1	Two factors and that gives you your twenty-seven which I got down here. Isn't that what that means?
	121	Stephanie	Um hm.
	122	R1	Okay. Now. Now. If you think about that and look at the second

			piece – um – here you have two factors of *a* and one of *b*. That's what you told me, right? *a* squared times *b* meant you had two factors of *a* and one factor of *b*. Nothing you can do with that.
	123	Stephanie	Um hm.
	124	R1	Right. That's sorta like – What is it sorta like? [*R1 goes back to an earlier example.*] Do we have that little piece represented here?
	125	Stephanie	Um. Well
	126	R1	Do you see any two factors of *a* and one of *b* any place here?
	127	Stephanie	Two of *a* and one of *b*? Um – *a* was three, right?
	128	R1	*a* was three.
	129	Stephanie	Okay.
	130	R1	So we had two factors of *a* and *b* was seven. Do any of these terms represent that?
	131	Stephanie	I don't know. Um. This one?
	132	R1	Um.
	133	Stephanie	Well that that can be divided by three –
	134	R1	Let's test it. A little diversion here, but this is interesting. You have seven times forty-two.
	135	Stephanie	And forty-two can be divided (inaudible)
	136	R1	Or seven times seven
	137	Stephanie	No. What I meant was
	138	R1	Remember we want *a*'s and *b*'s. So we only want three's and seven's.
	139	Stephanie	Okay.
	140	R1	Remember *a* was three and *b* was seven.
	141	Stephanie	Yes.
	142	R1	Right? So we only want three's and seven's.
	143	Stephanie	Um hm.
	144	R1	Alright. So forty-two is
	145	Stephanie	Fourteen.
	146	R1	Seven times six.
	147	Stephanie	Yeah.
	148	R1	Or seven times seven times three times two. I'm having a little trouble here.
	149	Stephanie	Now – what – I don't – you want me to find one that has one

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			seven and two three's?
	150	R1	One one -we wanted one that has two factors of *a*
	151	Stephanie	Um hm.
	152	R1	which means two factors of three and one factor of *b* – one factor of seven.
	153	Stephanie	Um hm.
	154	R1	Right? Isn't that what that means?
	155	Stephanie	Yes.
	156	R1	Three squared times seven means – Is there something that has
	157	Stephanie	Okay. So you want nine and seven?
	158	R1	Does that make sense?
	159	Stephanie	Oh. Yeah. Right here.
	160	R1	So that's sorta what you're talking about here.
	161	Stephanie	Yeah.
	162	R1	Right. Okay. Now this one is two *ab* times *a*. Now what does this mean? You have two times – how many factors of *a* do you have here?
	163	Stephanie	[*Stephanie sneezes.*]
	164	R1	God bless you. God bless you.
	165	Stephanie	I have
	166	R1	Do you need a tissue?
	167	Stephanie	No. I always get that feeling that I have to sneeze and I never do.
	168	R1	So here you have one factor of *a*. Right?
	169	Stephanie	Um hm.
	170	R1	One factor of *b* and one factor of *a* again.
	171	Stephanie	Yes.
	172	R1	Can you simplify that?
	173	Stephanie	Um. Can I simplify that like – Oh! I can I can make it *a* squared.
	174	R1	So you could make it two
	175	Stephanie	*a* squared
	176	R1	*a* squared
	177	Stephanie	*b.*
	178	R1	*b.*
	179	Stephanie	Okay.
	180	R1	You got that?

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	181	Stephanie	Yes.
	182	R1	So this term can be written – the second term – as
	183	Stephanie	Two *a* squared *b*
	184	R1	Good.
	185	Stephanie	plus and then it again, right? Oh. No. Now this time it's two *b* squared *a*.
	186	R1	Or two *ab* squared. If you're keeping them alphabetically.
	187	Stephanie	Okay. Plus you know that one is *b* squared times *a*. You can't do anything with that one.
	188	R1	You could put them alphabetically.
	189	Stephanie	Do you want me to?
	190	R1	You might want to put them alphabetically.
	191	Stephanie	Okay.
	192	R1	'Cause it may be you can simplify them. Maybe you can't. Do you know what I'm saying?
	193	Stephanie	Yes. And plus and this one can become *b* to the third.
	194	R1	Third. Okay. So let's take a look at this. *a* plus *b* quantity cubed. Wasn't that the problem?
	195	Stephanie	Um hm.
	196	R1	Oh. You wrote squared here. Don't you mean
	197	Stephanie	Oh.
	198	R1	Cubed? Right? We know this has an *a* cubed and we know it has a *b* cubed.
	199	Stephanie	Um hm.
	200	R1	Just like in *a* plus *b* quantity squared has an *a* squared and a *b* squared.
	201	Stephanie	Yes.
	202	R1	Agreed? But it has all this stuff in between.
	203	Stephanie	Um hm.
	204	R1	Can we simplify that? Are any of them alike?
	205	Stephanie	Yeah. Probably.
	206	R1	Here's an *a* squared *b*. Are there any other *a* squared *b*'s here?
	207	Stephanie	*a* squared *b*. Is this one of those, too, or is this a whole new thing?
	208	R1	Well. We know we have *a* cubed.
	209	Stephanie	No. But is this part of this problem?
	210	R1	And we know we have *ab* cubed. – Yeah, this is the second line.

	211	Stephanie	Whoa!
	212	R1	You just simplified this line to this line. That's what you did.
	213	Stephanie	Okay. So this is just this.
	214	R1	Right.
	215	Stephanie	In the same (inaudible)
	216	R1	So we have the *a* cubed and the *b* cubed. Right. We have one of those. Right?
	217	Stephanie	Um hm.
	218	R1	Now here we have an *a* squared *b*. Right? We have one of those.
	219	Stephanie	Um hm.
	220	R1	When we don't have a number, that means one of them, isn't that right?
	221	Stephanie	Yes.
	222	R1	We have one *a* squared *b*.
	223	Stephanie	Oh. Well here you have two *a* squared.
	224	R1	Oh. We have two of them. Okay. So we have one of them and two of them. How many of them will that give us?
	225	Stephanie	Three of them. Three *a* squared.
	226	R1	Okay. So these two together
	227	Stephanie	Yes.
	228	R1	Right? Why don't you write – rewrite the line again? The *a* cubed we have –
	229	Stephanie	Oh. Okay. – *a* cubed and then it's three *a* squared – what about the *b*?
	230	R1	*b* – it's still there.
	231	Stephanie	Okay.
	232	R1	It's plussed. Don't lose your plus.
	233	Stephanie	Yeah.
	234	R1	Okay. So we took care of this. We took care of these two. Right?
	235	Stephanie	Um hm.
	236	R1	Now what? This is two.
	237	Stephanie	A two *ab* squared.
	238	R1	And this is?
	239	Stephanie	*ab* squared.
	240	R1	How many of them are here?
	241	Stephanie	Three *ab* squared.

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	242	R1	Okay. So you have three *ab* squared. Okay.
	243	Stephanie	Three *ab* squared.
	244	R1	And then the last one is?
	245	Stephanie	Plus *b* cubed. Okay. Oh. Can this be like – oh – it's different.