Description: Fraction problems: Sharing Candy Bars (Side View) **Parent Tape: Fraction problems: Sharing Candy Bars (Side View)** **Date: 1993-10-29** **Location: Colts Neck Elementary School** **Researcher: Professor Carolyn Maher**	**Transcriber(s): Yankelewitz, Dina** **Verifier(s): Reid, Adrienne, Farhat, Marcelle** **Date Transcribed: Spring 2009** **Page: 1 of 22**

Line	Time	Speaker	Transcript
1.	15:38	T/R 1:	Well, good morning. [students Good morning] What did you do yesterday in math? [students raise hands] Ah. All these people are going to tell me. Amy?
2.	15:47	Amy:	We did, we figured out the chocolate, we divided chocolate.
3.	15:52	T/R 1:	Oh. Did you all agree?
4.	15:53	Students:	Yeah.
5.	15:56	T/R 1:	You agree? Was that an easy decision?
6.		Andrew:	Yeah
7.		T/R 1:	No discussion, or, or differences?
8.	15:59	Andrew:	Well, a little
9.	16:02	T/R 1:	How did that work.
10.	16:04	Andrew:	Well, we um like divided us into groups, the class into groups and um, and our, in my group, there was like nine people, so each person got like, um one and one ninth.
11.	16:21	T/R 1:	How did you decide that? How much did you have to start with?
12.	16:25	Andrew:	We had uh, ten pieces.
13.	16:28	T/R 1:	Ten pieces. I see, how did you do one and one ninth? I'm curious.
14.	16:32	Andrew:	Well, we um, we said there was nine people, so we had to give a whole piece of candy to each person and then we had one left over so we would have to, and there's nine people, so if we divided it into ninths there would um be enough, for everyone.
15.	16:53	T/R 1:	Is that hard to do?
16.	16:56	Andrew:	Yeah, a little.
17.	16:57	T/R 1:	But you did it?
18.	16:59	Andrew:	Yeah.
19.	17:00	T/ R 1:	And you all felt good about it?
20.	17:02	T/R 1:	Oh, and you were in that group too, Graham, huh?
21.	17:02	Graham:	Yeah.
22.	17:04	T/R 1:	What about another group? What did another group do? You were in a different group? Jessica, what did you do?
23.	17:08	Jessica:	Well, my group, we like had uh, eight people in our group, so well, we each got one whole piece and then we had two pieces left over

			so then we divided each of the two pieces into fourths.
24.	17:22	T/R 1:	And, so, how, how much did each person get?
25.	17:26	Jessica:	One and one fourth.
26.	17:29	T/ R 1:	You got one and one fourth. Did you all think that was fair, in that group? [mmm hmmm] Did the people in Andrew's group get the same amount as the people in Jessica's group? [no] Who got more, the people in Andrew's group or the people in Jessica's group? Michael?
27.	17:46	Michael:	The people in Jessica's group.
28.	17:50	T/R 1:	The people in Jessica's, now, of course I could ask you how much more, you think you could you figure that out? You don't have to tell me that right now.
29.	17:53	Michael:	Yeah
30.	17:56	Meredith:	Yeah, if we got one ninth and they got one fourth, then um, nine minus four equals five, so they got um one fifth bigger, than we…
31.	18:08	T/R 1:	Say that again?
32.	18:11	Meredith:	See, um, we had, each of us had one and one ninth.
33.	18:16	T/R 1:	Let's see, let's see, Andrew's group had nine people, right? Each person,
34.		Andrew:	Got one and one ninth
35.		T/R 1:	And, in Jessica's group, eight people and each person got, you said,
36.		Jessica:	One and one fourth
37.		T/R 1:	One and one fourth
38.	18:35	Meredith:	And
39.		T/R 1:	And so, you're telling me,
40.		Jessica:	But there was another group.
41.	18:36	T/R 1:	Maybe we'll hear about the other group and we'll come back to this, but I also didn't want to lose what Meredith said, what Meredith said was the people in Jessica's group got more than the people in Andrew's group. [Meredith laughs] and I, I kind of asked how much more
42.	18:55	Meredith:	Nine minus four equals five so they got one fifth more.
43.	19:01	T/R 1:	So you're claiming, this is Meredith's claim
44.	19:02	Meredith:	One fifth. They got five more, whatever.
45.	19:09	T/R 1:	[writing on overhead transparency, figure 10-29-01] That each person in Jessica's group got how much more did you say Meredith? Got one fifth more than each person in Andrew's group. How many of you believe that? [all students raise hands]. Ok,

			you're gonna have to then convince me. But we'll let that hold for a minute. But who's the other group? [there was three groups] Ok, who was, who was in a different group? A group other than Andrew's and Jessica's group? Kimberly? Ahah. How many in your group, Kimberly?
46.	20:04	Kimberly:	There, we each got one and one fourth.
47.	20:08	T/R 1:	How many people in your group?
48.	20:10	Kimberly:	Eight
49.	20:11	T/R 1:	Eight people? And in your group got
50.	20:12	Kimberly:	One and one fourth.
51.	20:12	T/R 1:	One and one fourth. So the people in Jessica and Kimberly's group, right? You're claiming you got more. And the difference you claim is
52.	20:26	Kimberly:	Five, one fifth.
53.	20:34	T/R 1:	Wow, that's a good question. I don't know you got one fifth. Um, it's sort of like saying to me, if I got a half, and Amy got a quarter, right? Who got more? I got more, right? I got a half, ok, and Amy got a quarter, but by your theory, you would tell me that I got, how much more?
54.	21:34	Meredith:	One fourth
55.	21:34	T/R 1:	But you would have told me a half more, think of the way you did that problem.
56.	21:19	Meredith:	Oh
57.	21:21	T/R 1:	Is that right, Meredith? Right? Did I get a half more [Meredith laughs]. You all know I didn't get a half more. I got how much more?
58.	21:21	Meredith:	Oh.
59.	21:23	T/R 1:	A quarter more. But if I used your method of figuring out how much more I'd be subtracting the four and the two, and I'd end up with a half more. That sort of doesn't make sense, does it? You still believe that it's a fifth more for sure? How many of you are not so sure? Not so sure [all students raise hands] It's a good question. Hmmm, I don't know. Well, we ought to keep this question in mind and uh, we ought to try to answer it, don't you think? Ok? I guess maybe another way to ask that question might be, might be what? You tell me what you think the question is. What are the fractions that are of interest in this problem? What decides who got more, the people in Andrew's group or the people in Jessica and Kimberly's

			group? Meredith?
60.	22:24	Meredith:	I know that Jessica and Kimberly's group got more than Andrew's group did.
61.	22:48	T/R 1:	You know they got more, right?
62.	22:50	Meredith:	Right.
63.	22:51	T/R 1:	And what number tells you?
64.	22:59	Meredith:	Well, um, if they got, uh, one fourth, and one rod was like, the one rod, and you had ninths and you had fourths, if you had the fourths they would take
65.	23:11	T/R 1:	You're talking about ninths and fourths, is that right?
66.	23:12	Meredith:	Yeah.
67.	23:20	T/R 1:	You all agree that it's ninths and fourths that's at issue here? And it's not the one piece? So let's focus on the ninth, right, and let's focus on the fourth. So which one you're claiming is bigger?
68.	23:25	Students:	The one fourth.
69.	23:26	T/R 1:	The one ninth is smaller
70.	23:28	Students:	Yeah.
71.	23:28	T/R 1:	Did you ever see that symbol, smaller than? [Figure 10-29-02]
72.	23:30	Students:	Yeah
73.	23:31	T/R 1:	One ninth is smaller than one fourth? Ok? So I'm sorry, Meredith.
74.	23:41	Meredith:	And, um, if you take a one rod and you divide it into ninths and fourths, the fourths are going to be larger because they're less. So they're going to be larger. So each person is going to be getting a larger piece.
75.	23:50	T/R 1:	Ok, so you've convinced me that if I could imagine a rod that I call one, and I imagine four pieces and I think of one of those pieces, that's going to have what number name?
76.	24:01	Meredith:	Fourths.
77.	24:08	T/R 1:	And if I kept that same rod and I imagine nine pieces, one of those pieces will have the number name.
78.	24:10	Meredith:	Ninths.
79.	24:12	T/R 1:	One ninth. And you could imagine in your head without the rods and telling me that the one ninth, that the one fourth is
80.	24:16	Meredith:	Bigger than
81.	24:18	T/R 1:	Bigger than the one ninth, or the one ninth is smaller than the one fourth. The question I'm asking is the difference one fifth? Now, could you imagine the fifth rod, what that looks like?
82.	24:31	Meredith:	Um, I think it would be the yellow rod, I'm not sure, I think it was

			the yellow rod that was the fifth.
83.	24:37	T/R 1:	Whatever you're thinking, you could imagine a fifth, you could imagine a fourth, you could imagine a ninth, do you imagine in your head, is my question, do you imagine in your head that the, if you'd compare the one fourth rod and the one ninth rod, the difference would be the one fifth rod, do you think that makes sense to you, as you're imagining this in your head?
84.	25:02	Meredith:	Ummm, if you put the four and the five together it would equal up to the ninth rod.
85.	25:10	T/R 1:	You think so? [mmm] I think we ought to get out the rods.
86.	25:11	CT:	Yeah.
87.	25:12	T/R 1:	I think we ought to get out the rods, what do you think? How many of you want to work on this? How many of you want to know how much more the people in Andrew's and Je- uh, Andrew's group, uh Jessica's group and Kimberly's group got than the people in Andrew's group. [Students raise hands, Dr. Landis enters with rods] Can somebody tell Dr. Landis the problem because she doesn't know any of the story of any of what happened and how this all came to be, could someone be so kind as to tell Dr. Landis the whole story? Kimberly do you want to give it a try? Dr. Landis? Do you want to hear what's going on?
88.		Dr. Landis:	I do want to hear it, yes!
89.	25:48	Kimberly:	First of all, they went to California and they brought back candy bars and we, yesterday, we had three groups cuz there were three candy bars and in my group and in Jessica's group got one and one fourth, but in Andrew was in his group got one and one ninth. So we're trying to figure out how much more my group and Jessica's group got than Andrew's group.
90.	26:18	Dr. Landis:	That’s an important problem, yeah.
91.	26:20	T/R 1:	Meredith conjectured one fifth.
92.	26:23	Dr. Landis:	Ok, Yeah, good
93.	26:25	Alan:	Now we gotta break out the rods.
94.	26:26	T/R 1:	Ok.
95.	26:31	Meredith:	Now we put the fifth up to the fourth
96.	26:33	Brian:	No, here. [Meredith and Brian raise hands]
97.	27:06	T/R 1:	What do you think?
98.	27:08	Meredith:	[Meredith has built a model of a blue rod and train of a purple and yellow rod.] We call this um, this is ninths, this rod has nine white

			little things, and this has five white ones in it, and this has four white ones, I added the five plus the four and it equaled a nine rod. [Figure 10-29-23]
99.	27:25	T/R 1:	I believe that. But the question, if you have the one fifth and the one fourth do you get one ninth?
100.	27:30	Meredith:	Yeah.
101.	27:36	T/R 1:	Can you show me what one fifth is and show me what one fourth is [Meredith makes a train of an orange and a red]
102.	27:48	Brian:	I don't think it fits by one fifth
103.	27:50	Meredith:	Oh, you can't even do that it's crazy. Let's see, let's get the ninths out. [Meredith places white rods next to her blue rod]
104.	28:52	Erik:	What would the, what would the ninth be? Reds?
105.	28:58	Michael:	I think the light greens might be.
106.	29:00	Erik:	[Erik has built a model of two orange rods, four yellow rods] I'm going to try the reds. One two three four five six seven eight, uh I need, give me all your reds.
107.	29:20	Michael:	I just need one more red. Dave, can we borrow one red? [Figure 10-29-24]. If that's one over, the red's one over. Then what would it be? Oh yeah! It is two more reds! See? use the two whites
108.	30:00	Erik:	Those are the tenths! Tenths.
109.	30:08	Michael:	I'm going to try light greens.
110.	30:19	Brian:	... that um one fourth, I mean, nine is smaller than one fourth by one fifth, um, because
111.	30:37	T/R 1:	Why don't you write that down, what you just said?
112.	30:42	Brian:	[Brian writes: 9 is smaller than and pauses] I mean one ninth is smaller than one fourth by one fifth.
113.	31:30	T/R 1:	Ok, so you want to write that one ninth is smaller. [Brian begins to write again on the next line - 1/9 is smaller than 1/4 by 1/5] You want to explain that to Dr. Landis? She looks very confused.
114.	32:08	Dr. Landis:	[to Alan] I'm confused. Are you confused too, Kimberly?
115.	32:14	Alan:	Here's the fourth, here's the ninth, now if you take out the fifth, if you take out one of those from the nine, you have a fifth. So this would be smaller than one ninth by one fifth.
116.	32:36	Dr. Landis:	I'm confused. This is, you said, what was this?
117.	32:14	Alan:	One fourth [purple], now here's the ninth [yellow stacked on top of the purple, Figure 10-29-25], you could take this [yellow] and put it on here [purple] and it would be nine too
118.	32:44	T/R 1:	[to Brian] So this is one ninth, I see one ninth, I don't see one

			fourth.
119.	32:47	Brian:	Oh, this is one fourth [purple rod]
120.	32:50	T/R 1:	How can this be one fourth if this is one?
121.	32:56	Brian:	Ohh. You mean it's
122.	32:58	T/R 1:	How could this be one fourth, if this is one? I don't understand that. Meredith, help me. How can the purple be one fourth if the blue is one?
123.	33:05	Meredith:	Well, I'm not really calling the blue one, I couldn't find a fourth of the blue, but if, if these are fourths of something.
124.	33:17	T/R 1:	No, well you have to tell me what it is, I need to know what you're calling the blue, because I'm confused unless you tell me what number name the blue is.
125.	33:26	Meredith:	Blue is, OK
126.	33:29	Brian:	Well, I guess-
127.	33:30	T/R 1:	Brian is calling the blue one and I could believe that the white is one ninth, I could imagine that.
128.	33:35	Brian:	We mean, is um, I guess we mean the um, like one of them, all of them is just like saying, well nine ninths you put together.
129.	33:45	T/R 1:	I understand that, I really, I understand that, I understand that you're calling this one,
130.	33:46	Brian:	Yeah.
131.	33:46	T/R 1:	And I understand that you're calling this one ninth. I have trouble now when you're calling this one fourth. [Points to purple in model, 10-29 Side 30,37]. You understand that? Well, what do you mean by a fourth? How would you convince me that something is a fourth?
132.	34:04	Brian:	Well, well um, that would be four of those.
133.	34:06	T/R 1:	That's right, how could that be a fourth? See where I'm having trouble?
134.	34:11	Brian	Well, it's like, put four of these against here, it's like a fourth [four white rods and a purple]
135.	34:16	T/R 1:	I agree that this is a fourth of this, but you called this one
136.	34:21	Brian:	Well, I guess, I guess I was wrong.
137.	34:24	T/R 1:	You want to think about that a little bit more, you and Meredith?
138.	34:27	Brian:	I guess I mean that one of them put together will just be one, will, like um, like um, this is, these are ninths, this is fifth, and…
139.	34:40	T/R 1:	Wait, wait, wait, I get mixed up again. What's a fifth?
140.	34:45	Brian:	One of these.

141.	34:50	T/R 1:	Again, if this is a fifth, how could this be a fifth if this is one? [Figure 10-29-27]
142.	34:51	Brian:	I, I'm not calling it one anymore.
143.	34:54	T/R 1:	Well, you have to always tell me what one is. Otherwise I don't understand what you're doing. What are you doing, Meredith?
144.	35:01	Meredith:	Well, I'm trying to make a model so that.
145.	35:01	T/R 1:	So you can show me what the names are?
146.	35:05	Meredith:	Yeah. [Meredith's model is composed of four purple rods and an orange and blue rod.
147.	35:06	T/R 1:	I see, well, why don't you work on that? Why don't you two talk a little bit?
148.	35:33	Dr. Landis:	Ok, that's what they're saying but what you're telling me a minute ago was that this was four.
149.	35:37	Alan:	No, this was, oh wait a minute, hold it, this would be a fourth, but you couldn't do that cuz you'd have, look. That would be one ninth. [Alan holds up one white rod. He has built a model of nine white rods and a train of a purple and yellow, Figure 10-29-28]. This would be one fourth, one fourth and one ninth would be the same size.
150.	36:00	Dr. Landis:	Oh, that's interesting.
151.	36:01	Alan:	If you take out that, and you'd have four here, [Alan builds a model of a purple rod and four white rods]
152.	36:07	Dr. Landis:	Kimberly, you'd better listen too, because I think I'm going to need your help.
153.	37:09	Alan:	Then if you eliminated one, that would be one fourth and if you eliminated one that would be one ninth but they'd still have the same value [Figure S-36-14].
154.	36:18	Dr. Landis:	So now you're saying that they're equal.
155.	36:20	Alan:	No, they're just, that's the same size, but they don't have the same number value. They're just the same size.
156.	36:26	Dr. Landis:	They're the same size but they don't have the same number value. What does that mean?
157.	36:29	Alan:	That means that this one is one ninth and that is smaller than one fourth.
158.	36:37	Dr. Landis:	You're telling me that this is one ninth [points to one white rod]
159.	36:40	Alan:	Right
160.	36:42	Dr. Landis:	And this is one fourth [points to one white rod]
161.	36:42	Alan:	Right

162.	36:44	Dr. Landis:	And you're saying that this one's smaller, to me they look the same.
163.	36:46	Alan:	In numbers. In number value.
164.	36:49	Dr. Landis:	In numbers they're smaller, but in the cubes, in the Cuisenaire rods
165.	36:50	Alan:	They're the same size.
166.	36:56	Dr. Landis:	They're the same. Is that possible to be the same size with the rods but to be different with numbers?
167.	36:57	Kimberly:	Maybe.
168.	36:57	Alan:	Yeah.
169.	36:59	Kimberly:	If you have different size wholes
170.	37:02	Alan:	If you take out one from there and then you take out one from there it's the same size
171.	37:06	Dr. Landis:	Kimberly just said that if they have different size wholes it would work.
172.	37:28	Kimberly:	[Figure S-37-17] Right, I think that if you had, it could be a ninth on this [purple and yellow train], because it equals nine, but if I took this and this [dark green and yellow train], it would probably be a higher number, because this is bigger. So they can be different number names and be the same size, but they have to be different models on the top
173.	37:31	Dr. Landis:	That's interesting, what do you think about what she's saying?
174.	37:49	Alan:	Well, I still think that about my number values. This could be a fourth and this could be a ninth because basically a number value the smaller the fraction, like, one fourth, it's bigger. But one ninth means you're dividing it into more pieces. So that would mean this had a smaller number value.
175.	37:55	Dr. Landis:	Ok, hold on, ninth, you're dividing it into smaller pieces, so what does that mean about the pieces?
176.	37:58	Alan:	So that means that these [points to the purple rod], you can only divide it into four
177.	38:00	Dr. Landis:	Right.
178.	38:00	Alan:	If you had different size rods that are smaller than this [points to white rod] you could divide this into ninths and it'd still be equal to that, but now you're dividing it into fourths, so this has a higher number, fraction value than the ninth.
179.	38:10	Dr. Landis:	Which is bigger, though, a fourth or a ninth, do you think?
180.	38:12	Alan:	A fourth.
181.	38:13	Dr. Landis:	Which do you think, Kimberly?
182.	38:14	Kimberly:	A fourth.

183.	38:15	Dr. Landis:	But I don't see them looking like they're -
184.	38:18	Alan:	Yeah.
185.	38:18	Dr. Landis:	And that's why I'm confused, you two talk about it a little because.
186.	38:22	Alan:	You could make a different model, but they'd still be the same value. Like, this would be the fourth [points to white rod], this would be the ninth [points to white rod], if you made another model that divided these up into ninths, this would still be a ninth [white rod] and this would still be a fourth [white rod]. Then you could make a model for this, you could have a fourth that was bigger, this would still be a fourth and this would still be a ninth.
187.	38:42	Dr. Landis:	I don't know, I'm just puzzled.
188.	38:45	Alan:	Well,
189.	38:45	Dr. Landis:	Because you're telling me that they're not the same size but then you're showing me with your model that they look the same. That kind of confuses me.
190.	38:52	Alan:	[counting out red rods] two three four five six seven eight nine.
191.	38:57	Dr. Landis:	Ok, if you have some- I'm going to walk around. Call me back if you kind of, uh, think of something else. Because I'm puzzled.
192.	39:05	Alan:	Ok, let's see. I need another blue.
193.	39:09	Kimberly:	Blue?
194.	39:10	Alan:	Two blues
195.	39:10	Kimberly:	I just gave one of our oranges to Graham
196.	39:17	Alan:	[Figure S-39-23] Two blues will be a whole, there [red rod] would be one ninth, but this would still be one fourth [white rod], and this would still be a higher number name than this.
197.	39:47	Kimberly:	Do you have any spare blues?
198.	39:49	Erik:	Yeah, how many? I have like twenty, if you wanted to. [camera shifts]
199.	39:55	Kimberly:	Actually, I need four.
200.	39:55	T/R 1:	Where I'm confused here is that you're telling me, what's one?
201.	39:57	Alan:	Two blues are one
202.	39:59	T/R 1:	mmm hmmm
203.	40:00	Alan:	[Figure S-41-04] The two purples are one. Here, you divide it into four.
204.	40:03	T/R 1:	Did you start out with different size candy bars when you shared?
205.	40:09	Alan:	No.
206.	40:10	T/R 1:	Why did you make the candy bars different?
207.	40:10	Alan:	Because they're one fourth and one ninth up.

208.	40:12	T/R 1:	Yeah, but you still started with the same size candy bar, I don't understand why you're switching your candy bars. Obviously you should get differences if you switch your candy bars.
209.	40:20	Alan:	What I'm just meaning is these are just models to show my hypotheses.
210.	40:23	T/R 1:	Yeah, but you're changing your candy bars, and you're not allowed to do that.
211.	40:26	Alan:	I know, these are just to explain the way I'm thinking. I'm thinking that the fourth is bigger than the ninth because if you took two of the same models and you divided it into fourths, those pieces would be bigger. If you divided it into ninths, those pieces would be smaller.
212.	40:41	T/R 1:	So do that for me. Show me, make me the same model and show me.
213.	40:46	Alan:	Let's see.
214.	40:47	T/R 1:	When you have it, call me.
215.	40:48	Alan:	Nine plus nine is eighteen, let's see. I can't wait to go to art. Dark green please? Dark green please?
216.	41:20	Erik:	Take us up to a red, give me a red. Take us up to a blue, we have that, then we need a purple
217.	41:46	Kimberly:	over here, what are those two things? Wait a minute, wait a minute.
218.	42:56	Alan:	Alright, here goes. This is the ninth, those are ninths, but you can't make ninths, you can't make fourths out of two nines. Two nines would be eighteen, no you can't fourth it. [takes purple rods] One two three, no that would be too small. Now what's the next after a purple? A yellow.
219.	43:51	Brian:	But, how, how are we going to make ninths?
220.	43:54	Meredith:	We can't. Because it's even. [They have four yellow rods and five purple rods, Figure 10-29-29]
221.	43:59	Brian:	We have to make an odd number. How about twenty-five? Last time I thought of sixty.
222.	44:13	Meredith:	Don't forget the fifths.
223.	44:20	Brian:	Yeah, um, the fifths.
224.	44:26	Meredith:	Because if you're going to do twenty-five, the fifths, the fourths,
225.	44:33	Brian:	Oh, uh,
226.	44:35	Meredith:	Very hard. You can't make ninths for it
227.	44:41	Brian:	We're trying to make ninths.

228.	44:42	Meredith:	How about we call this the ninths? This is the ninth, this is one. call this one [blue rod and nine white rods]
229.	44:56	Brian:	Yeah, but we can't make fourths and fifths out of them.
230.	45:05	Alan:	Nine is an odd number, and fourths are an even number.
231.	45:07	T/R 1:	How about half and thirds?
232.	45:10	Alan:	Half and thirds, I know, but if you had nine here, you count by twos you can't get to nine. And you can't make a model with fourths and ninths at the same time.
233.	45:17	T/R 1:	Maybe you shouldn't be counting by twos. I hear what you're saying. What would happen with the third and the fourth? You don't count by threes or fours? What happens when you work with thirds and fourths? How does it work with thirds and fourths?
234.	45:38	Alan:	The thirds and fourths, you're just thirding and fourthing it.
235.	45:42	T/R 1:	Well, compare, compare thirds and fourths to see how that works.
236.	45:45	Alan:	Ok.
237.	45:46	T/R 1:	If you want to. See how that works. See if that'll help for fourths and ninths. Ok?
238.	45:55	T/R 2:	You have to make a comparison. It's a tough one, huh?
239.	46:00	Meredith:	We're trying.
240.	46:01	T/R 2:	What have you tried?
241.	46:04	Brian:	Well, we've tried to make this. We've tried making one of these, it's like this.
242.	46:08	Meredith:	Well here's something, it shows that you started.
243.	46:08	Brian:	You split that in half and you turn it to red, and you put one of the halfs of that and you put it on that side, take one of the halfs and you put it on that side. That's what we've tried.
244.	46:18	Meredith:	But we've tried doing this.
245.	46:19	Brian:	Yeah.
246.	46:25	T/R 2:	[inaudible]
247.		Brian:	Yeah, and it didn't work
248.	46:32	Meredith:	And we tried this.
249.	46:35	Brian:	Yeah, and we tried an odd number to make the ninths, but we can't have fourths because four is an even number.
250.	46:43	T/R 2:	I think you want to think, I think you really want to think big in terms of models here, because I was walking on the other side of the room and I saw somebody come up with a model where they were able to use the rods right here to show that, to show the one fourth and the one ninth. So I think you want to think some more

			about this, ok? It's possible, is what I'm saying.
251.	47:11	Brian:	I was thinking of like a sixty or something.
252.	47:12	T/R 2:	You made a sixty?
253.	47:12	Brian:	Yeah
254.	47:15	T/R 2:	Did it work.
255.	47:17	Brian:	But it only had um fourths and um
256.	47:20	T/R 1:	They did do ninths and fourths
257.		Michael/ Erik:	We were so close. We did do ninths, and we came, we came so close
258.		Dr. Landis:	They are getting real close. What they said, you know what they just said, which I thought was real interesting, they said if your problem was eighths and fourths, they could build a million models. But this is more
259.	47:21	T/R 2:	I'd be interested to see what
260.	48:02	T/R 1:	Do a third and a fourth. Compare a third and a fourth, you've done that one, right. You've done a third and a quarter maybe if you do that it will help you understand how to do a fourth and a ninth.
261.	48:08	Michael:	The quarters are these.
262.	48:10	T/R 1:	Is there enough?
263.	48:11	Michael:	These are the quarters
264.	48:14	T/R 1:	He's thinking, he's thinking.
265.	48:14	Erik:	My brain is very scrambled I have no idea what's going on.
266.	48:28	T/R 1:	If you believe that you can do a third and a quarter, right? So what's the difference, between a third and a quarter? What's the difference?
267.	48:36	Michael:	One.
268.	48:39	T/R 1:	One what? What number name would you give to that white rod?
269.	48:43	Erik:	One twelfth.
270.	48:45	T/R 1:	One twelfth. You can do a third and a quarter, you said it's a twelfth, not one, right? Does that help you?
271.	48:52	Michael:	Oh, I get it!
272.	48:53	T/R 1:	You do?
273.	48:54	Michael:	Yeah.
274.	48:56	T/R 1:	What do you get?
275.	48:57	Michael:	Sort of like, um,
276.	49:01	T/R 1:	What's a half and a third?
277.	49:03	Michael:	A half and a third? The half is a half

278.	49:07	T/R 1:	If I compared a half and a third, you wouldn't get one, would you?
279.	49:09	Michael:	No.
280.	49:10	T/R 1:	What would you get?
281.	49:11	Michael:	One twelfth.
282.	49:13	T/R 1:	Show me. You said a quarter and a third, right, you got a twelfth, now compare a half and a third.
283.	49:21	Michael:	A half and a third?
284.	49:35	Erik:	I think I have a conclusion.
285.	49:40	Michael:	Oh I've got an idea!
286.	49:40	Erik:	I do too, I do too. I think I got it somehow.
287.	49:44	T/R 1:	Try this one.
288.	49:45	Erik:	Dr. Maher, I think I have it somehow.
289.	49:50	Michael:	It's a sixth!
290.	49:51	Erik:	I think I got it, Michael I think I got it.
291.	49:55	Michael:	Sixth, and then the thirds...
292.	49:58	Erik:	Mike, I think I got it.
293.	50:01	Michael:	It's one, what? It's one sixth. Look at that! It's one sixth.
294.	50:08	T/R 1:	What do you have with a half and a third, it's not one, huh? And a quarter and a third what did you say it was?
295.	50:18	Michael:	One twelfth.
296.	50:20	T/R 1:	Now we have a fourth and a ninth.
297.	50:23	Erik:	I think I just figured it out somehow.
298.	50:25	T/R 1:	What did you figure out, Mi- Erik?
299.	50:28	Erik:	Well what I did was I
300.	50:29	T/R 1:	You're really trying to confuse me, you two. Michael's now sitting by Erik, and Erik's now sitting by Michael [laugh] and now you want to know why I call you by the wrong names. Ok, tell me what you figured out.
301.	50:39	Erik:	Well I don't know, I did this thing, I don't know if it's, kind of tricky but - I said like this, three blues and then for the ninths I did light greens, and then for the fourths I did three browns and then I took a light green because I figured that evenly odd, even, odd it could take one and then put it and
302.	51:04	Michael:	My first thing was that I got, that I could get ninths out of was eighteen so I made an eighteen rod and I couldn't get fourths out of it.
303.	51:08	T/R 1:	Just think what you just did. You did very important things. You know what do me a favor, if you would build the two models you

			just made for comparing a half and a third and a quarter and a third on the board.
304.	51:30	Alan:	In one model. So that means up here there are ninths. You can't fourth that. It's not even. Now here
305.	51:38	T/R 2:	Yeah, but a third wasn't even.
306.	51:41	Alan:	Right, but you can't do it! Because you can't ninth that, nor can you ninth that, none of those, nor can you ninth two oranges in any way. Nor can you ninth any other combination, you can only ninth one blue or two blues. But you can't fourth a blue.
307.	51:52	T/R 2:	Are you sure about that?
308.	52:06	Alan:	Pretty much. I guess. What? You too? You too?
309.	52:12	T/R 2:	I'm just thinking back to some other models that we've built over the past month and I'm not
310.	52:17	Kimberly:	I though I was the one driving him crazy, not him driving me crazy. [T/R 2 laughs].
311.	52:26	T/R 2:	See, let me ask you another question, do you have to use blues in order to show ninths? Is there anything else you can use?
312.	52:32	Alan:	Yeah, no but I know but if you try singular things a singular blue you could ninth but you have to either add another rod onto some other rod to ninth cuz you can't use the two, the four, the two, the three, the four, the five, the sixth, the seventh the eighth, ... you can't do it, that equals up to twenty. You can't ninth twenty.
313.	53:21	T/R 1:	We have Graham and Kelly they have a model they want to share
314.	53:24	Dr. Landis:	Great I'd love to hear about that!
315.	54:29	Jessica:	[to Graham and Kelly] Did you get ninths yet? Did you get fourths?
316.	54:37	:	[Michael and Erik build the following models on the OHP: an orange and red train with four light green rods, three purple rods, and a white rod, and an orange and red train with two dark green rods, three purple rods, and a red rod. Figure 10-29-20]
317.	58:48	T/R 1:	[talking to Erik, Michael, Kelly, Graham, David, and Meredith] How is that model related if at all to these models?
318.	58:53	Erik:	Well they don't have fifths, and they don't have this.
319.	58:56	T/R 1:	No, they don't
320.	58:57	Michael:	They have ninths - like that! One two three four five six seven eight nine.
321.	59:02	T/R 1:	They're comparing ninths and fourths, Meredith, why do they need fifths. Your theory is they need fifths. Now they're comparing

			ninths, this is fourths, right? [Lays down blue rod] And this is ninths, is that correct? [Lays down purple rod]
322.		Graham:	Yeah [Figure 10-29-16]
323.		T/R 1:	You're comparing fourths and ninths and it's this, ok? [Graham hands teacher the yellow rod, and she shows that the yellow and purple are the same length as the blue rod]
324.	59:21	Meredith:	That's my method.
325.		T/R 1:	Well, so what number name are you going to give this? [Talking about the yellow rod]
326.		Graham:	This?
327.		T/R 1:	Wait a minute, let me see what you have here. This is one two three four and this is one two three four five six seven eight nine.
328.		Graham:	What, the white ones? What would we give the white ones?
329.		T/R 1:	You're saying how much is the difference? Do you have any more white ones? Can you get some or borrow some? Ok, let's see. Meredith?
330.		Kelly:	It's bigger by one fifth because you see. [Points to blue rod with one purple and five whites next to it]
331.	59:23	T/R 1:	What number name is this?
332.		Graham:	Thirty-fifths, one thirty-fifth.
333.		T/R 1:	Thirty-fifths.
334.		Graham:	Yeah. [T/R 1 straightens out model, Figure 10-29-17]
335.		T/R 1:	One two three four five six seven eight nine. And how many of them are there here? Counting? [Graham counts]
336.		Graham:	Thirty-six.
337.		Meredith:	What?
338.		Graham:	Thirty-six.
339.		Voice:	Thirty-six?
340.		Graham:	Yeah.
341.		Voice:	So what would that white one be?
342.		Graham:	One thirty-six. Ok, he’s right.
343.		T/R 1:	So what do you have here? What did you come up with, Kelly?
344.		Kelly:	One thirty-sixth.
345.		T/R 1:	How many? What's the difference?
346.	1:02:27	Graham:	Well, there's thirty-six. [In addition to the larger model of a train of three orange rods and a dark green rod, nine purple rods, four blue rods, and thirty-six white rods, there is a small model of a blue rod, a purple rod, and five white rods]

347.	1:02:30	T/R 1:	There's thirty-six of these?
348.	1:02:30	Graham:	Yeah, the whites.
349.	1:02:32	T/R 1:	And what's the difference between the two? How many of the thirty-sixths?
350.	1:02:38	Graham:	Five.
351.	1:02:39	T/R 1:	So, the difference between one ninth and one quarter is how much?
352.	1:02:40	Graham:	Five
353.		Kimberly:	Thirty-sixths.
354.		T/R 1:	Five thirty-sixths.
355.		Meredith:	And one fifth.
356.		T/R 1:	Well, where's the one fifth?
357.		Meredith:	Well, if you had one
358.		Kelly:	There's no one fifth.
359.	1:02:49	T/R 1:	Do you think that this is five thirty-sixths. If you could imagine one fifth in here,
360.	1:02:56	Meredith:	Yeah.
361.	1:02:56	T/R 1:	Right?
362.	1:02:56	Meredith:	Uh huh
363.	1:02:56	T/R 1:	You could imagine one fourth, it's the blue, right? Is this [yellow rod] one fifth? For one fifth, [T/R 1 places five yellow rods on the model] Could that be one fifth? Is that big enough to be one fifth?
364.		Kelly:	I don't think it's one fifth.
365.	1:03:14	Meredith:	Well, but it does have uh five thirty-sixths in there.
366.	1:03:19	T/R 1:	It's this length, but this has the number name, what, what, the yellow has what number name?
367.	1:03:29	Meredith:	Five thirty-sixths.
368.	1:03:30	T/R 1:	Five thirty-sixths. Not one fifth, right?
369.	1:03:33	Meredith:	Uh huh.
370.	1:03:33	T/R 1:	Think about what is causing the difficulty, ok, Meredith? [to class] Ok, is this a good time maybe to pull together for a few minutes and do some sharing? [no] Is this a good time? [to Kelly] Keep your model here. [to class] Ok. Is it possible, can, can I have your attention for a minute, we have a little bit of extra time thanks to Dr. Landis, uh, she's given us a little extended time, but we have some interesting ideas here and I think it's really important to share our ideas, I see some wonderful models another model here, right, with, um, Mark and Audra, right? You have another model. I guess, um, I was very interested in listening to your ideas as I walked

			around and I heard um our, does anyone, did anyone change their mind what they thought the difference between, uh, one quarter and a ninth were? Did anybody change their mind? Some of you changed your minds? How many of you still aren't sure about that difference [some students raise their hands]. Ok, so, so we had a theory, let's call it Meredith's theory, but she may have changed her mind she may not have, but Meredith's theory seems to suggest that if you wanted to find the difference between one fourth and one ninth that it's one fifth. That was the theory that we were testing, right? Now, if you used that same theory and I asked you what the difference was between one quarter and a third, and you applied that theory, what would you have said the difference was between a quarter and a third?
371.	1:05:48	Meredith:	A quarter and a third?.
372.		T/R 1:	Using that same theory.
373.		Meredith:	A quarter and a third would be, well, how big would the third be.
374.	1:06:06	T/R 1:	Ok, well one of the gentlemen here who have built the models up here, can you all kind of listen for a minute to what Michael and Erik and um James have built
375.	1:06:15	Students:	James?
376.	1:06:16	T/R 1:	I'm sorry, not James, it's David.
377.	1:06:21	Michael:	Um, uh, well, what me and Erik, me and Erik started building models like these to try and help us figure out how to one fourth and one ninth, and Dr. Ma- and um, and then we were on the edge of trying to find it out and then we had another model we started just we lost the idea of that was that we had before and
378.	1:06:53	T/R 1:	Do you want to tell us what that idea was?
379.	1:06:54	Michael:	Well, that idea was, try to get, try to um find the number and divide, um, divide it and see if it equals nine, then you've got a ninth, but we found that every single one that we tried there wasn't a fourth if there was a ninth, and if there was fourth there wasn't a ninth. So, um, we, we, um, we decided to try a new idea it turns out when we, uh, when we tried the new idea, the first time we tried it we were wrong.
380.	1:07:28	T/R 1:	What was that new idea?
381.	1:07:31	Michael:	Well, I don't really remember what we were thinking.
382.	1:07:34	T/R 1:	Was it the odd and even?
383.	1:07:40	Michael:	Yeah, I think so, yeah, what I also figured, um, is that you, it's so

			hard, like if you had you had to make a model with one fourth and one eighth in it, we could make a ton of them, but it's hard to make a model that has an odd number, like one ninth, and a even number, which is one fourth. So I figured that that was really hard and we made only like two models or so of it and it was really hard to find to get a train to something like that.
384.	1:08:11	T/R 1:	Ok, so where did that leave you. You told me there couldn't be any models when you had an odd and even.
385.	1:08:17	Michael:	I know. But then we figured that it had to be, because there was no other way to do it.
386.	1:08:22	T/R 1:	But you built two models here and you're comparing fractions where, you have an odd and even number on
387.	1:08:28	Michael:	Well, I didn't really, I was just trying to get an idea from these old models and I didn't get one, but I guess Dr. Maher did, so she wanted us to come up and say what we were thinking, I was just trying to get an idea from it.
388.	1:08:46	T/R 1:	When you compare this top one, what numbers were you comparing when you built this model here? [Continuing figure 10-29-20]
389.	1:08:50	Michael:	One third and one fourth.
390.	1:08:52	T/R 1:	And what did you find?
391.	1:08:53	Michael:	We found that it worked.
392.	1:08:53	T/R 1:	What worked?
393.	1:08:54	Michael:	That an odd and an even can go into a whole.
394.	1:09:02	T/R 1:	So, you mean you compared the quarter and the third, what did you find to be that difference?
395.	1:09:07	Michael:	The difference would be, the difference would be one twelfth. But in this model with the half and the third it would be one sixth.
396.	1:09:18	T/R 1:	Ok, so you could do that. Ok, um, alright, now James did James has some idea here let's here what James says and we all know that Graham and, why don't you sit down? Thank you very much, gentlemen. And let's, let's hear what James' idea is and then we'll hear if Graham and Kelly agree. Where did Graham go?
397.	1:09:40	James:	[at OHP] can I take this off?
398.	1:09:40	T/R 1:	Yeah, sure.
399.	1:10:26	James:	[James put an overhead transparency on OHP, Figure 10-29-21] Well, like, I got a huge model for this problem. First, but by experimenting I tried nine yellows and four oranges, for the ninths

			and the fourths. and I found out they weren't equal so I tried something else. I lowered its size so orange and uh the orange and the yellow and we got blue as the fourths and purple as the ninths and they were equal. So I just had to find a whole for that and I found out it was I just took three oranges and one dark green so then I had then I put up thirty-six whites on up to the whole and there, it took five whites to make the purple equal to the blue, so I think the answer would be five thirty-sixths.
400.	1:10:38	T/R 1:	What do you think? Anybody do anything like that?
401.	1:10:40	Erik:	Well I guess I sort of
402.	1:10:43	T/R 1:	Oh, Erin, Jackie, Beth, what did you do? Did you do something like that?
403.	1:10:47	Erin and Beth:	Uh, yes.
404.	1:10:48	T/R 1:	Just tell us about it.
405.	1:10:48	Jackie:	Um, well, we did the same thing we have the same fourths and the same ninths
406.	1:11:52	Beth:	But we have a different whole.
407.	1:11:58	T/R 1:	So you called one and you used different rods to show your one?
408.	1:12:01	Beth:	Yeah.
409.	1:12:02	T/R 1:	Ok, and so, uh, can you move aside a little bit, Erik, so the class can see? Uh, so your model here, it looks very much the same as James' model
410.	1:12:12	Jackie:	Except we have, instead of three oranges and one dark gree we have one dark green, one orange, one red, um, one black, one brown, and a light green.
411.	1:12:27	T/R 1:	Ok, so what rod did you give the number name one quarter?
412.	1:12:36	Erin:	Um blue.
413.	1:12:37	T/R 1:	The dark blue? And what rod did you give the number name one ninth?
414.	1:12:40	Girls:	Purple
415.	1:12:41	T/R 1:	Did you do the same thing?
416.	1:12:41	James:	Yeah.
417.	1:12:45	T/R 1:	Did anybody else do that? You did that and you did that and you did that and you did that? Ok, and so what number name did you give the white one?
418.	1:12:52	Girls:	Thirty-sixths, one thirty sixth.
419.	1:12:54	T/R 1:	One thirty-sixth? And what did you find the difference was

			between the ninth and the quarter?
420.	1:12:59	Jackie:	Five thirty-sixths.
421.	1:13:02	T/R 1:	How many of you got five thirty-sixths? I see. I see. Ok, what do you think? So, so you can actually see. What makes this problem so hard? What makes it so hard?
422.	1:13:21	Kimberly:	The odd number and the even number.
423.	1:13:25	T/R 1:	Pardon?
424.	1:13:25	Kimberly:	The odd number and the even number.
425.	1:13:28	T/R 1:	The odd and the even number? What about that makes it hard? You have a four and a nine.
426.	1:13:32	Kimberly:	Because it's harder to make a model when you have an even number for one and an odd for the other.
427.	1:13:39	T/R 1:	Ok, now have you learned anything on the models that you've seen today that might help you get some ideas for how to pick that number? If you remember that Erik and Michael when they compared a half and a third, what was your difference?
428.	1:13:57	Michael:	A half and a third?
429.	1:13:58	Erik:	A half and a third was
430.	1:13:59	Michael:	Was one sixth.
431.	1:14:00	T/R 1:	When you compared a half and a third it was one sixth. And when you compared a third and a quarter?
432.	1:14:06	Erik:	It was, it was, one one twelfth.
433.	1:14:07	T/R 1:	It was one twelfth. And when you compared a quarter and a ninth?
434.	1:14:17	Michael:	A quarter and a ninth?
435.	1:14:18	T/R 1:	One fourth and one ninth?
436.	1:14:19	Michael:	Oh.
437.	1:14:21	T/R 1:	It became, who did it here? You did it here, Erin and Beth you got five thirty-sixths.
438.	1:14:33	Michael:	Oh, it sort of went up by six I guess.
439.	1:14:37	T/R 1:	It's something to think about, isn't it? It's something to think about, right? Well we have here, thank you very much, and Kelly and Graham and all of those wonderful models, I'm going to keep this, that's lovely, thank you. How many of you believe the difference is five thirty-sixths, raise your hands. If you don't believe it, if you need to walk over to these models before we put them aside and see what they've done. When, we compared one half and a third, we got one sixth. When we compared a third and a quarter, right? We got one twelfth. When we compared a quarter and a ninth we got five

			thirty-sixths. [Writes on transparency: 1/2- 1/3 = 1/6, 1/3 - 1/4 = 1/12, 1/4 - 1/9 = 5/36, Figure 10-29-22.] Is there anything in these numbers that relate to the model you built? That's my question. We'll let you think about that. If you haven't built the model, I really think we have enough people here, we have Kelly and Graham, we have the table in the back, what do you think? Ok, so we can think about them. I'm wondering if there's anything that might give you a clue to building your models in the future. Maybe you ought to try to build some more and study these a little bit. It's something to think about. Ok, I'm going to see you on Monday, good! We get to talk some more. Thank you very much and thank you for staying longer, I appreciate, Mrs. Phillips, the extra time.
440.		Ms Phillips	This was terrific.
441.		TR1	A really good job. A really good job.
442.	1:16:40		Clean up, collecting papers, etc.