| **Line** | **Time** | **Speaker** | **Transcript** | **Pictures** |
| --- | --- | --- | --- | --- |
|  |  | T/R1 | Thank you all, thank you all for coming. |  |
|  |  | BRIAN | Is this table slanted? |  |
|  |  | MICHAEL | Yeah, I know, I was looking at- |  |
|  |  | T/R1 | Yeah, well, you know you can move back in. I have a problem for you. |  |
|  |  | JEFF | All right. |  |
|  |  | BRIAN | Yes! [Punching the air with is right fist.] |  |
|  |  | T/R1 | You’re all set. |  |
|  |  | BRIAN | Let’s do this. |  |
|  |  | T/R1 | Okay. |  |
|  |  | JEFF | We’re going to do taxicab geometry? |  |
|  |  | T/R1 | (Do) you know about it? |  |
|  |  | JEFF | I have no clue. |  |
|  |  | T/R1 | Did you ever hear of it? I understand that you all love geometry. I was listening to your interviews. |  |
|  |  | JEFF | Awe. [Wiping the left side of his face with his left hand]. |  |
|  |  | T/R1 | So, I though we would end with a smash of a problem in taxicab geometry. Okay. Why don’t I just give you the problem, okay? Um, I’ll give you a chance to look at it, and see if you understand the problem. [Leaving the table.] |  |
|  | 00:01:17 | Jeff | You have to stay on the lines, right? Those would be streets? |  |
|  |  | T/R1 | Exactly. |  |
|  |  | JEFF | I agree. |  |
|  |  | ROMINA | Isn’t it like anyway you go- |  |
|  |  | BRIAN | Pretty much, because look- |  |
|  |  | ROMINA | As long as you don’t go like past it. [Facing Brian’s direction.] |  |
|  |  | BRIAN | The first one- No, ‘cause. |  |
|  |  | MICHAEL | Well what if you go to the last one- |  |
|  |  | BRIAN | You can go all the way down and go over, and go down three and go over, and then down two. [Tracing the routes above the problem sheet with a black marker in his right hand.] |  |
|  |  | ROMINA | Isn’t it- Don’t they all come out to be the same amount of blocks? [Jeff beginning to draw.] |  |
|  |  | BRIAN | Five. |  |
|  |  | JEFF | Five? |  |
|  | 00:01:54 | ROMINA | Five? I got seven. |  |
|  |  | JEFF | Uh, which one- Yeah, we were both looking at the red one. |  |
|  |  | BRIAN | I’m looking at blue. [Michael tapping his pen on the grid along intersection points.] |  |
|  |  | JEFF | Yeah. |  |
|  |  | ROMINA | Oh, okay. |  |
|  |  | JEFF | All right. I mean pretty much. |  |
|  |  | ROMINA | As long as you don’t go like past it you’re fine. So it’s the same thing. |  |
|  |  | BRIAN | So, let’s prove it. |  |
|  |  | T/R1 | Okay, does somebody want to tell me what you think you understand the problem to be asking? |  |
|  |  | JEFF | Um, what’s the shortest route from there to here staying on the streets, right? |  |
|  |  | T/R1 | Okay, is there more than one shortest route? |  |
|  |  | BRIAN | Yes. |  |
|  |  | ROMINA | Yeah. |  |
|  |  | T/R1 | In other words, if there is, how many? |  |
|  |  | ROMINA | Ah- |  |
|  |  | BRIAN | Let’s do the blue. |  |
|  |  | T/R1 | Okay? |  |
|  |  | JEFF | All right, how many different shortest routes are there? |  |
|  |  | T/R1 | Yes. |  |
|  |  | JEFF | Is what you’re asking right now? //All right. |  |
|  |  | T/R1 | //Mm hm. |  |
|  |  | BRIAN | Blue’s got five. |  |
|  |  | T/R1 | Okay. And how do you know? You’re going to have to convince us. Okay. |  |
|  |  | BRIAN | All right. |  |
|  |  | T/R1 | If you need us call me or Gina. [Inaudible]. |  |
|  |  | ROMINA | I have five. |  |
|  | 00:02:59 | JEFF | Can we have like a- You have colored like markers? Word! [Responding to T/R2’s statement that she will give them some markers.] |  |
|  |  | BRIAN | For what? |  |
|  |  | JEFF | Because then we can just do each route a different color. To like- [Waving his hand.] |  |
|  |  | ROMINA | Yeah, but they all kind of go on top of each other. |  |
|  |  | JEFF | Well, I mean, I don’t know. I mean, let’s see what it looks like. If it get too ugly then- Which one are you doing? |  |
|  |  | ROMINA | Which one do you want to do? |  |
|  |  | JEFF | I’ll go to red. |  |
|  |  | ROMINA | I’ve got blue. |  |
|  |  | BRIAN | I did blue. |  |
|  |  | JEFF | Brian already- |  |
|  |  | ROMINA | One- |  |
|  |  | BRIAN | It’s just going to look like you’re filling //in the boxes. | 00:03:19 Brian’s paper shows the three points: blue at (1, -4), red at (5, -3), and green at (6, -5). |
|  |  | ROMINA | //Two. Yeah, it is. |  |
|  |  | JEFF | That’s what it’s going to end up looking like, right? |  |
|  |  | ROMINA | Yeah so screw it. There’s- Okay, so we know five- |  |
|  |  | JEFF | Well,- [Romina writing “Blue 5” on her paper to the right of the grid and tracing routes with her pen on the grid.] |  |
|  | 00:03:35 | BRIAN | Just count them and then make sure you know how you got them. You know? [Jeff and Romina counting by tapping their pen or marker on the grid. Each of them counts on their own grid.] |  |
|  |  | JEFF | Yeah. | 00:03:39  Jeff begins counting paths to the red point by writing on the grid. |
|  |  | ROMINA | One, two- |  |
|  |  | JEFF | So why- why is it the same every time? |  |
|  |  | MICHAEL | You’re going left and right. |  |
|  |  | ROMINA | Ours is a four by one, right? |  |
|  |  | MICHAEL | Yeah, it’s a four by one, unless you go backwards a couple of times. |  |
|  |  | ROMINA | You can’t go, well- |  |
|  |  | MICHAEL | I know that would be dumb.// |  |
|  |  | BRIAN | //[inaudible] the shortest route only if you go forward. |  |
|  |  | MICHAEL | But the only- You can’t go diagonal so you have to go up and down. So if the thing is down this many and// |  |
|  |  | JEFF | //Over that many, //it’s the same |  |
|  |  | MICHAEL | //It’s the same- |  |
|  |  | ROMINA | //It’s the same area |  |
|  |  | MICHAEL | No matter how you do it, no matter how you do it it’s you have to- you can’t //get around doing that. [Pointing and gesturing around his grid] |  |
|  |  | ROMINA | //All right. |  |
|  |  | MICHAEL | //You can’t get around going four down and right one ‘cause -. |  |
|  |  | JEFF | All right, yeah. All right. |  |
|  |  | MICHAEL | You can’t go over there. You can’t get around doing that. |  |
|  |  | JEFF | Yeah. |  |
|  |  | ROMINA | What if I were to go like to the red when I go one, two, three, four- [Pointing at her problem sheet.] |  |
|  |  | MICHAEL | But they’re not asking for like a //[Inaudible]. |  |
|  |  | ROMINA | //Five, //six, seven. |  |
|  |  | JEFF | //Five, six, seven. //It’s the same thing. |  |
|  |  | ROMINA | //Like //how- how am I going to- like //how would I- |  |
|  |  | JEFF | //It’s the same thing. |  |
|  |  | MICHAEL | //It’s the same. |  |
|  |  | ROMINA | -devise an area for that? Like this- this area up here? [Motioning with her pen on her grid, indicating the area of the rectangular space whose vertices are taxi stand and the red pick-up point.] |  |
|  |  | BRIAN | Like plus and [Inaudible]. |  |
|  |  | JEFF | Well, it’s not area. |  |
|  |  | MICHAEL | It’s not area. It’s //just a- |  |
|  |  | JEFF | //It’s the perimeter. It’s like //each one being one. |  |
|  |  | MICHAEL | //One, two, three, four, five, six, seven. [Pointing at Romina’s paper and counting the length of a route to the red pick-up point.] [Jeff scratching his head.] |  |
|  |  | ROMINA | All right. |  |
|  |  | MICHAEL | There’s no way you can get around going- [Gesturing with his hands] |  |
|  |  | JEFF | //Going seven blocks. |  |
|  |  | ROMINA | //No, yeah, I understand. |  |
|  |  | MICHAEL | Across that many and down that many because you can’t go diagonally. Can’t- [Gesturing with his hands over his problem sheet across to the left and then down] |  |
|  |  | JEFF | Yeah. |  |
|  |  | MICHAEL | Can’t get around it, so- [gesturing with his hands] |  |
|  |  | JEFF | I mean, that’s the most sensible way I think to say that. Right? And they want to know how many though. |  |
|  |  | BRIAN | Are there seven possibilities, though? You know how like blue was five? There’s five possibilities but- |  |
|  |  | JEFF | Ah, so- |  |
|  |  | BRIAN | You know how it’s only like five spaces. Like one, two, three, four, five. [Pointing at the grid on his problem sheet.] |  |
|  |  | ROMINA | Yeah, so if it goes more. |  |
|  |  | BRIAN | Is there seven for blue, I mean red? |  |
|  |  | JEFF | Well, check it out. |  |
|  |  | BRIAN | You’ve got one- [Pointing at the grid on his problem sheet] |  |
|  |  | ROMINA | Here, I’ll- //Me and Michael do |  |
|  |  | MICHAEL | //Is that the shortest routes? |  |
|  |  | ROMINA | Me and Michael do greens. The green one. |  |
|  |  | BRIAN | All right. |  |
|  |  | MICHAEL | //Oh, like that’s the biggest one. [Pointing at paper] |  |
|  |  | ROMINA | //And they’ll do red. |  |
|  |  | BRIAN | Green is nine I think. [Then he begins to check thisidea.] |  |
|  |  | ROMINA | Well //count how many ways. [They use their pens or markers to count on the grid.] |  |
|  |  | JEFF | //All right, we’ll look for it. |  |
|  |  | MICHAEL | One, two- [counting and pointing at paper] |  |
|  |  | BRIAN | Ten. My bad. [Correcting himself on the length of a shortest path to green.] |  |
|  |  | MICHAEL | There’s a lot. |  |
|  |  | ROMINA | Yes I know. I’m trying to devise a- like a- |  |
|  |  | JEFF | The- the way to do it? |  |
|  |  | ROMINA | Yeah. |  |
|  |  | JEFF | This is hard. [Romina draws routes on her grid with her pen.] (00 |  |
|  |  | ROMINA | Two- |  |
|  |  | JEFF | How many was there? For, um, for the blue dot. How many different ways. |  |
|  |  | BRIAN | Five. |  |
|  |  | ROMINA | Ha…I already lost count. [of the number of shortest routes to the green pick-up point.] | 00:05:53 Brian’s paper shows him working on a method to track the paths. |
|  |  | JEFF | How many //you got for red so far? [Talking to Brian] | 00:05:59 Jeff’s paper indicates path drawn to the red point. |
|  |  | ROMINA | //Well, I’m saying like if you go //all the way over. [Leaning over and pointing with her finger at the grid on Michael’s problem sheet.] |  |
|  |  | BRIAN | //Two, three- [pointing at paper] |  |
|  |  | ROMINA | And then //you go all the way// over and leave only one space. [Romina points to Michael’s grid and motions with her finger.] |  |
|  |  | MICHAEL | //Yeah. One, two, three- Yeah, one, two, three, four, five, six. Six going like that. [Outlining routes on his problem sheet.] |  |
|  |  | BRIAN | One, two, three, //four. |  |
|  |  | JEFF | //You only got five? |  |
|  |  | BRIAN | No I’m just. |  |
|  |  | JEFF | Oh, I can’t. //I can’t keep //track of what I’m doing. [While Romina watches, Michael traces routes with his marker on the grid, without writing.] |  |
|  |  | MICHAEL | //Six this way. //Then you got- |  |
|  |  | JEFF | You know what I’m //saying? |  |
|  |  | MICHAEL | //possibility of doing this. //One, two- |  |
|  |  | ROMINA | //Yeah. How do we get that. |  |
|  |  | MICHAEL | -three, four. Oh, got one. But then you got // Ah, this is a lot |  |
|  |  | ROMINA | //Yeah, you could do this. [Michael counting by tracing with his pen.] |  |
|  |  | MICHAEL | You guys want to do the green? We’ll do the blue. |  |
|  |  | JEFF | No that’s all right. //We already did the blue. |  |
|  |  | BRIAN | //We already did the blue. |  |
|  |  | ROMINA | Yeah, the blue is fine. |  |
|  |  | BRIAN | We’re doing red. |  |
|  |  | ROMINA | Okay, we can’t count. Like we need a- can’t we- can’t we do towers on this? (00 |  |
|  |  | JEFF | That’s what I’m saying. Look, all right, you go to here |  |
|  |  | ROMINA | And they’re like blocks. |  |
|  |  | JEFF | All right, you go to here and you got a choice of going there or there. Right? [Indicating a choice of across or down at an intersection point of the grid on his problem sheet.] So then you pick one of those and then you got a choice of there or there. When you get to you know what I’m saying? Maybe we can add all those up or something and get like a whole- [Explaining routes on grid paper.] |  |
|  |  | ROMINA | All right. |  |
|  |  | MICHAEL | There’s a lot. |  |
|  |  | ROMINA | Okay, for ours there’s ten // |  |
|  |  | MICHAEL | There’s more than ten. |  |
|  |  | ROMINA | No. I mean there’s ten blocks. Like ten lines to get to that thing, right? |  |
|  |  | MICHAEL | Yeah, six by five. |  |
|  |  | ROMINA | So if there’s ten, ten could be like the number of blocks we have in the tower. (00 |  |
|  |  | MICHAEL | This is one- |  |
|  |  | ROMINA | How do we do that? Two to the *n*? [Moving her pen cap on and off of her pen.] |  |
|  |  | MICHAEL | How- how many? This was five they said? [Pointing to the blue pick-up point on his problem sheet.] |  |
|  |  | ROMINA | Yeah. [Looking back to her problem sheet.] |  |
|  |  | MICHAEL | How much you guys get for the red? Still doing that one? |  |
|  |  | ROMINA | How could- |  |
|  |  | MICHAEL | It’s got to be some kind of pattern. |  |
|  |  | ROMINA | Okay, there’s ten lines- ten lines- |  |
|  |  | MICHAEL | Ten ways of getting there. So you can do. Like you got to |  |
|  |  | ROMINA | There’s ten different lines to get there. |  |
|  |  | MICHAEL | Think of the possibilities of doing this and then doing that. [Pointing at an intersection on his problem sheet grid and gesturing downward and then rightward.] |  |
|  |  | ROMINA | Well how many- okay, there’s ten. How many lines //end up in the thing? | 00:07:53 Brian continues writing staircase patterns. |
|  |  | BRIAN | //What are you doing man? |  |
|  |  | JEFF | I’m just- I’m not, uh, trying to- [Drawing routes on grid paper.] |  |
|  |  | ROMINA | Two, //three, four, five, six, seven, eight. |  |
|  |  | MICHAEL | //Three, four, five. |  |
|  |  | JEFF | -get easier. |  |
|  |  | MICHAEL | There’s thirty plus- I have thirty. About sixty I think. [Pointing with the pen on the grid.] You might want to- |  |
|  |  | ROMINA | So- It couldn’t be like a block ten high in six different colors, type deal? That would be- [Counting on the grid with her pen,] |  |
|  |  | MICHAEL | There’s like- there’s ten line- there’s ten like lines in here and the answer was five. So I’m waiting for them maybe. That’s like a half or something. |  |
|  |  | ROMINA | So maybe it’s thirty? [Counting the number of rows in the array and then draws a symbol. Jeff adds an “L” to the third row, left hand corner box and then adds an “L” to the fourth row left corner box.] |  |
|  |  | MICHAEL | It’d be nice if it was. |  |
|  |  | ROMINA | How many are there in here. One, two, three, four, twelve, twenty-. You guys got at least twenty-four yet? |  |
|  |  | JEFF | Uh, which, wait a sec- |  |
|  |  | BRIAN | I’m at eight. What to do you think? What are you guys thinking? |  |
|  |  | ROMINA | To get to this one, there could also be five times two but there’s ten lines- |  |
|  |  | BRIAN | I’ve counted it. |  |
|  |  | ROMINA | And there’s five ways to go. |  |
|  |  | JEFF | Wait, for five? |  |
|  |  | ROMINA | For the blue one. |  |
|  |  | JEFF | There’s ten lines? |  |
|  |  | ROMINA | //[Inaudible]. |  |
|  |  | MICHAEL | //You got eight for red. I already have nine. | 00:09:25  Jeff works individually on simplifying the number of paths to the red point. He appears to be reconsidering the blue point. |
|  |  | JEFF | //No but I’m like- |  |
|  |  | MICHAEL | //You have eight? |  |
|  |  | BRIAN | I’m drawing them. I’m not stumped; I’m just like not speeding through it. You know. Did you count the middle lines? |  |
|  |  | MICHAEL | No, I just got eight from the- you know, just- just //[Inaudible]. |  |
|  |  | ROMINA | //I didn’t- I didn’t do it. |  |
|  |  | BRIAN | All right. |  |
|  |  | MICHAEL | I was thinking about that- |  |
|  |  | ROMINA | So ten- |  |
|  |  | MICHAEL | Let’s- let’s try doing the red one. Let's try doing the red one. |  |
|  |  | ROMINA | Yeah but, how you going to know when we- how are you keeping track though? [Romina places her hand on her head.] |  |
|  |  | MICHAEL | I don’t know. I’m just- see like if I can just not forget. Are you going to like //just write them down? |  |
|  |  | ROMINA | //We can do what Brian’s doing. Like we’ll just draw a big thing on the board. |  |
|  |  | JEFF | And just go over each way to do it? There’s got to, there’s got to be |  |
|  |  | ROMINA | //There’s got to be something. |  |
|  |  | JEFF | //some kind of math- You know what I’m saying? [Placing his hand on his head.] |  |
|  |  | ROMINA | All right. |  |
|  |  | BRIAN | How many do you think for red? Twenty-four? |  |
|  |  | MICHAEL | I was guessing. |  |
|  |  | BRIAN | See that. |  |
|  |  | ROMINA | [Inaudible.] |  |
|  |  | BRIAN | How’d you count that? |  |
|  |  | ROMINA | Or- hold on. There’s- |  |
|  |  | MICHAEL | Uh, //that’s not really. It’s- it’s just a guess. |  |
|  |  | ROMINA | //No, there’s twenty- No it’d be twelve. Wouldn’t it be twelve? |  |
|  |  | MICHAEL | I don’t know. How- how much is this? |  |
|  |  | ROMINA | There’s ten lines and there’s five ways. So if there’s //twenty-four lines there would be twelve ways. [Pointing to Michael’s problem sheet.] |  |
|  |  | MICHAEL | //but there’s one, two, three, four- It’s twelve, yeah. We’re, we’re guessing twelve but that’s probably not it. I doubt it. [Counting routes on grid of problem sheet. Romina leaning over her problem sheet and outlining routes.] |  |
|  |  | JEFF | All right, you- you’re here. [Speaking to Brian, he points with his black marker to an intersection point on his problem sheet.] |  |
|  |  | BRIAN | Uh hmm. |  |
|  |  | JEFF | You;re here. You're either over, or you can go up. [From † (5,1),moving his pen to the left one unit and back and then up one unit [SK1, 0 |  |
|  |  | BRIAN | Mm hmm. |  |
|  |  | JEFF | So like here you can go over or up. [On the right side of the problem sheet, drawing a point and from it two lines, producing a binary tree.] |  |
|  |  | ROMINA | What are you doing? |  |
|  |  | JEFF | I don’t know. I’m not doing anything. I’m just trying to think. [Returning to Brian.] And then you get to here. You can either go over or up again. And then the same thing. But I don’t know what that has to do with anything. My brain is like- just looking at this right now and going like- [Inaudible.] It’s just not working. [Jeff waves his hand.] | 00:11:26  Jeff relates the choice of down or right to a branch of left or right aloud and via this diagram. |
|  |  | ROMINA | But you know, I am- //I understand what you’re doing- |  |
|  |  | BRIAN | //Just look at the lines and see where you’re getting five. |  |
|  |  | ROMINA | -but like for this one you know what sucks with this one, is because if you’re there you have either one of two choices. |  |
|  |  | JEFF | Mm hmm. |  |
|  |  | ROMINA | When you get here you have one or two choices, you know, this just doesn’t- |  |
|  |  | JEFF | Well, yeah, you’re here, you can either go there or there. You get here- [Tracing routes on the grid of his problem sheet.] |  |
|  |  | ROMINA | Yeah. |  |
|  |  | JEFF | -you can go there or there. But if you’re here, you’re only going to go down. [Pointing at an intersection point on the grid of his problem sheet.] |  |
|  |  | ROMINA | Yeah. //That- that- exactly. |  |
|  |  | JEFF | //Because you’re going out of your way. |  |
|  |  | ROMINA | That’s exactly what I was doing. |  |
|  |  | BRIAN | See this is- //this is what I was thinking of. |  |
|  |  | JEFF | //Then you’re here and you’re only going down or over. Again, this is just down and you can just follow all the routes to the end point- I don’t know. [Pointing to the binary tree that he drew on the right side of his problem sheet.] |  |
|  |  | BRIAN | I don’t know. That doesn’t sound right. That’s one. That’s two, three, four, five. That’s what I was doing with all of them. That’s how I got twenty-four for this one. [Referring to the red pick-up point, pointing at Jeff’s paper with his pen.] |  |
|  |  | JEFF | And that’s what you thought it was Mike? |  |
|  |  | MICHAEL | //What’d you do? |  |
|  |  | ROMINA | //Yeah. |  |
|  |  | JEFF | Wait, what’d you do? How’d you do it? //That’s one- |  |
|  |  | ROMINA | //No, not twenty-four. |  |
|  |  | BRIAN | //That’s two. [Brian points to the grid with pen.] |  |
|  |  | JEFF | //That’s two, three four //and five. [Brian pointing at Jeff’s paper with his pen.] |  |
|  |  | ROMINA | //Twelve. Twelve would work. |  |
|  |  | MICHAEL | But that was not like- |  |
|  |  | JEFF | So then that’s one, //that’s two- [Pointing to his paper.] |  |
|  |  | MICHAEL | //Good guess. |  |
|  |  | JEFF | And you counted those up for twenty-four? |  |
|  |  | BRIAN | Three, four, five... [Pointing at paper with pen] |  |
|  |  | JEFF | See, that’s what I’m saying. |  |
|  |  | BRIAN | Wait- |  |
|  |  | JEFF | And then the side streets. |  |
|  |  | ROMINA | But then there’s more. [Brian counting with his pen on the grid.] |  |
|  |  | JEFF | There’s more than fourteen? |  |
|  |  | ROMINA | No, I don’t know how many there are. |  |
|  |  | BRIAN | Are you sure you got- |  |
|  |  | ROMINA | No, I was just saying like if- that wouldn’t work with our theory. |  |
|  |  | JEFF | What theory is that? |  |
|  |  | MICHAEL | Divide //it by two. |  |
|  |  | ROMINA | //Divide it by two. It’s like a highly- it was like a- |  |
|  |  | JEFF | Was it- like what divided by two? All the- add them all up //[Inaudible]. [Pointing at paper] |  |
|  |  | ROMINA | //Because there’s ten lines- ten lines like that are all within this rectangle. [Pointing at paper with pen] |  |
|  |  | JEFF | All right. |  |
|  |  | ROMINA | There’s five ways to get to it. So if there are twenty-four lines there would be twelve different lines to get to it. But, it’s hard to prove. [Pointing to her grid with a pen.] |  |
|  |  | BRIAN | Actually, this whole thing, if you count the middle lines there’s thirteen. [Referring rectangular region between the to the blue pick-up point and the taxi stand.] |  |
|  |  | JEFF | There is. That’s why I- //as soon as I got to thirteen I stopped working because there’s none- it’s prime. |  |
|  |  | MICHAEL | //[Inaudible], right? |  |
|  |  | ROMINA | One, two, three, //four, five- |  |
|  |  | BRIAN | //It’s four on the sides, eight, nine, ten, eleven, twelve, thirteen. [Brian uses his two hands to show routes in the air.] |  |
|  |  | ROMINA | //-six, seven, eight, nine, ten, eleven, twelve- There is thirteen. |  |
|  |  | MICHAEL | Thirteen what? |  |
|  |  | JEFF | Lines //over here. |  |
|  |  | ROMINA | //Lines. |  |
|  |  | JEFF | That’s why I- I threw that out. I wrote- Oh, that’s a thirteen but I was like, oh man, prime numbers. [Jeff puts his head in his arms.] No good. |  |
|  |  | ROMINA | //thirteen. |  |
|  |  | JEFF | There’s like no way it could work with a prime number- like you can’t even like make something up. |  |
|  |  | BRIAN | All right. |  |
|  |  | ROMINA | I think we’re going to have to break it apart and draw as many as possible. |  |
|  |  | BRIAN | Yeah, //that’s what I’m going to do. |  |
|  |  | JEFF | //And then have that lead us to something? What if we do- why don’t we do easier ones? You know what I’m saying? What if the- the thing- Do you have another one of these papers? [Speaking to T/R2.] (00 |  |
|  |  | ROMINA | Here, to make it simple, just draw on here. |  |
|  |  | JEFF | All right. Well, yeah. We’re just going to make a grid. |  |
|  |  | T/R2 | Oh, we got grid paper. |  |
|  |  | JEFF | Oh yeah? We could get some grid paper? Or those. |  |
|  |  | BRIAN | Whatever. |  |
|  |  | T/R2 | To tell you the truth..[Inaudible] transparencies. |  |
|  |  | JEFF | We’re not there yet. We’re not- |  |
|  |  | T/R2 | No, I mean like so that you can cover it |  |
|  |  | JEFF | Whatever. We’re flexible. |  |
|  |  | T/R2 | Okay, here’s some more copies if that helps. Okay. And I’ll get you ... |  |
|  |  | JEFF | All right. So- |  |
|  |  | ROMINA | Pick a dot. | 00:14:28 Brian’s list of paths grows slowly. |
|  |  | JEFF | Right there. |  |
|  |  | ROMINA | One, two. |  |
|  |  | JEFF | Two. All right. Here. |  |
|  |  | T/R2 | We also have more to choose from. |  |
|  |  | JEFF | Jesus. |  |
|  |  | T/R2 | There’s graph paper there. Okay |  |
|  |  | ROMINA | Okay. So one, two, three- Oh, is this going to be dumb and stuff? One, two, three, four- It looks like a multiplication table. (00 |  |
|  |  | JEFF | All right. Uh, one-, two [Inaudible]. [Brian draws his eighth symbol on the right side of the grid and writes “1, 4, 2.” On the top of “1, 4, 2” he writes “DRD.” He also goes back to 7 and writes “D3, R1”. He has written a number with each of the first 6 symbols on Brian’s paper, too.] |  |
|  |  | ROMINA | All right. |  |
|  |  | JEFF | Why don’t you just- here, use blue. It doesn’t matter. | 00:15:26 Brian adds the eighth entry. |
|  |  | ROMINA | Yeah. One- |  |
|  |  | JEFF | One- //two. |  |
|  |  | ROMINA | //Two. Three. //Four. |  |
|  |  | JEFF | //Four. |  |
|  |  | ROMINA | Five? |  |
|  |  | JEFF | Where are you? Wait was that one, two over? The fourth spot? One, two- three- four- five. I don’t- I can’t remember what I- [Jeff draws routes on a 2 by 2 rectangle.] | 00:15:49 Brian adds the ninth entry. |
|  |  | ROMINA | I think it’s five. I think it’s five. [Brian draws his ninth symbol for a specific route, with the numbers “2, 4, 1” next to each line on the symbol.] |  |
|  |  | JEFF | I think it is five. |  |
|  |  | ROMINA | All right. Do the next one. Don’t- don’t count out loud and we’ll see if we get the same thing. |  |
|  |  | ROMINA | [After working silently.] What’d you get? |  |
|  |  | JEFF | Nothing. I’ve got to start all over again. And what is that? Six? |  |
|  |  | MICHAEL | What's that? |  |
|  |  | ROMINA | That's…how many I can- |  |
|  |  | JEFF | For each of those points? |  |
|  |  | ROMINA | Yeah. Like the point diagonally down. |  |
|  |  | MICHAEL | Yeah. |  |
|  |  | ROMINA | I’m not sure if I’m right though. I’m not sure if I’m counting right. |  |
|  |  | JEFF | // One, two, three- |  |
|  |  | ROMINA | I mean this one- this one looks to be like prime numbers- I know this one going up- [Romina points to an intersection on the rectangle with her pen.] |  |
|  |  | JEFF | How many did you get? |  |
|  |  | ROMINA | Hol’- I think- Seven. |  |
|  |  | JEFF | All right. Well, the only thing I’m seeing right now with this right, is those together is that and those together is that. |  |
|  |  | ROMINA | //Well I- |  |
|  |  | JEFF | //So hopefully- |  |
|  |  | ROMINA | I’m going two, three, four, five, six. Two, three, four, five, six. Five- three, five, //seven, nine. |  |
|  |  | JEFF | //Seven, nine. |  |
|  |  | ROMINA | Eleven and then we’re going to go up again? |  |
|  |  | JEFF | Well go for it. Yeah. |  |
|  |  | ROMINA | Here go- go and we’ll have to [Inaudible]. [Brian writes tally marks on the top of his grid. Brian crosses out two of the tallies on his paper.] |  |
|  |  | JEFF | Wait. Why don’t we give one of these like to- |  |
|  |  | MICHAEL | Brian, how many did you get, get so far? [Romina and Jeff wrote a number in each of the squares in a three by two rectangle that they drew on their grid. The top row contains the numbers 2, 3 and 4 and the bottom row 3, 5 and 7.] |  |
|  |  | JEFF | To like here. [Pointing to the intersection point † (9, 3) on the grid of the problem sheet in front of Romina.] No//and then- | 00:17:40 Jeff points, recommending a new point to check. The five and seven marked appear to be miscounted number of paths. |
|  |  | ROMINA | ///Because it’s going to be too much. Well, //go down and see like when we go down and we do all these and all of these that go out one more and see how much you get. [Pointing to intersection points †(5, 4),†(6, 4),†(4,1),†(5, 2),†(6, 3), and†(7, 4).] |  |
|  |  | JEFF | //For the red one, sorry. |  |
|  |  | JEFF | All right. |  |
|  |  | ROMINA | One- [Romina starts tracing routes to†(5, 4) with her pen on the grid.] |  |
|  |  | BRIAN | I’m not good at this kind of stuff. |  |
|  |  | ROMINA | //one, two, three, four, five. |  |
|  |  | JEFF | Where- where you going to? |  |
|  |  | ROMINA | Here, this is- this is five. [Writing a 5 in the†(5, 4) square.] And, go to this one now because- [Pointing at intersection point †(6, 4).]//I mean that one I’m pretty sure. [Referring to the result obtain for the point †(5, 4).] |  |
|  |  | JEFF | //Was it four by four? |  |
|  |  | ROMINA | Uh, four by two. |  |
|  |  | JEFF | That’s what I meant. I was drawing the right thing. [Jeff draws a four-by-two sub-grid on a sheet of 1-centimeter grid paper and draws routes within the subgrid.] |  |
|  |  | ROMINA | Yeah, it’s working. [Romina writes a 9 in the †(6, 4) square.] | 00:18:17  Jeff begins drawing paths for the point (-2,4). |
|  |  | JEFF | Wait, you only got nine for that!? |  |
|  |  | ROMINA | Uh hmm. [Romina writes a 4 in the square in the third row, under the 3 in the second row, after counting routes with a pen on the grid.] |  |
|  |  | JEFF | All right, wait a second. Check it out. Um, all right. You go one- | 00:18:33  Jeff checks his work after Romina quickly adds nine to their diagram. She adds in the light four on the other side without discussion. |
|  |  | ROMINA | All right. |  |
|  |  | JEFF | Wait- just wait a second. |  |
|  |  | ROMINA | No, I know. I’m just- One- |  |
|  |  | JEFF | One. Then two. [Drawing routes on grid paper.] |  |
|  |  | ROMINA | Uh hmm. |  |
|  |  | JEFF | And then- Uh, three, four, five. [Drawing routes on grid paper.] |  |
|  |  | ROMINA | Uh hmm. |  |
|  |  | JEFF | Six, seven, eight, nine, ten, eleven- you know what I’m saying? We’re missing- [drawing routes on the grid] |  |
|  |  | ROMINA | Okay, what am I missing? |  |
|  |  | JEFF | You’re- we’re like |  |
|  |  | ROMINA | Did we do that for seven? |  |
|  |  | JEFF | Well you’re- I don’t know. You’re not going like over two down one. //Over two over one. [Jeff motions with his pen on the grid.] |  |
|  |  | ROMINA | //I’m not doing, you're right. I’m not doing that. |  |
|  |  | JEFF | So- |  |
|  |  | ROMINA | Okay. |  |
|  |  | JEFF | You want to go back from the //beginning. |  |
|  |  | ROMINA | //Go back to- //go back to seven. |  |
|  |  | JEFF | //You got to go- Well, how do you know- we did five right? |  |
|  |  | ROMINA | We had to have done five because there was like- |  |
|  |  | JEFF | As long as it’s right I don’t- I don’t care. Just as long as it’s right. All right, so, which one’s the seven one? Two by three? |  |
|  |  | ROMINA | I got, I got eight for there now? [Jeff draws routes on the grid.] |  |
|  |  | JEFF | Seven, eight- I got more than that. All right, wait. We got to go through this, and you got to watch. |  |
|  |  | BRIAN | There are at least twenty-two for red. I assure you of that. |  |
|  |  | JEFF | Assure you? |  |
|  |  | BRIAN | It’s not raining no more. I’m sweating. |  |
|  |  | ROMINA | Yeah. |  |
|  |  | JEFF | Yeah, it’s like the hot seat. All right, check it out. One- [On 1-centimeter grid paper, drawing a route in a two-by-three sub-grid.] |  |
|  |  | ROMINA | Mm hmm. |  |
|  |  | JEFF | All right. There’s only one you can go by going two down. I’m trying to like figure out ways to like cross them out. You know what I’m saying? And then going one down, you can go one, two, three- There’s no other ways to go. [Drawing more routes on his 1-centimeter grid paper.] |  |
|  |  | ROMINA | Mm hmm. |  |
|  |  | JEFF | What about like that? Four? |  |
|  |  | ROMINA | Mm hmm. Mm hmm. |  |
|  |  | JEFF | And then, five, six, seven, eight- [Counting the routes as he draws them.] |  |
|  |  | ROMINA | You did that one. |  |
|  |  | BRAIN | // I don’t remember if I did that. |  |
|  |  | JEFF | Which one? |  |
|  |  | BRIAN | //There’s definitely twenty-two. | 00:21:02 Jeff and Romina point to Jeff’s paths. Romina notes Jeff repeated one, but they cannot tell which. |
|  |  | ROMINA | All right guys. This is what we’re trying to do. |  |
|  |  | End Clip 1 |  |  |
|  |  | Begin Clip 2 |  |  |
|  |  | ROMINA | Why don’t we try to do this- [Taking a blank piece of 1-centimeter grid paper.] |  |
|  |  | JEFF | All right, what’s- |  |
|  |  | ROMINA | Wait, we’re getting all confused. You see how we’re like going to like we’re drawing like we’re going to here. How many it takes to get to that point and then we’re going to here and it’s like a- this is just going up like one, two, three- two, three, four, five and then we go down to here and there’s the same thing and then like how much we’ll get to this point and how much we’ll get to that point. [Pointing to intersection points on a blank 1-centimeter grid paper.] Why don’t we all try to do that because we’re getting confused and we’re- (00 |  |
|  |  | JEFF | Yeah. |  |
|  |  | ROMINA | We’re doing the same mistakes. |  |
|  |  | JEFF | And it’s like real hard. My brain- |  |
|  |  | ROMINA | If we do that and we see a pattern I’m sure we’ll be able to- uh |  |
|  |  | JEFF | Hey, you know what we could even do, we could, uh where are those transparencies? We could exploit the fact that we have those. You know what I’m saying? Like- [Michael silently writes.] |  |
|  |  | ROMINA | Well I was going to go over like to see how far we’ve gone. That’s good. Oh, that’s not the same size.[Romina takes a transparency with a grid on it.] |  |
|  |  | JEFF | No, but even- I mean you could say, all right, um, on on the- you could do, um, a hundred six squares here. You could do- [Pointing at paper.] |  |
|  |  | ROMINA | Yeah. |  |
|  |  | JEFF | You know what I’m saying? And then just- |  |
|  |  | ROMINA | So- okay, we definitely know this is two, right? |  |
|  |  | JEFF | Here, knock yourself out. |  |
|  |  | ROMINA | We definitely know that’s two, right? Now give me a blank. [Romina writes 2, 3 and 4 in the first row of the grid and a 3 directly below the 2.] |  |
|  |  | JEFF | Well go to- which one are we having the most trouble with right now? |  |
|  |  | ROMINA | Well, I’m just going to write numbers. Two- |  |
|  |  | JEFF | Yeah, but I’m saying like before we get involved in all this, let’s find out like how many there are and- |  |
|  |  |  | [Michael and Brian silently write.] |  |
|  |  | ROMINA | Okay, let’s make sure that’s- Let’s make sure how much that is. I’m going to go with that’s- [Jeff draws rows of two by twos while Romina rewrites her numbers in the squares, only writing the top 3 numbers and the number in the second row, first position on the left.] |  |
|  |  | ROMINA | I think that’s five. |  |
|  |  | JEFF | That is five? [On centimeter grid paper, drawing three horizontal lines across the page, creating two sets of parallel lines 2 centimeters away from each other.] |  |
|  |  | ROMINA | Mm hmm. Oh well, you do it too. |  |
|  |  | JEFF | Oh. |  |
|  |  | ROMINA | I mean- |  |
|  |  | JEFF | Which- by what by what? |  |
|  |  | ROMINA | Two by two. |  |
|  |  | JEFF | Two by two? |  |
|  |  | ROMINA | Let’s get that done. |  |
|  |  | JEFF | One. All right. One, two, three, four, five- [Using a transparency of a centimeter grid paper, traces in the air shortest routes for a 2 by 2 square.] |  |
|  |  | ROMINA | You’re counting one twice. |  |
|  |  | JEFF | Six- All right, wait. That’s why- here watch. |  |
|  |  | ROMINA | Maybe, yeah. |  |
|  |  | JEFF | You just go make two by twos. [Drawing three vertical lines on his centimeter paper to create two-by-two subgrids.] |  |
|  |  | ROMINA | Mm hmm. |  |
|  |  | JEFF | You could go- [Drawing two-by-two sub-grids.] |  |
|  |  | ROMINA | Yeah, make at least six at the moment. |  |
|  |  | JEFF | All right. You can go this way. [Drawing 1 two-down route.] |  |
|  |  | ROMINA | Yeah that’s one. |  |
|  |  | JEFF | That’s one. Now that’s all the ways you can go- [Drawing a route.] |  |
|  |  | ROMINA | Yeah. |  |
|  |  | JEFF | -by two down. So then you can go like this… |  |
|  |  | ROMINA | Two. |  |
|  |  | JEFF | You can go like this. [Drawing 2 one-down routes.] |  |
|  |  | ROMINA | Three. |  |
|  |  | JEFF | Is there any other ways to go by going down? No. |  |
|  |  | ROMINA | Okay. |  |
|  |  | JEFF | All right. So then you could- you could go like that? [Drawing 2 one-over routes.] |  |
|  |  | ROMINA | Mm hmm. |  |
|  |  | JEFF | You could go like that. [Drawing 1 two-over route.] |  |
|  |  | ROMINA | Mm hmm. Or you go all the way top to bottom. |  |
|  |  | JEFF | There’s nothing else to do? Right? Now that would be the opposite of that one. That would be the opposite of that one and that would be the opposite of that one. //They’re all covered. [Pointing to pairs of routes on the grid with a pen.] | 00:24:00  Jeff checks the number of paths to the point (2,-2) by drawing in two by two boxes. He notes which paths are opposites. |
|  |  | ROMINA | //So we got six. Good. Good thing we did that over again. | Romina notes their finding. This begins to show Pascal’s Triangle. |
|  |  | JEFF | All right, well. Yeah, good because at least we’re- you know, //we’re- we’re making progress. [Romina writing 6 on her transparency of centimeter paper in the square that represents a two-by-two grid.] |  |
|  |  | ROMINA | //Yeah, all right. And go- |  |
|  |  | JEFF | All right. //The three- |  |
|  |  | ROMINA | //Three and two. [Jeff draws three vertical lines, creating four three-by-two rectangles.] |  |
|  |  | JEFF | The greatest MC in the world. [Singing.] Look at that. Beautiful. [Drawing three-by-two rectangles on the grid and crossing out the others] |  |
|  |  | ROMINA | Tell me you know how to count those. All right. [Jeff crossing out the 6 different 2 by 2s he just drew shortest routes on.] |  |
|  |  | JEFF | All right. We can go like this, and that’s the only way- [Drawing the one 2-down, 3-across route.] |  |
|  |  | ROMINA | Right. |  |
|  |  | JEFF | -to do that. |  |
|  |  | ROMINA | You want-, you want to do them in couples? (00 |  |
|  |  | JEFF | Now the opposite of that is that right there. So that’s that covers those two. [Underneath the previous route, drawing the one three-over route.] Now, the other way- now we’ve got to go one down like that. [Using a red marker to draw a route one-down, three-over.] And the couple of that would be- //I’m not- |  |
|  |  | ROMINA | //[Inaudible]. |  |
|  |  | JEFF | -not exactly sure so wait. |  |
|  |  | ROMINA | We can’t go in couples I mean. |  |
|  |  | JEFF | Yeah well- |  |
|  |  | ROMINA | All right, I’m going to open the windows. |  |
|  |  | JEFF | Ah yeah? [Draws 2 more one-down routes in his 3-by-2 grids.] |  |
|  |  | Cameraperson | What’s making noise here? [Inaudible]? |  |
|  |  | ROMINA | [Inaudible]. |  |
|  |  | Cameraperson | I understand. |  |
|  |  | JEFF | All right. |  |
|  |  | ROMINA | What’d you get? |  |
|  |  | JEFF | I don’t know. I’m waiting for you, man. |  |
|  |  | ROMINA | All right. One, two- |  |
|  |  | JEFF | All right. That’s that- [With his pen, pointing at the different three-by-two routes on the grid in which the first move is one down.] |  |
|  |  | ROMINA | Mm hmm. |  |
|  |  | JEFF | And that’s that. And then, you know, that’s going one over. It’s going two over. It’s going //three over. |  |
|  |  | ROMINA | //Three over. |  |
|  |  | JEFF | That covers all going through the middle. |  |
|  |  | ROMINA | Mm hmm. |  |
|  |  | JEFF | Correct? |  |
|  |  | ROMINA | Yes. |  |
|  |  | JEFF | All right. So now we’ve got to start going to the top. You can go one over, down, over. You can go one over or two over, down. You could also go one over, down two and over. You could also go- [Drawing the route.] |  |
|  |  | ROMINA | We’ve got eight so far, right? |  |
|  |  | JEFF | Could also go, um, two over, two down and over. [Draws the route.] |  |
|  |  | ROMINA | Mm hmm. |  |
|  |  | JEFF | Anything else? That’s one, two, three, four, five, six, seven, eight, nine. Oh, it’s nine because that one doesn’t have a couple. | 00:26:29 Jeff points out their nine paths for the point (3,-2). He notes the answer is odd because the center path does not have a couple. |
|  |  | ROMINA | Yeah, //okay. |  |
|  |  | JEFF | //Those are couples, uh, this one and that one are couples, uh- [Pointing to routes and matching them with marker.] |  |
|  |  | ROMINA | //The one going- |  |
|  |  | JEFF | //These two are couples. [Pointing with marker.] |  |
|  |  | ROMINA | The one going all the way across in the middle is never going to have a //couple. |  |
|  |  | JEFF | //Never going to have a couple. |  |
|  |  | ROMINA | Because- |  |
|  |  | JEFF | That’s- //so that will always be odd. |  |
|  |  | ROMINA | //All right, so you can’t [Inaudible]. |  |
|  |  | JEFF | So every other one will be odd because there will be one going fully across the middle. Right? That’s why that’s nine. |  |
|  |  | ROMINA | Well that can’t be odd because it’s- |  |
|  |  | JEFF | Hey- ‘cause that- that won’t- |  |
|  |  | ROMINA | Maybe any one with an odd length or width. | 00:26:56 Brian checks his work by running his pen over paths. |
|  |  | JEFF | Which would be every other one. |  |
|  |  | ROMINA | Yeah. |  |
|  |  | JEFF | All right. So now where are we at? [Romina writing a 5 next to the 4 and I notice she has a 6 and 9 next to the 3 in the second row. She also writes a 4 under the 3 in the second row.] |  |
|  |  | ROMINA | This is five. Okay, do you want to go down this- has to be four [Inaudible]. This should be nine too. [Pointing to the square below the 6.] | 00:27:10 Romina fills in their findings, noting there must be fives on the outer edges, and that there is a nine symmetric to the one already in place. |
|  |  | JEFF | Right. Because that is the- that is the same as that. [Jeff rotates the grid that Romina is writing numbers on.] Exactly. So that should be nine too. And- all right, do you want to go three by three? [Pointing to the routes and matching them.] |  |
|  |  | ROMINA | Yeah. |  |
|  |  | JEFF | You write it. |  |
|  |  | ROMINA | Um,- |  |
|  |  | JEFF | Cut a long one. |  |
|  |  | ROMINA | [Inaudible]. |  |
|  |  | JEFF | It’s you? |  |
|  |  | ROMINA | No. I thought it was you. |  |
|  |  | JEFF | Are you serious? |  |
|  |  | ROMINA | No, I didn’t know. |  |
|  |  | JEFF | Oh man. It’s the greatest MC in the world. [Singing.] |  |
|  |  |  | [Brian working silently. He has a symbol for 10 now.] |  |
|  |  | JEFF | You’re going to draw the lines on this one because it’s- [Jeff draws rows of 3 by 3 rectangles.] |  |
|  |  | ROMINA | So I can mess it up? |  |
|  |  | JEFF | Yup. Because I can’t handle it no more. |  |
|  |  | BRIAN | Oh man. |  |
|  |  | ROMINA | He’s getting a little like kidish. |  |
|  |  | BRIAN | What are you starting? |  |
|  |  | JEFF | None of that. |  |
|  |  | ROMINA | One- |  |
|  |  | BRIAN | Isn’t your head like |  |
|  |  | ROMINA | Two, right? [Drawing a route in the first and second three by three on the grid.] |  |
|  |  | JEFF | Opposites. Uh, wait, wait, wait. Stick with a pattern. Do all the ones like going down first. You know what I’m saying? [Pointing to paper in front of Romina.] |  |
|  |  | ROMINA | I was going to do all the ones going across first. [Pointing to paper] |  |
|  |  | JEFF | All right. Then do that. But, [Inaudible] we’re just doing all the ones that are going like one across. |  |
|  |  | ROMINA | Like I’m going to do two to one. Instead of one to- |  |
|  |  | JEFF | All right. Just don’t blow it. |  |
|  |  | ROMINA | One. |  |
|  |  | JEFF | Where you going with that? |  |
|  |  | ROMINA | Uh, well, you know what //I meant. |  |
|  |  | JEFF | //Go for the whole deal now. |  |
|  |  | ROMINA | Okay. Should I- on the next one should I go all the way down? [Drawing routes] |  |
|  |  | JEFF | Yeah. That’s another two over piece. |  |
|  |  | ROMINA | Okay. I’m going to go one- one over, one two over, one three over. Got all those? [Drawing routes] |  |
|  |  | JEFF | Yeah. And those are all the ways that you can go from the top over? |  |
|  |  | ROMINA | Yeah. Now going down. |  |
|  |  | JEFF | Now- now before you even do that, can’t you just move these all the other way? |  |
|  |  | ROMINA | Yeah I know but- shouldn’t we draw them just to make sure though? |  |
|  |  | JEFF | Yeah. Well let’s do the opposites then like the same way we did the other thing. |  |
|  |  | ROMINA | Okay, so now we’re going to go //two down. [Pointing to paper] |  |
|  |  | JEFF | //So, two down over- |  |
|  |  | ROMINA | Over- //All the way? |  |
|  |  | JEFF | //All the way. |  |
|  |  | ROMINA | Down. |  |
|  |  | JEFF | Right? Where’s that there? That’s- that’s that right there. One over- [Jeff marks off two of the 3 by 3s to show couples.] |  |
|  |  | ROMINA | All right. |  |
|  |  | JEFF | So you could either just like, uh- [Drawing routes.] |  |
|  |  | ROMINA | Down- Here? [Drawing routes.] |  |
|  |  | JEFF | You can do whatever you want and we’ll just- all right- [Marking off two more 3 by 3s with routes drawn.] |  |
|  |  | ROMINA | Down over- |  |
|  |  | JEFF | Uh, where do you see- All right. Um, where’s that one the other way? [He marks off 2 more three by threes with routes drawn.] |  |
|  |  | ROMINA | Hold on not yet- I’m All messed up now. [Inaudible] Okay, so now I’m going to go down one- [drawing routes] | 00:30:29 Michael’s work indicates he is attempting to create a system to track paths similar to Brian. |
|  |  | JEFF | Mm hmm. |  |
|  |  | ROMINA | Over down across. [Drawing a horizontal line of their grid paper] Down one- down one over two. Okay. |  |
|  |  | JEFF | All right, wait, I've got a question. Where’s the other one of this? That’s the other one of that? But, that’s already the other one of that. So there’s more ways that you can have two boxes open- Yeah, it’s getting- it’s getting heavy. All right. Well, just continue. [pointing at paper] |  |
|  |  | ROMINA | Down one. Down one over two. I already went down two. I could do- I could do one of these little babies. [drawing a “staircase” route] |  |
|  |  | JEFF | What? You don’t know? What about the opposite of that. Of that one. Got that? |  |
|  |  | ROMINA | I already did the ones that are in bold. [Drawing another “staircase” route] |  |
|  |  | JEFF | How many are there? |  |
|  |  | ROMINA | One, two, three, four, five, six, seven, eight, nine, ten, eleven, twelve, thirteen, fourteen - It doesn’t work. |  |
|  |  | JEFF | That’s all of them? |  |
|  |  | ROMINA | Well, no it’s working. It’s going. It’s going. |  |
|  |  | JEFF | [Inaudible]. [Counting routes in the air with his marker silently.] |  |
|  |  | JEFF | Hmm. |  |
|  |  | ROMINA | Hmm. [Jeff points to the numbers on Romina’s grid.] |  |
|  |  | JEFF | Uh, but are we sure there’s only fifteen? Is my question. Coming out [singing, inaudible] What about like, um, down one- Where’s all the down ones? All starting here? |  |
|  |  | ROMINA | Second row. |  |
|  |  | JEFF | Uh, down one over two- Where’s that? You got that? |  |
|  |  | ROMINA | Down one- down one’s are over here. |  |
|  |  | JEFF | Down one, over two. Hmm- [Drawing a route then crosses it out.] |  |
|  |  | ROMINA | You just draw, I’ll find it. [Inaudible] yeah- |  |
|  |  | JEFF | That one was already there. Huh? Come here. Maybe there is only fifteen. Or- I wish we knew like- |  |
|  |  | ROMINA | Three by three? Is that what we’re doing? | 00:33:31 Romina fills in Jeff’s temporary answer of fifteen for the point (3,-3). |
|  |  | JEFF | I guess. Put it in there for now. [Romina writing a 15 in the square next to the 9 so the 3rd row reads 4, 9, 15.] |  |
|  |  | ROMINA | Do four by two. What are you still working on? //The reds? |  |
|  |  | MICHAEL | //Uh, yeah. Did you do the red ones? |  |
|  |  | JEFF | We’re working on, uh- |  |
|  |  | ROMINA | Oh, we’re getting there. |  |
|  |  | JEFF | We’re //just working on stuff. |  |
|  |  | ROMINA | //Where’s red? Three by four? That’s our next one. |  |
|  |  | JEFF | Nah, there's one after that. So, if we could get to there it would be, uh, big time you know what I’m saying? |  |
|  |  | ROMINA | It’s this one. |  |
|  |  | JEFF | This one right here? |  |
|  |  | ROMINA | Mm hmm. |  |
|  |  | JEFF | Three by- |  |
|  |  | ROMINA | Yeah. |  |
|  |  | JEFF | All right, well we’re on- what are we on? Two by four? [Brian writing rows of numbers 0, 1, 2 or 3 silently. Michael has routes drawn all over his paper. He continues working.] | 00:34:36 Brian’s work shows sets of four numbers written across. The scribbled out numbers were {0, 0, 0 ... 1, 4}. His other hand traces paths as he writes. |
|  |  | ROMINA | Mm hmm. That’s not going to be enough. |  |
|  |  | JEFF | That’s all right. We can make more. |  |
|  |  | ROMINA | Now I’m really starting to hate doing this. |  |
|  |  | JEFF | Oh yeah? |  |
|  |  | ROMINA | One. |  |
|  |  | JEFF | Yep. |  |
|  |  | ROMINA | Two. All right. |  |
|  |  | JEFF | Go all the way across. | 00:35:32 Brian boxes off sets of numbers at the top of his work, and studies them closely. |
|  |  | ROMINA | Two down? [Romina draws routes.] |  |
|  |  | JEFF | We already did all the two downs. [Pointing to paper] |  |
|  |  | ROMINA | I mean go two down, across. //Did that. |  |
|  |  | JEFF | //We already did that. Um, what about- All right that’s all of //them. |  |
|  |  | ROMINA | //Over one. [pointing to paper] |  |
|  |  | JEFF | All right. |  |
|  |  | ROMINA | Over one. [Romina draws routes for each four by two rectangle.] |  |
|  |  | JEFF | Uh um. Wait, stay with- go over ones. Do all the over ones. |  |
|  |  | ROMINA | Oh I was going- I was doing this //one. [Pointing to paper] [She continues drawing routes.] |  |
|  |  | JEFF | //All right then. Well, whatever you want to do. You’re in control. |  |
|  |  | ROMINA | Now, I want to go over one. |  |
|  |  | MICHAEL | What’d you get so far for the red one? What are you up to // now? |  |
|  |  | ROMINA | // Can I go anymore? |  |
|  |  | BRIAN | Before I got at least like thirty. |  |
|  |  | MICHAEL | How many? Thirty? |  |
|  |  | BRIAN | Right now I’m actually writing them out, I got like seventeen. | 00:36:20 Romina’s work shows eleven paths currently. |
|  |  | JEFF | Over. |  |
|  |  | ROMINA | No that’s this one. |  |
|  |  | BRIAN | What do you have? |  |
|  |  | MICHAEL | I have to count them up. |  |
|  |  | JEFF | Oh man. Wait, there should be one more. | 00:36:33 Michael writes the fourteen and twenty in the middle of his paper. It is unclear where these numbers are derived from, but he tells Jeff and Romina the red point has thirty-four paths. |
|  |  | ROMINA | Yeah, I’m drawing- |  |
|  |  | JEFF | I’m saying - I think there should be one more. |  |
|  |  | MICHAEL | I got thirty-four. |  |
|  |  | BRIAN | So far? |  |
|  |  | MICHAEL | That might be it. [Counting routes on Brian’s grid. Romina counting with a pen over grid in air.] |  |
|  |  | JEFF | Um- No, over to there, down there, like that. [Drawing routes] |  |
|  |  | ROMINA | [Inaudible]. [Brian working with the rows of numbers 0,1,2 or 3 and adding more rows.] | 00:37:03 Brian writes another set of numbers, but stops midway and says he gives up. |
|  |  | JEFF | You got that? |  |
|  |  | BRIAN | Man, I’m giving up on it. |  |
|  |  | ROMINA | Hum, that’s kind of weird. |  |
|  |  | BRIAN | Mike here’s the list. So far I’ve got some of the things [Inaudible]. |  |
|  |  | MICHAEL | How many have you got there, thirty? |  |
|  |  | BRIAN | No that’s only like //[Inaudible]. |  |
|  |  | JEFF | //I think- I think we should like [inaudible] on like the next one we do, I think we should just like //do all ones over one. [Motioning across with his pen.] |  |
|  |  | BRIAN | //D’s is like down- //down one. |  |
|  |  | JEFF | //All those, you know what I’m saying? |  |
|  |  | BRIAN | Like the order. |  |
|  |  | JEFF | What else? Is there anything else? |  |
|  |  | ROMINA | No. |  |
|  |  | JEFF | That should be it. |  |
|  |  | ROMINA | That looks nice too, what they’re doing. |  |
|  |  | JEFF | What? |  |
|  |  | ROMINA | Brian, see that looks like a much- when you do like the- |  |
|  |  | BRIAN | Opposites and all that? |  |
|  |  | ROMINA | All right, this is- start counting- see, uh,- Which one is this? |  |
|  |  | JEFF | Well it’s- well it should //be twelve. |  |
|  |  | BRIAN | //Oh man. |  |
|  |  | ROMINA | Twelve- |  |
|  |  | JEFF | You got the [Inaudible] right now. |  |
|  |  | BRIAN | All right //now this- |  |
|  |  | ROMINA | //That makes no sense. Oh well they’re all – oh yeah they’re all factors of three. |  |
|  |  | JEFF | Yeah, now this is the one that’s- that’s making it tough. |  |
|  |  | ROMINA | But this one has to be nine. One, two, three- Here Brian, do a box- |  |
|  |  | JEFF | Well- well you know what //that is? |  |
|  |  | ROMINA | //Two by three. |  |
|  |  | JEFF | That’s plus five, plus six, maybe it’s plus seven there? That’s plus one, plus one, plus one. That’s all plus threes. Or that’s- I don’t know what that is. I don’t know. But that’s plus- You know what I’m saying? Plus five, plus six? Plus fifteen plus seven um- twenty-two? [Placing his finger over each number on Romina’s grid. Romina wrote a “12” next to the “9” in the second row of her grid.] |  |
|  |  | ROMINA | Mm hm. |  |
|  |  | JEFF | Is that an option for what that is? |  |
|  |  | ROMINA | How many did you guys get by the- the- |  |
|  |  | JEFF | To the red. |  |
|  |  | ROMINA | Three by- or four by three? To the red? |  |
|  |  | MICHAEL | I got thirty-four. |  |
|  |  | BRIAN | [Inaudible]. So what am I doing with the box two by three? |  |
|  |  | ROMINA | How many- how many to the one at this one. [Pointing to Brian’s grid.] |  |
|  |  | BRIAN | From here to here? |  |
|  |  | ROMINA | Yeah. Do your down- do that cool number thing. |  |
|  |  | JEFF | Cool number thing. [Brian beginning writing rows of 2 numbers, then 3 numbers in a row.] |  |
|  |  | ROMINA | We have to have some of these wrong. |  |
|  |  | JEFF | Well just- I don’t know, is this just twelve? I mean I’m saying we found this one like in a second. That’s it? We quit after we found that one? [Pointing to paper] |  |
|  |  | ROMINA | Only because it’s not like long enough to be going like zigzagging through. [Romina zigzagging with a pen in the air.] |  |
|  |  | MICHAEL | Which one, that point? |  |
|  |  | ROMINA | Mm hmm. |  |
|  |  | MICHAEL | What’s that’s two by-//. |  |
|  |  | ROMINA | He’s doing two by three, now you do four by two. |  |
|  |  | MICHAEL | Let me finish the two by four. |  |
|  |  | JEFF | Here Mike, you got all this man. |  |
|  |  | BRIAN | Ohaa. |  |
|  |  | JEFF | Mike, because then you could- you see how we’re doing it? Like you could just do, you know, on all different- |  |
|  |  | ROMINA | Because we’re going to be working on the one that you just did now. What is this? Four by two? |  |
|  |  | JEFF | You're such a-. |  |
|  |  | BRIAN | Do you have like a formula that you’re wanting to see if it works with this one? |  |
|  |  | ROMINA | No, we’re just guessing. |  |
|  |  | JEFF | What are you doing? |  |
|  |  | ROMINA | Nothing, I was just going to put these under here so- |  |
|  |  | JEFF | All right, just- [inaudible] |  |
|  |  | ROMINA | Sure I’ll do it. Are you doing four by three? |  |
|  |  | JEFF | It’s big money. |  |
|  |  | JEFF | Now you’re cooking with oil. Good. She’s really good. |  |
|  |  | ROMINA | [Inaudible]. [Brian continuing by writing rows of 4 numbers 0, 1, 2 or 3. Romina makes rows of 4 by 3s on the grid.] |  |
|  |  | JEFF | Oh yeah? |  |
|  |  | ROMINA | Here, and we’ll show- we’ll even show you our patterns. |  |
|  |  | JEFF | Well wait, let him do his first. |  |
|  |  | ROMINA | Yeah, then- |  |
|  |  | JEFF | Because you’re going to- it’ll- gets in your [Inaudible] brain. |  |
|  |  | ROMINA | All right. Here why- if you have an organized way why don’t you do it? |  |
|  |  | JEFF | All right- All the ones that you can go three down and get- Right, come over here. There’s that and that’s all the ones you can go three down and get. Right? | 00:40:58 Brian works on checking the two by three case for Romina. |
|  |  | ROMINA | Mm hmm. |  |
|  |  | JEFF | All right. So going two down, if you go two down then you could either go, um,- |  |
|  |  | ROMINA | Over one down? [Michael counts with the pen on grid silently.] |  |
|  |  | JEFF | Over one down and over. If you go two down, you can go over two, down and over. You go two down, you can go over three down and over. You go two down, you can go over four and down. Um, is there any other place you can go if you go two down? No. What about- yes you can. You can go two down, over two, uh- No you can’t. I was going to say and then down and over but we //already got that. [drawing routes on the 4 by 3 rectangles] |  |
|  |  | ROMINA | //You just messed up the box. [Romina cross out the box, 4x3 sub-grid, in which Jeff drew an incorrect route.] |  |
|  |  | JEFF | You’re out of control. |  |
|  |  | End Clip 2 |  |  |
|  |  | Begin Clip 3 |  |  |
|  |  | ROMINA | All right. Now go one down. |  |
|  |  | JEFF | You go one down, you could go all the way over. You go one down, you can go almost all the way over. You go one down, you can go two over. You go one down, you can go one over. Now you can go one down- [Drawing routes on the 4 by 3 rectangles.] |  |
|  |  | BRIAN | //How many did you think was going to be for this one? |  |
|  |  | ROMINA | Nine. |  |
|  |  | JEFF | What’d you get? |  |
|  |  | BRIAN | Ten. |  |
|  |  | JEFF | Do you know what they are? |  |
|  |  | BRIAN | Yeah. |  |
|  |  | JEFF | Can you do them- can you do it //on something like this? |  |
|  |  | ROMINA | //Here- Where’s- where’s ours? |  |
|  |  | JEFF | Which one is- |  |
|  |  | MICHAEL | I got twelve for the one you just got- |  |
|  |  | JEFF | For the one we got twelve for? //All right. |  |
|  |  | ROMINA | //Here. Those are the ones we have for that one. |  |
|  |  | MICHAEL | They probably the same thing |  |
|  |  | ROMINA | Yes. |  |
|  |  | JEFF | What are you looking for [inaudible] |  |
|  |  | ROMINA | Did- we did that one. |  |
|  |  | JEFF | All right. |  |
|  |  | BRIAN | What did- do you know what your twelve are? |  |
|  |  | ROMINA | Nine. |  |
|  |  | JEFF | One, two- |  |
|  |  | MICHAEL | Me? |  |
|  |  | BRIAN | //Him. |  |
|  |  | ROMINA | //Oh. |  |
|  |  | MICHAEL | I haven’t- don’t have them written down but I know- |  |
|  |  | ROMINA | These are our twelve. [Handing Brian a sheet containing her and Jeff’s work counting routes on a 3x2 sub-grid.] |  |
|  |  | BRIAN | All right, let me do it on the board for you. |  |
|  |  | ROMINA | Mike, do three over and two down. |  |
|  |  | BRIAN | Writing up on the board. [Jeff drawing a four by 3, draws in routes, then crosses it out with his pen in the air. Brian draws his symbols or taxonomy of routes on the board with a number next to each edge.] |  |
|  |  | MICHAEL | Huh? |  |
|  |  | ROMINA | three over and two down. |  |
|  |  | JEFF | One, two- Uh, that’s [Inaudible]. |  |
|  |  | ROMINA | Couldn’t we just do something like in towers where like lines over are like the color and the lines down are the, um, number of blocks? | 00:43:22  Jeff ‘s work indicates eleven patterns for the red point so far. |
|  |  | JEFF | All right. And that would? |  |
|  |  | ROMINA | Because, okay, lines over- because what is it- the number of blocks to the number of colors? |  |
|  |  | JEFF | I don’t know what you’re- what- what’s that? |  |
|  |  | ROMINA | Two to the *n*. Two is the amount of blocks or the colors? (00 |  |
|  |  | MICHAEL | For what? Like towers on them? |  |
|  |  | ROMINA | Yeah. |  |
|  |  | JEFF | Colors. *n* is the number of blocks. I think. I don’t know. I’m not sure. |  |
|  |  | MICHAEL | Well you figure a block has this- you got two- two towers over like this. Or two colors actually. I think it’s, uh, the colors and *n* is the blocks. |  |
|  |  | ROMINA | Color two- //right. [Writing the words “color” and “blocks” on a piece of paper.] |  |
|  |  | JEFF | //Same thing. |  |
|  |  | ROMINA | All right, here we have one color- nah; it doesn’t work for the first one. |  |
|  |  | ROMINA | Scratch that idea. [Crossing out the words on her paper.] |  |
|  |  | JEFF | Well- why- you know, what happened to the- to what we were doing? |  |
|  |  | ROMINA | No, I know. Just keep on going. [Jeff, Brian and Michael working silently.] |  |
|  |  | JEFF | All right. |  |
|  |  | ROMINA | You’re right [inaudible] three by two. |  |
|  |  | JEFF | Can you help me out? |  |
|  |  | ROMINA | What- what [Inaudible] //by two of this sheet? |  |
|  |  | BRIAN | //That’s what I got so far. |  |
|  |  | ROMINA | //You need one [Inaudible]? |  |
|  |  | BRIAN | //That’s how far right there. It’s on the board. //The board. |  |
|  |  | ROMINA | //I know, I’m looking for- [Jeff continuing to draw routes.] |  |
|  |  | BRIAN | Mike do you see anything that I’m not getting? |  |
|  |  | ROMINA | //Three by three. |  |
|  |  | MICHAEL | //Which one you doing? |  |
|  |  | BRIAN | Two by three. |  |
|  |  | ROMINA | Three by two. All right, here. This is what we got. |  |
|  |  | JEFF | It’s really hot in here. |  |
|  |  | ROMINA | All right, we got down two over three. Over three, down two. [Brian drawing routes on the chalkboard while Romina reads off her possibilities.] |  |
|  |  | BRIAN | //Okay. |  |
|  |  | ROMINA | //That’s one of those? The first one. |  |
|  |  | BRIAN | It's like four moves. |  |
|  |  | ROMINA | All right we got those. [Brian continues writing on the chalkboard.] Got down one over three. |  |
|  |  | ROMINA | Except they don’t have one, one, one, one, one, that one. |  |
|  |  | JEFF | That’s one we don’t have? |  |
|  |  | ROMINA | We don’t have his last one over there. Check. I think that was the only one. So that nine does equal ten. [Brian writing, “start over” on the chalkboard and the word “Moves” up top.] |  |
|  |  | JEFF | I don’t see uh- Um- two, four, six, eight... |  |
|  |  | ROMINA | Because we don’t have that one? |  |
|  |  | JEFF | No, we don’t have that one. [Inaudible]. [Romina erases the 9s and writes in 10s. She also writes a 5 under the 4.] |  |
|  |  | ROMINA | All right. It’s, um, - it’s Pascal’s triangle. [Looking at the numerical array of the 1-centimeter-grid transparency.] | 00:46:50 Romina accepts Brian’s answer of ten paths for the two by three case, and states the solution is Pascal’s Triangle before even writing it. |
|  |  | MICHAEL | What is that? Two by three? [Looking and pointing to Brian’s inscription on the classroom chalkboard.] | 00:46:59 Romina’s work. |
|  |  | JEFF | It is? |  |
|  |  | ROMINA | Yeah. |  |
|  |  | JEFF | Let me see. |  |
|  |  | ROMINA | All right. Yeah it is. |  |
|  |  | MICHAEL | What? |  |
|  |  | ROMINA | It’s Pascal’s triangle. |  |
|  |  | MICHAEL | Two, three- |  |
|  |  | ROMINA | No, it’s not. It doesn’t work out. |  |
|  |  | JEFF | See look at- Here, Mike- |  |
|  |  | ROMINA | Because twelve that doesn’t- |  |
|  |  | JEFF | Mike look- just look at it in this thing. You got the 6 and the 4 and the 6 are the 10. That should be a 15- //that’s should be a 20- [Pointing to the 1-centimeter transparency grid that is in front of Romina.] |  |
|  |  | ROMINA | //But that’s not a 15. That is a twelve because he even got the 12. |  |
|  |  | JEFF | Well- that should- that should be a 20 right there. [Pointing to the square † (6,3) on the transparency that contains the datum 15.] |  |
|  |  | ROMINA | Ah, you can [Inaudible] the twenty. |  |
|  |  | MICHAEL | Up to here is been a one, one, one, one and- |  |
|  |  | JEFF | Huh. |  |
|  |  | BRIAN | So what’s wrong? |  |
|  |  | MICHAEL | It should be six- fifteen. |  |
|  |  | ROMINA | Do- do a four by two. |  |
|  |  | MICHAEL | Yeah. |  |
|  |  | JEFF | You do the four by two, and it should put us, uh, in business. |  |
|  |  | BRIAN | All right. |  |
|  |  | ROMINA | And then- because we’ll compare it to all- |  |
|  |  | JEFF | If this comes through it just- |  |
|  |  | ROMINA | If it’s Pascal’s triangle it’ll just give us problems. |  |
|  |  | JEFF | No but it- it’s just nice how- you start- like when you start from nothing. You know what I’m saying? Like we have no clue what we’re doing. [Putting his hand on his forehead and then waves his hand in the air by his forehead.] |  |
|  |  | ROMINA | But he even got twelve when he did it. |  |
|  |  | MICHAEL | I might be missing two. |  |
|  |  | JEFF | It could be- it’s not hard to miss three, right? [Jeff waves his hand in the air.] |  |
|  |  | MICHAEL | Two. |  |
|  |  | JEFF | Three. |  |
|  |  | ROMINA | So for the next one Jeff we missed five? |  |
|  |  | JEFF | It’s very easy. I mean, //there’s a lot of things going on. |  |
|  |  | MICHAEL | //That’s kind of a lot. |  |
|  |  | JEFF | We like blew like a lot of these. You know what I’m saying? [Waving his hand in the air and puts it back on his forehead.] |  |
|  |  | ROMINA | Yeah. I think we, uh, got every single one wrong so far. |  |
|  |  | JEFF | That’s what I’m saying. So why- like it wouldn’t be totally out of control. [Removing his hand from of his forehead and waving his hand toward the grid.] |  |
|  |  | BRIAN | Oh. |  |
|  |  | ROMINA | Do- do it the other way. Just turn it around. That’ll make our life- that- because that’s we did. It’s the same thing but- [Brian writing rows of numbers silently, this time adding a 4 too.] |  |
|  |  | Jeff | (singing?) Comin' out. |  |
|  |  | BRIAN | Is that the air that just turned on? |  |
|  |  | JEFF | Yeah. But, it don’t work though. |  |
|  |  | ROMINA | I’ll be right back. [Leaving the room.] |  |
|  |  | ? | So how do you, crazy... |  |
|  |  | JEFF | So how do you do your deal? I don’t know how to do your deal. | 00:49:14 Brian’s work building the four by two case. |
|  |  | BRIAN | It’s nothing, the ones with two moves, the ones with three moves so I just go like three moves over- starting over first. Over three down two boom, boom boom, boom boom. Then, then I go to over down, over down. This row gets eliminated pretty much. [Jeff nods his head at Brian.] |  |
|  |  | JEFF | All right. So, you’re not going to get there. I hear you. |  |
|  |  |  | [Jeff shakes his head “no” and then him and Brian work silently.] |  |
|  |  | JEFF | It’d be so much easier if some of us were lefties. [Brian already wrote his rows of 2 numbers, 3 numbers and now is writing rows of 4 numbers choosing from 0, 1, 2, 3 and 4] |  |
|  |  | BRIAN | Why? |  |
|  |  | JEFF | You’d just block like, uh, you try to see what someone does and it’s just like- I mean like what is Mike looking at when I’m writing right now. //You know what I’m saying? |  |
|  |  | MICHAEL | //Oh yeah. [Michael is drawing routes in the air on top of the 4 by 2 rectangle drawn on his grid.] |  |
|  |  | JEFF | It’s like, what- Which one are you doing, man? |  |
|  |  | MICHAEL | We’re looking for fifteen for this one, right? [Brian works silently.] |  |
|  |  | JEFF | Didn’t you get that? |  |
|  |  | MICHAEL | Hmmm. Don’t know, yet. [Jeff works silently.] |  |
|  |  | BRIAN | What number are we looking for on this one? |  |
|  |  | JEFF | Fifteen. How many you got? |  |
|  |  | BRIAN | Eight. [Jeff is drawing routes on his 4 by 2 rectangles.] |  |
|  |  |  | [inaudible conversation] |  |
|  |  | JEFF | When it rained he went home and as soon as it stopped he came back out. Annoying bastard. I can’t take it no more. [Inaudible singing]. [He is referring to the driver of an ice cream truck the noise that the truck makes.] | 00:51:30 Michael traces paths in the four by two box, then writes numbers in the list below. |
|  |  | MICHAEL | What is that? |  |
|  |  | BRIAN | Zero. |  |
|  |  | MICHAEL | I got twelve so far. |  |
|  |  | JEFF | Yeah, twelve’s like the number that we got stuck on last time. |  |
|  |  | MICHAEL | I think I got it. |  |
|  |  | BRIAN | [inaudible] it’s fifteen. | 00:52:12  Jeff draws the four by two grids and paths. |
|  |  | JEFF | All right. All right, what if we even went- let me know when you’re done. All right. Because there’s an easier way to [Inaudible]. Listen to me for one sec. |  |
|  |  | MICHAEL | Go ahead. |  |
|  |  | JEFF | All right. If- all right. Say in a situation where it’s like, uh a two by four. [Drawing a two-by-four sub-grid on 1-centimeter paper.] |  |
|  |  | MICHAEL | Uh hum. |  |
|  |  | JEFF | All right. If we know that in a four-by-four [really meaning a two-by-two] it’s six [shortest routes] if you figure out all the ways to get to the beginning parts of this, this would all just be six different ways to get from here to here. So you figure out all the ways to get there and you could just add six- you know. [Subdividing the two-by-four sub-grid into two two-by-two sub-grids.] |  |
|  |  | MICHAEL | If you have the two, you could find out how many ways to get to here and add that where every two is. [Leaning over to Jeff’s paper and pointing.] |  |
|  |  | JEFF | You know what I’m saying? So like from- from- |  |
|  |  | BRIAN | I got fifteen. |  |
|  |  | JEFF | You did? |  |
|  |  | BRIAN | Yeah. |  |
|  |  | JEFF | All right. ‘Cause from there to there you have six different ways. And then from there, there’s one way. To there there’s one way and from there- // |  |
|  |  | BRIAN | //Haaa. Tell me when you’re done. |  |
|  |  | JEFF | Sure. one- two- there’s three ways. Um- | 00:53:39 Brian’s work for the four by two case, which he claims generates fifteen paths. |
|  |  | MICHAEL | I got fifteen also. |  |
|  |  | BRIAN | Yeah Mike. [Inaudible]. [Leaving the room.] |  |
|  |  | MICHAEL | So what does that mean? |  |
|  |  | JEFF | It means that it is the triangle. Right here? [Pointing to paper] |  |
|  |  | MICHAEL | Mm hm. |  |
|  |  | JEFF | You have fifteen there? |  |
|  |  | MICHAEL | I got fifteen. |  |
|  |  | JEFF | That’s good. Yeah, because then- Yeah. This- then in a three by three it should be twenty. That’ll be, uh,- [Pointing to paper and writing a 6 in the lower right hand square.] |  |
|  |  | MICHAEL | Is nine blocks for that one? [Pointing to intersection point (6,3) on the transparency] |  |
|  |  | JEFF | In the nine block it should be twenty. [Jeff writes the numbers 1, 3, and 6 in squares vertically with two 3s to the left of the other 3.] [inaudible] | 00:54:27  Jeff points to the fifteen, noting it should be twenty. |
|  |  | MICHAEL | Where’d they go? | 00:55:08  Jeff creates this case, traces paths, and writes numbers below. He ultimately shakes his pen at this and moves on without discussion. |
|  |  | JEFF | What? |  |
|  |  | MICHAEL | Where’d they go? |  |
|  |  |  | [Brian returns.] |  |
|  |  | JEFF | Well, Brian’s just standing there. I don’t know. I need to go to the bathroom though. I’m like going to pass out. [Jeff leaves.] |  |
|  |  | BRIAN | So what are we doing now. |  |
|  |  | MICHAEL | No idea. |  |
|  |  | BRIAN | Did you figure out the five by five? |  |
|  |  | MICHAEL | Five by five? I’m doing three by three right now. |  |
|  |  | BRIAN | It’s the green. If we already know what it, why don't we just figure out- |  |
|  |  | MICHAEL | I just want to make sure that’s twenty first, so- [Counting routes with his pen on his grid.] |  |
|  |  | MICHAEL | I’m missing two. That’s probably right though. |  |
|  |  | BRIAN | Did you get the, uh, staircase one? |  |
|  |  | MICHAEL | Which one? For the three by three? |  |
|  |  | BRIAN | Yeah. [Romina returning.] All right, I got twelve, fifteen, right. |  |
|  |  | ROMINA | Oh, you guys went and wrote on this didn’t you? |  |
|  |  | MICHAEL | I didn’t do it. |  |
|  |  | ROMINA | All right. |  |
|  |  | BRIAN | Did Jeff tell you? |  |
|  |  | ROMINA | What? |  |
|  |  | BRIAN | I got fifteen for this one- |  |
|  |  | ROMINA | For which one? |  |
|  |  | MICHAEL | //For- |  |
|  |  | BRIAN | //Four by two. |  |
|  |  | ROMINA | So you did get fifteen? So now it’s working? And then the two by four has to be fifteen too. Now if we do three by three and that’s twenty, then we’re done. |  |
|  |  | BRIAN | That’s what he’s doing? |  |
|  |  | ROMINA | What? |  |
|  |  | BRIAN | He said he was off by two. [Romina erasing the numbers on the grid transparency then takes a new transparency with a grid on it.] You can just get another one. |  |
|  |  | ROMINA | I’ll just turn this around. [Referring to the transparency of a centimeter grid. She then writes 2 and 3 in the squares of the first row of the transparency.] |  |
|  |  | BRIAN | It’s only a couple of numbers. |  |
|  |  | ROMINA | I did it again. You got twelve for this one? Fifteen, I mean? [Rewriting the numbers on the grid and adds a 15 to the right of the 10 and under the 10.] |  |
|  |  | BRIAN | Yep. Now, what one are you expecting to be twenty? Three by three? | 00:57:51 Romina rewrites their work. She notes she repeated the mistake by writing nine instead of six, but she fixes it before it dries. |
|  |  | BRIAN | I guess I’ll do it. Check it out. |  |
|  |  | ROMINA | I don’t think- it’s here- he has- He was just doing three by three wasn’t he? [Looking through her papers.] |  |
|  |  | BRIAN | Yeah. It’s no big deal. |  |
|  |  | End Clip 3 |  |  |
|  |  | Begin Clip 4 |  |  |
|  |  | ROMINA | I’m already stuck. [Brian drawing a three-by-three subgrid on his paper. Romina draws in shortest routes for the “imaginary” three-by-threes on her grid. Romina’s pen stops when drawing a route.] | 00:58:34 Brian draws a three by three grid by first placing nine outer dots, connecting them, placing four inner dots, then completing the figure above. |
|  |  | JEFF | You shouldn’t be. Where you going? | 01:00:00 Romina pauses to count her thirteen paths. |
|  |  | ROMINA | Three by three. [Showing the paper to Jeff.] |  |
|  |  | JEFF | You said F making the- the boxes. |  |
|  |  | MICHAEL | Yeah, I got twenty for that one. |  |
|  |  | JEFF | For three by three? |  |
|  |  | MICHAEL | Yeah. |  |
|  |  | JEFF | All right well then- I mean can’t we explain why we think- well- all right. [Waving his hand.] |  |
|  |  | MICHAEL | //They’re going to ask us- |  |
|  |  | JEFF | //All right then the next question is why- //why |  |
|  |  | ROMINA | //Now- |  |
|  |  | MICHAEL | //How do you know- |  |
|  |  | ROMINA | //Just relate this back to the //blocks. [Pointing to the 1-centimer grid on the transparency with his marker.] |  |
|  |  | JEFF | //Wait- Why is this- why does the Pascal’s triangle work for this is the question. |  |
|  |  | ROMINA | //Exactly. Relate it to the blocks. |  |
|  |  | MICHAEL | //Just think first how do you know it’s twenty? You know, how do you know it’s not nothing else? |  |
|  |  | JEFF | Well F that. If we could explain- |  |
|  |  | ROMINA | Stop saying that. |  |
|  |  | JEFF | Why- why this is the Pascal’s triangle up to here [Pointing to the numerical array on the transparency 1-centimeter grid.], we don’t need to explain how we’re positive this is twenty. //You know what I’m saying? |  |
|  |  | ROMINA | How does it go- this is- |  |
|  |  | JEFF | One- |  |
|  |  | MICHAEL | It should be ones on all the sides. [Jeff writing ones on the outside lines of their numeral array on the transparency 1-centimer grid.] |  |
|  |  | ROMINA | Yeah right. So- [Writing out Pascal’s triangle.] |  |
|  |  | JEFF | And that’s six- |  |
|  |  | ROMINA | This is just one, two, three. //So- |  |
|  |  | JEFF | //What’s that? |  |
|  |  | ROMINA | With one- //there’s only one possibility. |  |
|  |  | MICHAEL | //All right, how- //how is he getting them? |  |
|  |  | ROMINA | //Two- |  |
|  |  | MICHAEL | How are you getting yours? Maybe the way you’re doing will give us |  |
|  |  | JEFF | Has some kind of- Yeah, we can work something out. |  |
|  |  | BRIAN | [Inaudible]. |  |
|  |  | MICHAEL | Do you just like- are you guessing or do you have some kind of pattern? |  |
|  |  | BRIAN | I’m just- doing it man. I’m just- you know- |  |
|  |  | MICHAEL | Ah- [Romina pointing to the numbers on her transparency with a marker.] |  |
|  |  | BRIAN | I know there’s a way to make two and get there in two moves. I know there’s a way to make it in three moves. Four moves. |  |
|  |  | MICHAEL | So you’re going by the moves, right? |  |
|  |  | BRIAN | Yeah. |  |
|  |  | JEFF | Don’t use that one. |  |
|  |  | ROMINA | Hold on. For the Pascal’s triangle- |  |
|  |  | MICHAEL | Yeah. |  |
|  |  | JEFF | You’re making thumbprints again. |  |
|  |  | ROMINA | The one, //two, one- |  |
|  |  | JEFF | //Bringing it back to eighty-six. |  |
|  |  | ROMINA | -that’s with what? With? |  |
|  |  | MICHAEL | Um- |  |
|  |  | ROMINA | Two colors- It’s, it’s two to the *x* like that? [Pointing to the second diagonal “row” of the array of numbers on the 1-centimeter-square transparency, containing the numerals 1, 2, 1.] |  |
|  |  | MICHAEL | Yeah it’s two. |  |
|  |  | ROMINA | So it’s two colors- |  |
|  |  | MICHAEL | Think of it as zero, one, two- you only have two colors of choices - zero, one, two. Three |  |
|  |  | ROMINA | Huh |  |
|  |  | MICHAEL | Three toppings on a pizza. | 01:01:50 Brian’s work for the three by three case. |
|  |  | ROMINA | Yeah, like- so then how could this- this is two what? Two? Two different ways- like- [Pointing to the top numbers on the transparency with her marker.] |  |
|  |  | MICHAEL | Two- Uh- it’s the total. One, two, three- That’s, that’s the total length that you can get, have to get there- to get there. [Pointing at numbers on transparency with marker.] |  |
|  |  | ROMINA | Yeah, okay. |  |
|  |  | MICHAEL | You know? |  |
|  |  | ROMINA | So for this one, the total length is three. |  |
|  |  | MICHAEL | But then this one is one, two, three, four, five and you get ten. You know? [Pointing at the 6 on the transparency grid] |  |
|  |  | ROMINA | But you’re in the second row. [Pointing at triangle] |  |
|  |  | MICHAEL | Yeah. [Romina taps her marker on the table.] Right. This is one, two, three- four, five, six and you get twenty. [Pointing at the 20 on the transparency grid.] |  |
|  |  | ROMINA | All right. |  |
|  |  | BRIAN | All right. |  |
|  |  | ROMINA | I’m going to write it this way because I’m having a- I don’t know about you people but- How does this go? It’s not like in the blocks, is it? |  |
|  |  | JEFF | What? For the thing? |  |
|  |  | ROMINA | Yeah. |  |
|  |  | JEFF | Yeah, it’ll fit. Well- why don’t you start like in the middle like here. | 01:02:58 Romina’s work showing Pascal’s Triangle for the taxicab grid. |
|  |  | ROMINA | Yeah. |  |
|  |  | JEFF | Or why don’t you use a different transparency? |  |
|  |  | ROMINA | Well I just want it like- I’m just doing it so I can see it. |  |
|  |  | MICHAEL | Why don’t you do it like //that that way we can see it. [Pointing to the transparency grid with his marker.] |  |
|  |  | JEFF | //Why do you keep- //you’re starting all the way over on the side every time. |  |
|  |  | BRIAN | //All right. There’s twenty |  |
|  |  | MICHAEL | Start like this. It’s easier to figure out like a two by two box. Over here [Inaudible]. |  |
|  |  | ROMINA | No, I know. It’s just- it’s just so I can see it so that’s one block, two block, three block, okay. |  |
|  |  | JEFF | All right. |  |
|  |  | MICHAEL | That would be seven- twenty-one- thirty-five- |  |
|  |  | JEFF | All right. You want to, um- You want to try and explain this and then wherever we get like confused along the way, you know maybe that’s how we’ll be able to- as we talk through it we could even- Oh sorry. I tried to stop it from hitting your leg. I don’t even see it. |  |
|  |  | MICHAEL | It’s a wet erase marker it will come off with water. |  |
|  |  | BRIAN | Oh man. |  |
|  |  | JEFF | At least you don’t have grease all over your pants. |  |
|  |  | ROMINA | Yeah but this is like my favorite- |  |
|  |  | JEFF | Oh I hate these pens. |  |
|  |  | ROMINA | Would you lick it because my fingers have blue on them? Lick your fingers Jeff. |  |
|  |  | JEFF | It’ll be all right. It’s going to be there for a little while, you’ll have to deal with it. All right, can we try to explain this? |  |
|  |  | MICHAEL | To who? |  |
|  |  | JEFF | Anyone who wants to hear it. |  |
|  |  | JEFF | Here’s some water for it. |  |
|  |  | BRIAN | Jeff- |  |
|  |  | JEFF | All right. Uh- |  |
|  |  | MICHAEL | Put the caps on so they don’t roll. |  |
|  |  | BRIAN | We’ve got like five minutes. |  |
|  |  | BRIAN | You’re just going to spread it all over the place. |  |
|  |  | JEFF | Well don’t get mad at me. Relax. I’m trying to work this out here. What do you think? Should //I continue. |  |
|  |  | BRIAN | //You ain’t working nothing that way. |  |
|  |  | JEFF | What about a tissue that we could dab- we could- |  |
|  |  | BRIAN | What about Romina, when you go home- |  |
|  |  | JEFF | Yeah, you put a little stain stick on it- |  |
|  |  | BRIAN | A little Shout. //It’ll Shout it out. |  |
|  |  | JEFF | Shout it out. |  |
|  |  | ROMINA | I don’t have those things. |  |
|  |  | JEFF | You could go to the //store and pick them up. |  |
|  |  | BRIAN | //Go to the store. You could buy little Shout wipes. |  |
|  |  | JEFF | Yeah, they’re real cheap. You could clean it up and you’ll never have to worry about it. |  |
|  |  | ROMINA | I’m very upset right now. |  |
|  |  | BRIAN | Tell me they got? |  |
|  |  | JEFF | Do you see this? |  |
|  |  | UNKNOWN | Romina do you want a baby wipe? |  |
|  |  | ROMINA | Yeah please. We’ll try this. |  |
|  |  | JEFF | Can I get one of those just for my hands? |  |
|  |  | UNKNOWN | Yes. |  |
|  |  | ROMINA | Yeah, my hands are- |  |
|  |  | UNKNOWN | Anybody else? Baby wipe Brian? |  |
|  |  | BRIAN | Nah, I’m clean man. |  |
|  |  | UNKNOWN | Mike? |  |
|  |  | MICHAEL | No I’m good. |  |
|  |  | JEFF | Let me see your hands. |  |
|  |  | BRIAN | I ain’t working with the markers. |  |
|  |  | JEFF | Oh that’s- |  |
|  |  | ROMINA | So when I asked someone to lick my shirt you were obviously not going to. |  |
|  |  | BRIAN | Well Romina, I’m going to come over and lick your shirt. That’s what I’m going to do. |  |
|  |  | ROMINA | Lick your fingers. I didn’t mean lick my shirt. |  |
|  |  | BRIAN | And you see what it did? It spread it all over your shirt. |  |
|  |  | JEFF | Why don’t you go for that on your shirt? |  |
|  |  | ROMINA | Because I’m going to try to- |  |
|  |  | BRIAN | I love the smell of baby wipes dude. |  |
|  |  | JEFF | They do smell good. |  |
|  |  | ROMINA | Oh. It’s just getting worse. |  |
|  |  | BRIAN | Now it’s going to be a wet stain. |  |
|  |  | JEFF | Ah!- |  |
|  |  | BRIAN | Romina has it- Romina if it didn’t- |  |
|  |  | MICHAEL | You just better leave it. |  |
|  |  | JEFF | If it- Just stop. |  |
|  |  | BRIAN | You’re making it worse. |  |
|  |  | ROMINA | It’s already bad. |  |
|  |  | BRIAN | You’re going to ruin it beyond repair. |  |
|  |  | BRIAN | Is she busy? She can’t come and visit us? |  |
|  |  | UNKNOWN | She’s just all the way down the hall, she's coming. |  |
|  |  | BRIAN | All right. |  |
|  |  | JEFF | How- //how are those kids doing? |  |
|  |  | ROMINA | //Yeah you know they’re probably done with the assignment. |  |
|  |  | JEFF | Are they- //what are they doing? |  |
|  |  | ROMINA | //They’re on problem five. |  |
|  |  | MICHAEL | This takes a long time to figure this out. |  |
|  |  | BRIAN | You know probably- if we just think about it what do we work on every single //time. |  |
|  |  | JEFF | //Yeah I know, but we go to- |  |
|  |  | MICHAEL | We got to explain it. |  |
|  |  | JEFF | You got to figure it out. You know what I’m saying? You got to go through it. |  |
|  |  | BRIAN | She’s going to look at these, and she’s like I have no idea what you’re doing. |  |
|  |  | JEFF | I’m out- I’ve got to leave //in five minutes. |  |
|  |  | ROMINA | //No she’s going to go like this. You’re still on this? |  |
|  |  | JEFF | She won’t say that. |  |
|  |  | MICHAEL | No they got- they got a different problem than us. |  |
|  |  | JEFF | They have the same- do they have the same problem down- |  |
|  |  | End Clip 4 |  |  |
|  |  | Begin Clip 5 |  |  |
|  |  | JEFF | ...down there? |  |
|  |  | ROMINA | Are they done? |  |
|  |  | T/R1 | Um, they’re working on a different problem. |  |
|  |  | JEFF | They have a different problem? |  |
|  |  | BRIAN | All right. |  |
|  |  | ROMINA | Like they didn’t get //this one to work on? |  |
|  |  | MICHAEL | //We- we can’t justify our answer but we’re- we’re, uh- |  |
|  |  | JEFF | We’re going to talk through it. |  |
|  |  | ROMINA | //[Inaudible] |  |
|  |  | JEFF | //And we want to see where that takes us. I’m going to have to leave in five minutes though. |  |
|  |  | T/R1 | Oh so, you’ve got to talk fast. |  |
|  |  | JEFF | So, we’re going to talk fast. All right. |  |
|  |  | T/R1 | Okay, the problem I really wanted to give you was for all the points on the grid. |  |
|  |  | ROMINA | Oh good. //We did that. |  |
|  |  | JEFF | //Oh yeah. That’s what we did. |  |
|  |  | ROMINA | Why don’t we do points- |  |
|  |  | BRIAN | We got it. We got it. |  |
|  |  | JEFF | You know- |  |
|  |  | ROMINA | Points up to- |  |
|  |  | T/R1 | All right. So tell me, tell me. |  |
|  |  | BRIAN | Pens are flying now. |  |
|  |  | T/R1 | Yeah. Did you like the problem? |  |
|  |  | ROMINA | No. Nah, it was okay. |  |
|  |  | JEFF | It’s just-, doing all this kind of stuff really hurts your brain, but other than that //it was all right. |  |
|  |  | ROMINA | //It- your eyes. All right. What we did is we- we took it |  |
|  |  | JEFF | We broke it down. |  |
|  |  | ROMINA | Yeah, we just went from point to point on the thing. |  |
|  |  | JEFF | Yeah. Like we even- we’ll just say we started making the box like that. How many different ways can you get from this point to this point? You know, make an easier problem. Like the basic math- deal. [Romina draws in points with her marker and points to the numbers on the transparency grid.] |  |
|  |  | ROMINA | So we did like up to this point there’s two. Up to this point there’s three, four, six, three- So that- those are our numbers. Those are up to the points like down and diagonal. And what we got is Pascal’s triangle. [Jeff points to the numbers on the transparency grid with his marker.] |  |
|  |  | JEFF | Yeah. We started, you know, and then as we started, you know, like it takes two to get to there. Three to you know, to get there as Romina just went through and did. And then as we started filling it out we noticed that if you tilt it like that [Rotating the transparency.] and throw ones on the outside and a one on top, I mean you’re looking at Pascal’s triangle. And so we stopped at this point [Jeff points to a point on the transparency grid with his marker.] because I mean making, you know, like thirty plus different things like this it gets- it just gets confusing you know. [Drawing a curve on his paper.] |  |
|  |  | T/R1 | Hm. |  |
|  |  | JEFF | And so Brian had a- Brian was get- like doing, you know, we were- some of us were drawing out all the ways. [Jeff begins to draw on his paper.] Brian had another method of finding out the ways to do it. //You know. //And we just- [Jeff waves his hand to Brian.] |  |
|  |  | ROMINA | //And then we just compared //them. And like //whatever he didn’t have- |  |
|  |  | JEFF | //-brought it all together and then that’s kind of what we’re looking at right now. |  |
|  |  | T/R1 | So you found those numbers, all of them, by counting? [Referring to the numbers on the taxi grid] |  |
|  |  | ROMINA | Yeah. //The ones we have written. Yeah. |  |
|  |  | JEFF | //Well up- up to here. [Jeff points to a number on the transparency grid.] Right. What is written we counted through them. [Making a circular motion with his hand.] |  |
|  |  | T/R1 | Okay. So is there anyway you can justify if I were to say to pick- you said these are like rows, like so this one, two, one would be what row? These points here //of the triangle? [Pointing to 3 vertices on the grid.] |  |
|  |  | JEFF | //What? Um, I’m not- |  |
|  |  | T/R1 | You put ones on the side I noticed. |  |
|  |  | JEFF | Yeah. |  |
|  |  | T/R1 | So if you were to look at //one, two, one- |  |
|  |  | MICHAEL | //Do you mean like this row? [Pointing to triangle] |  |
|  |  | T/R1 | Well pick any row. |  |
|  |  | JEFF | All right. All right. We’ll say one, two, one because that’s an easy place to start from. |  |
|  |  | T/R1 | Right. |  |
|  |  | JEFF | What’s the question though? |  |
|  |  | T/R1 | Right. So- |  |
|  |  | BRIAN | //One, two, three, one- |  |
|  |  | T/R1 | //-that’s the second row. |  |
|  |  | JEFF | //Yeah. |  |
|  |  | MICHAEL | //I mean I guess we’re saying- |  |
|  |  | JEFF | That’s the second- yeah. [Pointing to triangle] |  |
|  |  | MICHAEL | Things with, uh, one- one block. [Pointing to the transparency grid with pen.] |  |
|  |  | T/R1 | Okay. |  |
|  |  | MICHAEL | Two blocks, three blocks, four blocks. |  |
|  |  | JEFF | And then this would be five blocks then- [Pointing to triangle] |  |
|  |  | MICHAEL | Not four. That doesn’t make sense. |  |
|  |  | T/R1 | How would that be? |  |
|  |  | MICHAEL | No. Six, you could, hum, things that- I don’t know. |  |
|  |  | JEFF | See I’m still not exactly sure what you’re asking. |  |
|  |  | MICHAEL | //Yeah, I don’t know. |  |
|  |  | ROMINA | //Yeah. |  |
|  |  | T/R1 | I didn’t ask anything yet. |  |
|  |  | JEFF | I’m all- |  |
|  |  | T/R1 | I was- I was saying that you- |  |
|  |  | JEFF | What are you trying to- |  |
|  |  | T/R1 | You’re showing me that’s Pascal’s triangle but I don’t see it. Help me see it. |  |
|  |  | JEFF | You don’t see it? |  |
|  |  | T/R1 | Right. Can you //show it to me? |  |
|  |  | JEFF | //All right, well here. The one, one two one, one three three one, one four six four one- [Pointing to transparency grid with marker] |  |
|  |  | T/R1 | Okay let- show me again where’s the four? |  |
|  |  | JEFF | All right. We’re on- all right. The- that one right there- [Pointing to grid] |  |
|  |  | T/R1 | Mm hm. |  |
|  |  | JEFF | -that we added in and this two is the three. The two in that one there is a three and there’s two ones on the outside- [Placing his finger on each number as he speaks.] |  |
|  |  | T/R1 | Mm hum. |  |
|  |  | JEFF | So you get one three three one. And then one- the one and the three for the four. Three and the three for the six. The three and the one for the other four and then the other one on the end and then continuing through the four and the one together is the five. The four and the six is the ten. Six and the four is the other ten. Four and the one is the five. //Do you see it? [Pointing with his finger and marker to the numbers on the transparency grid.] |  |
|  |  | T/R1 | //Okay. So can you explain to me, for instance, why that works? Why- where this ten comes from when you know- you’re just saying well there’s a pattern here because you found them, but is there a way where you haven't found them that makes sense to predict the number of paths of one you haven’t found? |  |
|  |  | JEFF | Well like to here, I mean we //would say- |  |
|  |  | T/R1 | //You understand my question? |  |
|  |  | JEFF | Well like to here we would say it was thirty-five. [Pointing to a square on the transparency grid with marker] |  |
|  |  | T/R1 | Right. How would you- how- where //would the thirty-five come from? |  |
|  |  | MICHAEL | //You can’t justify it because- You can justify these because you can say you counted. You can’t justify that because you can’t say you counted. |  |
|  |  | JEFF | Yeah because we didn’t count it. We’re saying we’re following the pattern- [Waving his hand.] |  |
|  |  | T/R1 | Right. |  |
|  |  | JEFF | That’s- that is our justification as of now. |  |
|  |  | ROMINA | [Inaudible]. |  |
|  |  | T/R1 | Right. |  |
|  |  | JEFF | That we’re just following //the pattern. |  |
|  |  | T/R1 | Do you understand my next question Jeff? What I’m asking? |  |
|  |  | JEFF | //Yeah. |  |
|  |  | ROMINA | //What if three- what if Pascal- |  |
|  |  | T/R1 | Because so you notice this pattern and the pattern fits Pascal’s triangle. |  |
|  |  | BRIAN | So does that mean there’s //thirty-five for the red one? [Romina and Mike are counting. Mike writes something.] |  |
|  |  | MICHAEL | //Only these are zeros. This is like one topping- you know on the pizza? [With Jeff looking at the transparency grid. Jeff pointing to a number on the grid.] |  |
|  |  | ROMINA | Yeah, one topping, two toppings. |  |
|  |  | BRAIN | Remember how- Mike you had thirty-four for the red one, right? |  |
|  |  | MICHAEL | Um- Yeah I think that was the problem. |  |
|  |  | BRIAN | It’s thirty-five. |  |
|  |  | JEFF | Yeah, it’s thirty-five. |  |
|  |  | MICHAEL | Oh, I probably missed one. |  |
|  |  | JEFF | Good, uh, deduction. |  |
|  |  | T/R1 | So you counted thirty-four by brute force //and you’re saying that by this pattern, um, you would feel more comfortable with the pattern in saying thirty-five. |  |
|  |  | JEFF | //Yeah. |  |
|  |  | BRIAN | But- |  |
|  |  | T/R1 | Right? |  |
|  |  | ROMINA | Did you actually get thirty-five? |  |
|  |  | MICHAEL | I got //thirty-four. |  |
|  |  | BRIAN | //He got thirty-four but you know he’s been off by like one cause you know. Yeah, it could- it could of //been one. |  |
|  |  | ROMINA | //Natural tendencies? Um,- |  |
|  |  | MICHAEL | Stop that. |  |
|  |  | T/R1 | Okay. So why is- why is that- |  |
|  |  | ROMINA | All right. [With Jeff studying the transparency grid.] |  |
|  |  | T/R1 | Why do you think that- Why do those numbers seem to work? How could you explain those numbers? That’s that’s really- isn’t that interesting? |  |
|  |  | JEFF | Yeah. It- it hurts though. It really does. |  |
|  |  | ROMINA | Yeah, I’m having trouble seeing Pascal’s triangle. [Rewriting the triangle the way she is used to seeing it.] |  |
|  |  | T/R1 | It’s hard to see the other way, isn’t it? |  |
|  |  | ROMINA | Mmhmm. All right. So for this one the two comes from when there’s- [Pointing to numbers in the triangle with her marker] |  |
|  |  | JEFF | One block. |  |
|  |  | ROMINA | One- |  |
|  |  | JEFF | Block. |  |
|  |  | ROMINA | Is that- |  |
|  |  | JEFF | One block. |  |
|  |  | ROMINA | Isn’t that two blocks? |  |
|  |  | JEFF | One, two. |  |
|  |  | ROMINA | No. Um, let’s go back to towers. The two comes from this is one block. This is two blocks with two colors. [Continuing to point to numbers in the triangle with her marker.] |  |
|  |  | JEFF | I have to leave. I’m kind of out. |  |
|  |  | ROMINA | Alright. Hold on. How’s this go? Just tell me where this comes from. |  |
|  |  | MICHAEL | What happened? |  |
|  |  | ROMINA | Okay. This is with- with just one block? |  |
|  |  | MICHAEL | This is nothing. |  |
|  |  | ROMINA | This is nothing? This is one block? | 01:12:51 Romina’s Pascal’s Triangle is used to discuss how to relate the taxicab grid to their answer. The red box was Jeff’s demonstration of two paths forming a block. |
|  |  | MICHAEL | This is like- yeah, //one. All right. |  |
|  |  | ROMINA | //One block, two- this one tells how many blocks. |  |
|  |  | MICHAEL | One block. Two blocks. [Pointing to the 1 and 2 in the triangle Romina redrew.] Not two blocks but like- [He points to the numbers on the transparency grid.] [Inaudible.] |  |
|  |  | ROMINA | One block, two blocks, three blocks- Oh no, this is zero block, one block, two block? |  |
|  |  | MICHAEL | For one block you get two. Right? For two blocks- |  |
|  |  | ROMINA | All right. |  |
|  |  | MICHAEL | Three- three- three blocks. One- So you can’t really say it because there’s three for three and then you get four here. You can’t really- I don’t think you can use that. That- that row thing. [Pointing to the numbers on the transparency grid.] |  |
|  |  | ROMINA | All right. Yeah. I know. I’m just trying to- because for like- |  |
|  |  | MICHAEL | There’s got to be some type of, you know, way. Be nice if I could see- |  |
|  |  | ROMINA | Can’t you just go one, two, three, four? |  |
|  |  | MICHAEL | Uh hum [nodding his head in agreement] |  |
|  |  | ROMINA | That’s what it goes one, two, three, four? Because then okay for this one for the three. If we name all the ones going horizontal- *A'*s and ones going down same with *B*. And this would be with two *A'*s and one *B* there’s three and then there’s two *B'*s with one *A*, three. [Pointing with a green marker at the intersections Points † (3,2) and † (3,1) on the transparency grid.] And for this one remember like two *A*s two *B*s- //six. [Now pointing to the intersections point † (4,2) and on the transparency grid.] |  |
|  |  | MICHAEL | //You could say, um- |  |
|  |  | ROMINA | Do you understand what I’m saying? |  |
|  |  | MICHAEL | Like yeah, these are like this row is everything with perimeter two. I mean I half the perimeter, like. [Pointing with his marker to numbers on the transparency grid.] |  |
|  |  | ROMINA | //Well no I’m saying so to get that- |  |
|  |  | MICHAEL | //In order to get to that point you have to go over one and down, uh, one or down one and over one. [Pointing to the intersection point † (2,1).] Just like that row. Everything in this row, over two and down two and over one. |  |
|  |  | ROMINA | Yeah but like I’m just saying like if she were to pick anything like right there we could say it’s like eight *A'*s and like six *B'*s. [Tracing a rectangle on the transparency grid.] You know like- and then we could tell you where you it is in this one. [Pointing to the redrawn Pascal’s triangle on the piece of paper.] |  |
|  |  | MICHAEL | Well you could say all- everything in this row, the shortest route is two. Everything in this row shortest route is three. This one shortest route is four. [Pointing to a diagonal of numbers—1 4 6 4 1—in the transparency grid.] |  |
|  |  | ROMINA | Yeah. |  |
|  |  | MICHAEL | The shortest route is five, six and so on. So that’s how you could, you know, name them. This is row six because it has everything in the row has shortest route of six. [Pointing with a marker to diagonals of numbers on the transparency grid.] |  |
|  |  | ROMINA | No, I understand. I’m just saying like- |  |
|  |  | MICHAEL | There’s a, you know- |  |
|  |  | ROMINA | To get it- |  |
|  |  | MICHAEL | //To- to say it like, oh I’ll pick this block- |  |
|  |  | ROMINA | //Because isn’t that how- isn’t that how we get like the *B*'s? Like doesn’t the two- there’s- that I mean, that’s one- that means it’s one of *A* color, one of *B* color. [Pointing to the 2 on the redrawn triangle on paper.] Here’s one- it’s either one- either way you go. It’s one of across and one down. [Pointing to a number on the transparency grid and motions with her pen to go across and down.] And for three that means there’s two *A* color and one *B* color [pointing to the 3 on the redrawn triangle], so here it’s two across, one down or the other way [tracing across and down on the transparency grid] you can get three is //two down- [Pointing to the grid.] |  |
|  |  | MICHAEL | //You mean like one *A* color and two- |  |
|  |  | ROMINA | Yeah. |  |
|  |  | MICHAEL | This is one- |  |
|  |  | ROMINA | Like two blues, one red. Two across, one down or this is two reds, one blue, two down, one across. And that’s how we would get the Pascal’s triangle. [Pointing to numbers on the redrawn grid and transparency grid.] |  |
|  |  | MICHAEL | But there’s like- you know, there’s got to be a way that we could just say, all right this one’s three. //So five down this has to be this because of some kind of- |  |
|  |  | ROMINA | //I know, I’m just saying- |  |
|  |  | ROMINA | So if it were- |  |
|  |  | MICHAEL | Pattern- I mean like, you know, reasoning. You can’t just say I counted them. |  |
|  |  | ROMINA | I know. I’m just saying so like- and then that could relate back to this but that is this, so it’s relateable- and for- |  |
|  |  | MICHAEL | So what- what are you looking for right now? |  |
|  |  | ROMINA | Yeah like- |  |
|  |  | T/R1 | I think Romina knows what I’m looking for. I think she’s said it very articulately. That if I were to pick any point right on- |  |
|  |  | MICHAEL | Mm hmm. |  |
|  |  | T/R1 | If I were to make a larger grid- right Brian? I think he //knows what I’m looking for. |  |
|  |  | BRIAN | //Yeah. |  |
|  |  | T/R1 | She’s looking for a way to come up with a particular pattern that she’s identifying that. I think I’m hearing you say- you’re trying to look at blocks- |  |
|  |  | 1227. RROMINA | Mm hmm. |  |
|  |  | T/R1 | Colors? |  |
|  |  | 1229. ROMINA | Yeah. |  |
|  |  | T/R1 | And then you’re doing *A'*s and *B'*s. |  |
|  |  | 1231. ROMINA | Mm hmm. |  |
|  |  | T/R1 | That’s what I’m hearing you say? And you were trying to say maybe that could get you to some general point. Why don’t you try saying that again? I- I thought I followed you, but I’m not so sure that Brian and Michael followed what you said. |  |
|  |  | 1233. ROMINA | Like why- |  |
|  |  | T/R1 | So say it again. What you were- |  |
|  |  | 1235. ROMINA | Like why this and this are related? |  |
|  |  | T/R1 | Yeah. |  |
|  |  | 1237. ROMINA | Well- |  |
|  |  | T/R1 | Throw out your idea //again for them so we can hear it. |  |
|  |  | ROMINA | //When we look- whenever we do this we always- we always talk about towers and how this is like a tower of two high with two different colors and there’s one- one tower you can make that makes all one color and one and one and then all the other color. And- and then for this one it’s three high and this is all one color. There’s two of one color and one of the other, whatever. And for this it’s basically the same thing because this is- let’s see. This is- this is two but usually you go one across and one down so there’s two different ways to get to that one. And for this one there’s going to be two across and one down. Or to go down here it’s two down and one across which is basically the same thing and it just goes on. Do you understand? Understand? Was that good? Or, do you want more? [Connecting the data from the grid and the triangle drawings by pointing to the numbers on each back and forth.] |  |
|  |  | BRIAN | Yeah. |  |
|  |  | ROMINA | Or do you want more? |  |
|  |  | T/R1 | I don’t know. I don’t know if Michael- |  |
|  |  | BRIAN | Mike do you understand? |  |
|  |  | MICHAEL | Yeah, I understand what you’re talking about. |  |
|  |  | ROMINA | Yeah. Yeah. |  |
|  |  | MICHAEL | This would be, um, one- we’ll think of it as pizza because that’s the thing I like but- |  |
|  |  | ROMINA | Think of towers. |  |
|  |  | MICHAEL | Or towers. I mean this will be a tower of three- |  |
|  |  | T/R1 | Think of it as pizzas. |  |
|  |  | MICHAEL | A pizza. A pizza with, um, three possible choices for toppings and- I like the tower. |  |
|  |  | ROMINA | Yeah, the tower is easier. |  |
|  |  | MICHAEL | You have, you have a tower of three and you have, you know, two colors. So one- it’s either you know- Color *x* and two of color *y*. Well this is direction *x* and two, two directions of *y*, you know-// [Pointing with a marker to the redrawn Pascal’s triangle.] |  |
|  |  | ROMINA | //Yeah. |  |
|  |  | MICHAEL | //of *y*. So that makes- that makes sense. |  |
|  |  | ROMINA | So for like the three, it would be two *x*, one *y* or two *y*, one *x*// [Referring to the taxi grid.] |  |
|  |  | MICHAEL | //Yeah, I got that. |  |
|  |  | ROMINA | And this would be |  |
|  |  | T/R1 | Okay. Well- where I’m still having a little trouble is, um, - Okay, so you’re talking about these blocks, right? |  |
|  |  | ROMINA | Mm hmm. |  |
|  |  | T/R1 | So what are you labeling them? These blocks? [Referring to blocks on the taxi grid.] Which is the *A* and which is the *B* and why is it //okay to call them *A'*s and *B'*s? |  |
|  |  | ROMINA | //We’ll do it- how about x and y? |  |
|  |  | T/R1 | Sure. |  |
|  |  | ROMINA | *x* will be the ones that go horizontal. [Motioning across with her marker on transparency grid.] |  |
|  |  | T/R1 | Okay. |  |
|  |  | ROMINA | And y will be the ones that go up and down, basic graphing skills. [Moving her marker down.] |  |
|  |  | T/R1 | Does that make any sense Brian? |  |
|  |  | BRIAN | Yeah. |  |
|  |  | T/R1 | Brian, do you think so? |  |
|  |  | BRIAN | I think so. Yeah. I’m- I’m hanging out. I’m doing good now. You know what I’m saying. Oh, I was like what is that? A research paper. |  |
|  |  | T/R1 | T/R3, T/R2, do you have any questions? |  |
|  |  | T/R3 | Well I mean I have a very simple questions. Things you [Inaudible], that is, it’s still not clear to me how- how they know that the- to get to any particular corner it corresponds to one of the numbers in Pascal’s triangle. |  |
|  |  | ROMINA | All right, you see I haven’t done that either yet. |  |
|  |  | T/R1 | Okay, why don’t you think about that for a couple of minutes? |  |
|  |  | ROMINA | All right let’s say- [Drawing on Michael’s representation of Pascal’s triangle] |  |
|  |  | T/R1 | Let me just leave you be while you think. |  |
|  |  | ROMINA | What would that be anyway? |  |
|  |  | BRIAN | We’ll say thirty-five there. [Romina writing 35 on the transparency grid.] |  |
|  |  | ROMINA | You know, why don’t we do this one? |  |
|  |  | BRIAN | Thirty there. |  |
|  |  | ROMINA | This is thirty? |  |
|  |  | MICHAEL | No, no that’s uh-// |  |
|  |  | ROMINA | No. |  |
|  |  | BRIAN | No //twenty-one. |  |
|  |  | ROMINA | //That's not twenty? |  |
|  |  | BRIAN | Twenty-one. |  |
|  |  | ROMINA | No, you know, why don’t we do it this way. |  |
|  |  | MICHAEL | That should be twenty-one. |  |
|  |  | BRIAN | That one right there should be twenty-one. |  |
|  |  | ROMINA | One, six- [Drawing on triangle.] |  |
|  |  | BRIAN | And that should be a six. Fifteen plus six, twenty-one. And twenty- [Pointing to a number on triangle] |  |
|  |  | ROMINA | Like that? Is that one of them? One //six- |  |
|  |  | MICHAEL | //No. The next one. The next one. |  |
|  |  | ROMINA | All right so that’s one, seven- [Writing more rows of the triangle on paper.] |  |
|  |  | MICHAEL | Twenty-one. |  |
|  |  | ROMINA | Okay, I’m just not- I, I’m doing |  |
|  |  | BRIAN | Thirty-five, thirty-five, and twenty-one. |  |
|  |  | ROMINA | And one- //seven. |  |
|  |  | BRIAN | //Seven. |  |
|  |  | ROMINA | Thirty-five, thirty-one, seven, and one. |  |
|  |  | MICHAEL | Like we know it is that. |  |
|  |  | ROMINA | Okay- //So this- |  |
|  |  | MICHAEL | Without- //without just saying //oh it follows the pattern. |  |
|  |  | BRIAN | //[Inaudible] why. |  |
|  |  | MICHAEL | He wants to know why. Yeah. |  |
|  |  | ROMINA | So this one is- is that thirty-five again? Or no, this one’s thirty-five. [Writing the numbers in on the transparency grid.] |  |
|  |  | BRIAN | This one’s thirty-five. |  |
|  |  | ROMINA | This one’s thirty-five, so then this one is? |  |
|  |  | BRIAN | Twenty-one. |  |
|  |  | ROMINA | Twenty-one. So let’s see. One, two, three, four, five, one, two- Like, I don’t know. I see how it would go. Because- [She draws lines in between the numbers in the 7th row.] |  |
|  |  | MICHAEL | I- I know- we know it follows a pattern but he wants to know- |  |
|  |  | ROMINA | Okay. Five- |  |
|  |  | MICHAEL | Without saying oh it just follows a pattern. //Why is it- |  |
|  |  | ROMINA | //Okay, five and two- five and two, just add that. That’s how many blocks there are. That’s seven. So you got to go one, two- no. One, two, three, four, five, six, seven. Gets you down to seven. And five of one thing and two of another thing, so you just- you don’t count- we won’t count the one because that doesn’t involve that. [Pointing between the transparency grid and the redrawn, augmented version of Romina’s Pascal’s triangle.] |  |
|  |  | MICHAEL | Yeah, what do you mean five and seven? |  |
|  |  | ROMINA | What? |  |
|  |  | MICHAEL | What are you talking about five and two? |  |
|  |  | BRIAN | Five across //and two down. |  |
|  |  | ROMINA | //Five across and two down. Like you just count in. It goes- that’s with one of one color and that’s with two of two- of another color. That’s with three, that’s with four, that’s with five. So it’s either the two or the five. Both of them are the same thing. Yeah, we can explain this. Right? If anyone you pick like this one, you know it’s one, two, three, four, five, six, seven. You know it’s seven and it’s going to be one, two, three- six of one color so it’s going to be seven. [Pointing to both the redrawn, augmented triangle and numbers on the transparency grid.] |  |
|  |  | MICHAEL | Are you saying five across- one, two, three, four, five, one, two. [Working with a figure of the first six rows of Pascal’s triangle.] |  |
|  |  | ROMINA | So- either way- no, but it’s seven blocks. It’s five plus two. That’s how many blocks you had. For seven blocks you go down. Go one, two, three, four, five, six to the seventh row. And now you know it’s five by two so it means there’s five of one color, two of another color so if I go to the second one this has to- this is all one color. This is one with one color this is two. So it’s either twenty-one or there’s three of one color, there’s four of one color, and this is five of one color or twenty-one again. [Circling the two 21s on the redrawn, augmented version of Romina’s Pascal’s triangle.] (01 | 01:22:52 Romina circles the two entries of twenty-one at 7C2 and 7C5 in the seventh row of Pascal’s Triangle, relating this to their grid point of (5, -2) with Michael. |
|  |  | MICHAEL | Starting with, say, not colors but like //ups and downs, you know- |  |
|  |  | ROMINA | //Or like that- this is //with two- two- |  |
|  |  | MICHAEL | //But why- you know, why is it thirty-five? If you go- Or why is it- let’s go- go a little easier. Why is it, you know, four if- of, um |  |
|  |  | ROMINA | All right. Four, right? Four is- all right, why don’t we do six? Six is a little harder. Six is one two- the one with six. There’s one, two, three, four- you know there’s four- [Pointing to triangle.] |  |
|  |  | MICHAEL | It’s two and two. All right. Two, four- |  |
|  |  | ROMINA | This one. |  |
|  |  | MICHAEL | One, two, three, four. |  |
|  |  | ROMINA | It’s because it’s four blocks. No matter how you go there you had to take four spaces. And any direction you take has to be four spaces, right? So that means it’s four- it’s four blocks high. So you go to the fourth one. So you know it’s in here. [Circling the 4th row of the triangle.] And it’s- to get here it’s two across and two down. So whatever, like, you know- Do you understand? Whatever route you take you're going to have to get two across two down. So it means there’s- |  |
|  |  | MICHAEL | Two across and two down would, would be this one because this would be one across and two down and this is two across and two down and this is- Wait, two down- two down and one across. One across and two down and this is two across and one down. [Pointing to redrawn triangle.] |  |
|  |  | ROMINA | No, this is three across one down. |  |
|  |  | MICHAEL | Oh whatever. Three. |  |
|  |  | ROMINA | And this is //three down- |  |
|  |  | MICHAEL | //No it’s imposs-. //It doesn’t make sense. |  |
|  |  | ROMINA | //Three across. |  |
|  |  | MICHAEL | Three across would be at- you’d be in- you’d be somewhere else. |  |
|  |  | ROMINA | No you won’t. Three across, one down is still in that row. |  |
|  |  | MICHAEL | Yeah but you- you’re doing this- this square right here, right? Two and two. |  |
|  |  | ROMINA | I’m doing the six, right? You want me to do the six? |  |
|  |  | MICHAEL | Yeah. That square right there. [Pointing at taxi grid transparency] |  |
|  |  | ROMINA | That’s still a four. |  |
|  |  | MICHAEL | Mm hum. |  |
|  |  | ROMINA | That’s two across two down. That’s four so you’re in the four blocks. And then it’s this- to get to here the only way to get to here is somewhere you got to go two across and two down. So that means there’s two of one color and two of another. This is all one color. This is one and three. Two and two. Three and one.// [Pointing to grid and redrawn triangle] |  |
|  |  | MICHAEL | //All right. Yeah - That makes sense// |  |
|  |  | ROMINA | //All one color. And this- the four is still three and one but then it’s three across and one down so it means it’s three of one color or the one of the other color. [Pointing to triangle] |  |
|  |  | MICHAEL | That- that’s a pretty good explanation. |  |
|  |  | BRIAN | It’s cool. |  |
|  |  | ROMINA | Who’s calling them in? (01 |  |
|  |  | BRIAN | Man. Don’t call them in yet. Let’s hang out. I’m going to go home //I’m going to weigh a hundred and ten pounds. |  |
|  |  | ROMINA | //Does it look better? |  |
|  |  | MICHAEL | Yeah. |  |
|  |  | BRIAN | You didn’t have to get them. |  |
|  |  | T/R1 | Oh. So- |  |
|  |  | ROMINA | We’re ready for his question. |  |
|  |  | BRIAN | Romina’s got something good. |  |
|  |  | T/R1 | Okay, ready for your question. |  |
|  |  | ROMINA | Come on down. |  |
|  |  | End Clip 5 |  |  |
|  |  | Begin Clip 6 |  |  |
|  |  | T/R1 | RESEARCHER 3. |  |
|  |  | BRIAN | RESEARCHER 3. |  |
|  |  | ROMINA | He’s our summer buddy. |  |
|  |  | MICHAEL | All right. Ask- ask your question again so we know what we’re- |  |
|  |  | ROMINA | Exactly what you’re saying. |  |
|  |  | T/R3 | Uh, my question was you said that you found Pascal’s triangle here and um, it wasn’t clear to me that if you go, let’s take- |  |
|  |  | MICHAEL | Do you want a like reason why- how it relates? |  |
|  |  | T/R3 | Yeah. |  |
|  |  | ROMINA | Okay. |  |
|  |  | MICHAEL | Not because it looks like it? You want to know why. |  |
|  |  | ROMINA | Now we just picked any point. Let’s say we picked this point. No matter how you get to this point- |  |
|  |  | MICHAEL | Do the six one. The six one- |  |
|  |  | ROMINA | Well we’ll do the six and the four. |  |
|  |  | MICHAEL | All right. |  |
|  |  | ROMINA | Okay, to this point you know you need to take at least you have to take four moves. That’s the shortest amount of moves because just like a simple one, two, three, four. So that means it’s- let’s say you we’re relating back to this four moves equals four blocks. So I’d have to go down to the four block area. So that’s one, two, three, four. [Pointing to the fourth row of her Pascal’s triangle.] And now here you’re going three across and one down. Or- so- [Illustrating the moves on the taxi grid and pointing to the numbers on the grid and redrawn triangle.] |  |
|  |  | MICHAEL | There’s no possible way you could- |  |
|  |  | ROMINA | //Do anything else. |  |
|  |  | MICHAEL | //You have to- no matter how or which way you go you have to go three and then one. |  |
|  |  | ROMINA | Right. In any move you’re going one down and three across no matter- in any direction you take. So the three across and one down, that would relate to three colors and then- |  |
|  |  | MICHAEL | Of one- |  |
|  |  | ROMINA | Three of one color and one of another. So you go and you look in here. Say- Okay, here’s with all one color. This is with one of one color- |  |
|  |  | MICHAEL | That’s- that’s nothing. |  |
|  |  | ROMINA | No that’s all one color but we’re not using that because you can’t all go all in the same direction. That’s all one color. That’s with one of one color and three of the other. So that’s four and that’s what we have and if you go down to here this is two and two and this is three and one which is the same thing. So there’s your other four. And if you go to the sixth, the only way you can get there again is by four moves. It goes one- one, two, three, four. So you’re in the four block again but this time you have to take, no matter what you do, you go two across and two down anyway you do it. So that would be two and two which is your six but you’re still in like the four block area. [Relating the taxi grid to Pascal’s triangle.] |  |
|  |  | MICHAEL | Like you know what the uhm- let me write this down. Like when you write the Pascal’s triangle, this is really like- like- all right, let’s say- |  |
|  |  | ROMINA | [Inaudible]. |  |
|  |  | MICHAEL | Let’s say it’s like, uh- I don’t know how to say it- like, um, like a pizza or something. All right, you have a choice of four toppings. |  |
|  |  | T/R3 | Okay. |  |
|  |  | MICHAEL | All right. This one is the pizza with nothing. So you’ll only- there’s only one possibility without any toppings on the pizza. [Pointing at the triangle.] |  |
|  |  | T/R3 | Uh hum. |  |
|  |  | MICHAEL | Now if you have one choice of topping you get four. I see it but I don’t know how to like say it. [Waving both hands.] |  |
|  |  | T/R3 | Maybe you can help me see how you’re relating the number of toppings and the number of //blocks. |  |
|  |  | MICHAEL | //To this? |  |
|  |  | T/R3 | Yeah. To the- get- getting to any- to a particular corner. |  |
|  |  | MICHAEL | I like see something and I- if I say it’ll- it’ll make it a lot clearer but I just don’t- don’t know how to say it. |  |
|  |  | T/R3 | Why don’t you just try saying it? |  |
|  |  | MICHAEL | All right. Well- I’m trying to think of like a- a way// |  |
|  |  | ROMINA | //Mike, if we were to use pizza could you explain this ‘cause I don’t know how to do this, okay, that means you have four toppings- [Pointing with Michael to the 4th row of the triangle.] |  |
|  |  | MICHAEL | This is, um,- Yeah, four toppings. |  |
|  |  | ROMINA | //Plain. [Pointing to the 1st number in the 4th row.] |  |
|  |  | MICHAEL | //You have one topping, you’re going to make //four different kinds of pizzas. |  |
|  |  | ROMINA | //One topping. //Two toppings. [Pointing to the 2nd # in the 4th row] |  |
|  |  | MICHAEL | //Two toppings. [Pointing to the 3rd #] |  |
|  |  | ROMINA | //Three toppings. [Pointing to the 4th number] |  |
|  |  | MICHAEL | //You can make six. |  |
|  |  | ROMINA | Four toppings. [Pointing to the 5th number] |  |
|  |  | MICHAEL | Yeah. |  |
|  |  | ROMINA | All right. So, you can do that. Just do- |  |
|  |  | MICHAEL | Don’t know where to go from there though. Like how to relate toppings to that. |  |
|  |  | ROMINA | Just the same way I just did with the blocks. It’s the same thing. |  |
|  |  | MICHAEL | All right, think of a topping as like, um, being able to go across so if you’re only able to go across one time then you could do it four different ways and- |  |
|  |  | ROMINA | That’s one topping. |  |
|  |  | MICHAEL | Here. You could do this- This- this one right here. Go across this time and go down this time and go down and this time and that time. The rest is all going down. The rest of your moves are all going down. [Tracing moves on grid] |  |
|  |  | T/R3 | So you’re say one topping- |  |
|  |  | MICHAEL | Yeah. Yeah, one topping would be like you’re only able to walk across or go across or drive across actually it’s a taxi, one time- one block. |  |
|  |  | T/R3 | Okay. |  |
|  |  | MICHAEL | Now the six would mean you’re able to drive two blocks across and two down. Um, four would be you’re able to drive three across and the last- and this one right here is you’re able to drive- wait four, um, you’re able to drive four across which- I mean, drive four down- no, nothing across. I’m trying- I’m trying to say- I can’t really say- |  |
|  |  | BRIAN | Good job. |  |
|  |  | MICHAEL | Yeah, this would mean you would drive nothing across. It wouldn’t even get you to that- wouldn’t even get you there. So, that’s why, you know, the ones don’t really count in our- in our like model. Like- [motioning with fingers in air and pointing to redrawn triangle and grid triangle] |  |
|  |  | ROMINA | The ones- the ones //would be if you just could- |  |
|  |  | MICHAEL | //The only thing- |  |
|  |  | ROMINA | -if you’re going just to this point because it’s only you’re only going in one direction. Like you can’t get to any of the inside points because you have to use two directions. |  |
|  |  | MICHAEL | Yeah. So on the odd do you see like four- |  |
|  |  | T/R3 | What I understood you say- you’re saying is that the number of toppings related to- |  |
|  |  | MICHAEL | To the number of times you go across. |  |
|  |  | T/R3 | Okay. So that one that you have at the corner there- |  |
|  |  | MICHAEL | This one right there? [Pointing to a number in the redrawn triangle] |  |
|  |  | T/R3 | Uh hum. How many toppings is that one? |  |
|  |  | MICHAEL | That’s all the toppings. But you really- you can’t get there by going all- you know- um- |  |
|  |  | ROMINA | Those would be like the across- toppings. |  |
|  |  | MICHAEL | Yeah. This one actually- this would be, uh, all toppings, which would really mean all down. |  |
|  |  | T/R1 | So are you telling me that some of those are across and some of those are down? |  |
|  |  | MICHAEL | Yeah, like how I was saying it. |  |
|  |  | ROMINA | This one would be two across- [Pointing at 4 in the triangle] |  |
|  |  | MICHAEL | No, no. This would be one across and-[pointing at 4 in triangle] |  |
|  |  | ROMINA | One across, yeah. |  |
|  |  | MICHAEL | -and three down. All right? That’s- [Pointing at one by three in grid] |  |
|  |  | ROMINA | No- |  |
|  |  | MICHAEL | No, one across and three down. [Pointing at grid] |  |
|  |  | ROMINA | Yeah, that one |  |
|  |  | MICHAEL | All right, this one you go two across and two down and three across and one- and one down. [Pointing at grid] |  |
|  |  | T/R1 | So how does that work with the A’s and the B’s and the toppings? So I see what you mean by across and down but now if I’m thinking of *A*s and *B*s or *x’*s and *y’*s, right. Would you say that just one more time? I know that you’ve said it. |  |
|  |  | MICHAEL | I- I said it? |  |
|  |  | T/R1 | No. Somehow it came out of the conversation. Somebody said it. |  |
|  |  | BRIAN | Romina was bringing it up. |  |
|  |  | ROMINA | Um, I’m sorry. What am I trying? |  |
|  |  | BRIAN | *x*’s and *y*’s like- |  |
|  |  | T/R1 | I think it was Romina who did it, yes. She used *x*’s and *y*’s for acrosses and downs. |  |
|  |  | ROMINA | Okay, so if we’re doing the same one with, um, with no- no *x*’s then you’d have to go four down- four *y*’s down and that would be this one. [Motioning across and down on grid] But you’re not going to get there. Whatever. But if you’re trying to get there it’s one *x* and then you go three *y*’s. So that’s your four. If you’re trying to get to this one over here it’s two *x*’s, two *y*’s then three *x*’s, one *y* and they're all- they all equal four but they all have different amounts of *x*’s and *y*’s and that’s how we get this. Yes? No? [Referring to the drawing of Pascal’s triangle.] |  |
|  |  | T/R3 | And the *x*’s and *y*’s- What does *x* correspond to again? |  |
|  |  | ROMINA | //*x* is across. |  |
|  |  | BRIAN | //Going across. And *y* is //down. |  |
|  |  | ROMINA | //Or a topping or a color. All the same thing. And all our *y*’s are down, toppings, color. |  |
|  |  | T/R1 | Could you use zeros and ones? |  |
|  |  | ROMINA | Sure. |  |
|  |  | T/R1 | How does that work |  |
|  |  | ROMINA | That’s his area. |  |
|  |  | MICHAEL | I don’t believe it. |  |
|  |  | BRIAN | Come on Mike. |  |
|  |  | T/R1 | s that Michael’s area? |  |
|  |  | ROMINA | Come on Mike. Zero, one. |  |
|  |  | BRIAN | //Break out the binary. |  |
|  |  | T/R1 | //Does that work with zeros and ones? |  |
|  |  | MICHAEL | Uh man, I haven’t seen that in a while. Uh, I really gotta remember. |  |
|  |  | ROMINA | Well just- the same thing- |  |
|  |  | MICHAEL | Oh like- |  |
|  |  | ROMINA | One would be every time across- |  |
|  |  | MICHAEL | Yeah, one- |  |
|  |  | ROMINA | Zero would be every time down. |  |
|  |  | MICHAEL | Just- All right, this- right there. This group is, you know, everything that has one, one and two zeros. [Writing binary codes |  |
|  |  | T/R1 | Uh hum. |  |
|  |  | MICHAEL | That’s that. The next one would be- [Writing binary codes |  |
|  |  | T/R1 | //Mm hm. |  |
|  |  | MICHAEL | //or two across’ and one down there’s a zero. That’s a, is that good? |  |
|  |  | T/R1 | I don’t know. Is that another way? |  |
|  |  | MICHAEL | Do you- like do you see how you can relate the zeros //across and down. |  |
|  |  | BRIAN | //The same thing. |  |
|  |  | T/R1 | Brian- //Brian thinks- |  |
|  |  | MICHAEL | The one moving across and the zero would mean down. |  |
|  |  | T/R1 | Romina? |  |
|  |  | ROMINA | Yeah, see I can’t work like that. I work in, um, towers. |  |
|  |  | T/R1 | You’re working in towers. |  |
|  |  | ROMINA | He works in pizzas and binary. |  |
|  |  | T/R1 | Brian are you- work both ways Brian? |  |
|  |  | BRIAN | No. No I’m totally not a binary kid. I don’t- |  |
|  |  | ROMINA | We- see me and Brian were absent when we did binaries in like sixth grade. |  |
|  |  | BRIAN | I missed a week. |  |
|  |  | ROMINA | We obviously weren’t there. |  |
|  |  | BRIAN | What class was that? |  |
|  |  | MICHAEL | Seventh grade, twice. |  |
|  |  | ROMINA | Seventh grade. We weren’t there. |  |
|  |  | BRIAN | I wasn’t in that class all year man. |  |
|  |  | ROMINA | I was in surgery. |  |
|  |  | BRIAN | I was playing basketball all year in that class. |  |
|  |  | T/R1 | Wow. That’s really neat. Do you have anything else to add? |  |
|  |  | BRIAN | Um, no. I mean I’m |  |
|  |  | MICHAEL | I mean- I mean did that convince you? |  |
|  |  | T/R3 | Well sort of. |  |
|  |  | T/R1 | Well I see- I see how you get the numbers. I see how you get those numbers. |  |
|  |  | MICHAEL | How you figure- |  |
|  |  | T/R1 | I guess my- my question still is suppose once we get just a general number there, um- |  |
|  |  | ROMINA | Okay, that- |  |
|  |  | T/R1 | How would you talk about some general numbers? |  |
|  |  | ROMINA | All right. We’ll just pick this one. [Drawing the intersection point † (10, 5).] |  |
|  |  | T/R1 | Um hum. |  |
|  |  | MICHAEL | We’ve proved to you that you understand why it relates to the Pascal’s triangle. |  |
|  |  | ROMINA | Yeah. |  |
|  |  | T/R1 | Oh yeah. |  |
|  |  | MICHAEL | So you give us a general number, we look at the triangle. |  |
|  |  | ROMINA | You pick a general number= |  |
|  |  | MICHAEL | That’s basically- |  |
|  |  | ROMINA | To get the simplest way you’re going to go all your overs and all your downs at one time so that’ll tell you this is going to be one, two, three, four, five- five across so one and //then one, two, three, four, five and five down. [Counting with marker on grid.] |  |
|  |  | MICHAEL | //And five down. |  |
|  |  | ROMINA | So you know there’s going to be a total of ten blocks. |  |
|  |  | T/R3 | Mm hm. |  |
|  |  | ROMINA | And then- so you’ve got your ten block row and then you’re going to know it’s five of one color and five of the other color. |  |
|  |  | MICHAEL | There’s going to be one right //in the middle. |  |
|  |  | ROMINA | //There’s going to be a number- yeah, it’s going to be the one right in the middle. It’s going to- Well I don’t know. I don’t know what it’s going to be but- |  |
|  |  | MICHAEL | The one that like- |  |
|  |  | ROMINA | The one right in the middle of everything. |  |
|  |  | MICHAEL | I don’t- That’s- that’s- |  |
|  |  | T/R3 | Which- which row? |  |
|  |  | MICHAEL | -that’s way up there. That’s- |  |
|  |  | ROMINA | It’s going to be the tenth row because you took ten moves to get there. So you’re going to go down to the tenth row. |  |
|  |  | MICHAEL | Yeah, it’s going to be the tenth row because you have- |  |
|  |  | ROMINA | And the tenth row that has five of one color and five of the other color, that’s your number and that’s how many ways you can get to that point. |  |
|  |  | MICHAEL | Which that one will be in the middle. |  |
|  |  | ROMINA | Uh hum. |  |
|  |  | MICHAEL | Because just the way it’s set up. That one will end up in the middle. |  |
|  |  | ROMINA | Plus it’s like an even //the square. |  |
|  |  | MICHAEL | //One- yeah, it’s- no it’s an odd number. That’s why it’s in the middle. |  |
|  |  | ROMINA | Yeah it’s a square. |  |
|  |  | MICHAEL | Even numbers- there is no- |  |
|  |  | T/R3 | How do you know it’s the tenth row? |  |
|  |  | T/R1 | Yeah. |  |
|  |  | ROMINA | Because it took us five moves to get- uh, ten moves to get there. |  |
|  |  | MICHAEL | Because you have ten spots. Ten toppings and- |  |
|  |  | ROMINA | Because you know //you can always- |  |
|  |  | MICHAEL | //Ten different places to put these numbers. |  |
|  |  | ROMINA | Yeah. |  |
|  |  | MICHAEL | Which is ten. |  |
|  |  | ROMINA | And you know- and this ten there’s- there’s only ten moves you can take because this is like the simplest way. You go all the way across and all the way down. |  |
|  |  | T/R3 | Mm hmm. |  |
|  |  | ROMINA | And that’s going to be like the simplest way and that’s going to mean that’s the shortest way to get there. Like- |  |
|  |  | T/R3 | Maybe help me understand that by running me through- |  |
|  |  | ROMINA | Okay //like- |  |
|  |  | T/R3 | //-each story //from the first row- |  |
|  |  | ROMINA | //-this one? |  |
|  |  | T/R1 | Yeah, what’s the first row. |  |
|  |  | T/R3 | -of Pascal’s triangle. |  |
|  |  | ROMINA | This one, there’s only two moves you can get to this one. You go over one down one. //Two moves. |  |
|  |  | MICHAEL | //You mean like the first row that would be- |  |
|  |  | ROMINA | To the second row because there’s two high in block terms. And for this one it’s two across and one down- |  |
|  |  | MICHAEL | I mean, like I said before, the rows correspond to the //shortest distance. |  |
|  |  | ROMINA | //Yeah. |  |
|  |  | MICHAEL | I mean the //shortest route. |  |
|  |  | ROMINA | //Yeah. So this is //three moves. |  |
|  |  | MICHAEL | //Everything in this row, two. [Pointing to triangle] |  |
|  |  | ROMINA | Third row. |  |
|  |  | MICHAEL | And this one three. So that’s how- |  |
|  |  | T/R3 | Say it again please. |  |
|  |  | ROMINA | Okay, this one. There’s three moves. |  |
|  |  | BRIAN | One, two, three. |  |
|  |  | ROMINA | And this is the third row. [Pointing at row 3] |  |
|  |  | T/R3 | So the- |  |
|  |  | ROMINA | This one’s four moves, fourth row. [Pointing at row 4] |  |
|  |  | MICHAEL | If the shortest route is ten, then it- then it’s //in the tenth row. |  |
|  |  | ROMINA | //Tenth row. |  |
|  |  | T/R3 | I’m still a little confused. |  |
|  |  | MICHAEL | All right. If you pick any point on- [Pointing to the grid.] |  |
|  |  | T/R3 | Start- start from the very first row please. |  |
|  |  | MICHAEL | The first- the first one. |  |
|  |  | ROMINA | The first- |  |
|  |  | MICHAEL | All right. |  |
|  |  | ROMINA | No moves. There’s only- you’re stationary there. That’s one. Just one. [Pointing at first row of her Pascal’s triangle] |  |
|  |  | T/R3 | So it’s the top row of- |  |
|  |  | ROMINA | Yeah, that’s just //your Pascal’s. |  |
|  |  | T/R3 | //-Pascal’s triangle? |  |
|  |  | ROMINA | Yeah. You go down to here. There- You’re going to go over one, down one. There’s only //two moves. [Pointing to the grid] |  |
|  |  | T/R3 | //Two. |  |
|  |  | ROMINA | That’s the simplest way you can go. |  |
|  |  | T/R3 | Uh hum. |  |
|  |  | ROMINA | So that’s Pascal’s like second row, two blocks, two toppings, whatever you want to say. [Pointing to the redrawn triangle.] |  |
|  |  | T/R3 | Uh hum. |  |
|  |  | ROMINA | And this one, you go over two and down one so that’s a total of three moves. The simplest moves so that’s the third row and you can go- |  |
|  |  | T/R3 | So it’s the second going over two blocks- |  |
|  |  | ROMINA | Yeah. |  |
|  |  | T/R3 | -and it’s which row of Pascal’s triangle? |  |
|  |  | MICHAEL | //That’s in the third row. |  |
|  |  | ROMINA | //The third row. [Pointing to the third row in the triangle.] |  |
|  |  | MICHAEL | //Because it takes three to get there. |  |
|  |  | ROMINA | //Because you have two and one. And you’re going over two over one. You’re doing three complete moves. And that move just happens to be two and one. [Inaudible]. [Gesturing across and down on the grid.] |  |
|  |  | T/R3 | Uh hum. |  |
|  |  | ROMINA | And- and this one here you’re making- you’re going over three and down one so that’s a total of four moves. That’s the fourth row. |  |
|  |  | T/R1 | So, what about the *r* th row? |  |
|  |  | MICHAEL | Would be- |  |
|  |  | ROMINA | The *r* th row would be- r moves |  |
|  |  | MICHAEL | Yeah, *r* moves *r* shortest distance. Whatever- |  |
|  |  | ROMINA | All right, yeah. |  |
|  |  | T/R3 | Uh hum. |  |
|  |  | MICHAEL | *r* half the perimeter whichever, you know- |  |
|  |  | T/R3 | MM hum. Okay. |  |
|  |  | T/R1 | Are you convinced? |  |
|  |  | T/R3 | Yeah. |  |
|  |  | T/R1 | It’s really very interesting. Interesting problem. Did you ever do anything like this before? |  |
|  |  | MICHAEL | No, no I’ve never seen it before in my life. |  |
|  |  | ROMINA | We just discovered Pascal’s triangle. |  |
|  |  | BRIAN | Didn’t we have to- didn’t we have to do something in Pantozzi’s class with the subway? |  |
|  |  | T/R1 | What was that? |  |
|  |  | ROMINA | Yeah but we didn’t do it though. |  |
|  |  | BRIAN | Uh, no. Something- I don’t know, somewhere like- |  |
|  |  | ROMINA | We can- |  |
|  |  | BRIAN | If a person is let off at like this subway station and they want to go to this building what’s the shortest way to go or something? |  |
|  |  | MICHAEL | No it was like- no it was a bunch of subway stops |  |
|  |  | ROMINA | Yeah. |  |
|  |  | MICHAEL | And the sub- the subway stop is three blocks away from this building- something- //which stop should he get off at? |  |
|  |  | BRIAN | //Something like this. |  |
|  |  | MICHAEL | In order to get there. And //cause he had to go to a couple of buildings. |  |
|  |  | BRIAN | //It wasn’t exact. It wasn’t exact so we’re not going to get into it. |  |
|  |  | T/R1 | So some of the same kind of- |  |
|  |  | MICHAEL | Yeah. |  |
|  |  | T/R1 | -reasoning you used. |  |
|  |  | MICHAEL | Yeah. That was last year though. |  |
|  |  | T/R1 | Okay, well you... |  |
|  |  | End Clip 6 |  |  |