[Christmas music] [Betty Ohlrogge Dabbs] Today I am going to tell you the story of the first Christmas with my finger paints. Many many years ago, Mary and Joseph were on their way to Bethlehem to pay their taxes. King Herod had decreed that everyone should be counted. It had been a long trip, and they were so glad when they could see the little town of Bethlehem far in the distance. Joseph had used his little brown donkey as a means of travel. Mary rode on the little donkey. And Joseph walked beside her. They were so happy when they could see the town of Bethlehem in the distance. [math instructor] And if you add the measures of the three angles of the triangle you will get 180 degrees. Alright? We will see what happens on a sphere when we do that, too. Well, let's look at drawings, some of these things on a sphere, for instance. Alright? Here's a sphere, and we'll move some of this stuff out. For example, I have drawn on this globe, or sphere, or ball... some lines. And consider this point up here, the North Pole, all right? You could consider this the equator, couldn't you? This could be considered the equator, all right? And this is what is called a great circle. While we would like to limit our discussion today to great circles on the sphere, rather than just any old line on the sphere, are these the same kinds of lines that we had in plane geometry? No, they aren't, are they? They're a little bit different. Let's look at another great circle. Here's one I've drawn this way, around here, and it goes on around behind and comes back to where it started. Well, let's look at some of the properties we saw with plane geometry that we had written and see if they apply here. One of our first properties was what? The first one was that we could extend a line to any length, in either direction. Right? That a line could be extended to any length in either direction. Well is this true on a sphere? What happens if I extend this line? It keeps going around, doesn't it? In fact, it comes around and comes back to where we started. So that a line on a sphere, if we consider just these great circles, cannot be extended to any length you wish, can it? All right? What was another idea we had? Well, another idea was that two lines either intersect or are parallel. And let's look at this one. We said this. We said that two lines cannot intersect in more than one point in a plane, didn't we? They can only intersect in one point, not any more. Okay? Well, let's see what happens with a sphere. Here are two lines. Here's one called the equator, and here's another one. You see that these two lines intersect right here, all right? They intersect right there, don't they? Do they intersect any place else? Well, let's turn our globe around or our sphere around. Yes, they intersect right here, too, don't they? And so two lines on a sphere, there are different kinds of lines, intersect where? In two points, don't they? In two points. So this property of plane geometry does not hold. Well, what else...? [teacher speaking in Spanish] Estoy en San José. Estoy en San José. Repitan. Estoy en San José. Estoy en San José. Estoy en San José. Estoy en San José. Sí, estoy en San José. But you're not there alone. I'm not here alone. You're here with me. So, estamos. Sí, estamos. Estamos en San José. Repitan. Estamos en San José. Estamos en San José. ¿Estamos en San José? Sí, estamos en San José. Y es muy bonito. No, sí es muy, muy bonito. Mira y mira. Es muy bonito. Repitan. Es muy bonito. Es muy bonito. Es muy bonito. Es muy bonito. Si, es muy bonito. And you know this edificio behind us? Well, it says at the top, it's Teatro Nacional. Do you know what Teatro Nacional means? Si, you know. Of course, the National Theater. And it's very beautiful inside. It has wonderful drapes and beautiful marbles from all over the world and murals painted on different scenes and gorgeous colors and carving all over the ceiling and above the sides and gilt gold trim and it's very, very, very elaborate, and gorgeous. Si. And that's the Teatro Nacional. But another thing that is so wonderful about San Jose and Costa Rica. I said they had mucha agricultura. Well, you can imagine, they also have muchas flores. Yes, they do. Flores everywhere. And for instance, here is a señorita. She's a Costa Riquenia because she was born here. And she is holding some orquideas in her hand. And

there, amarillas orquideas. Las orquideas son amarillas. Hay muchas flores. Si. Hay muchas flores. Hay muchas flores. Repitan. Hay muchas flores. Hay muchas flores. Hay muchas flores. Hay muchas flores. You know, one of the things that makes Costa Rica quite distinctive from the other Latin American countries is that they have a very special thing here that they use. It's called a carro. It's really a little cart. And it's very elaborately done with these designs. And these designs are handed down from father to son. And you can tell what family you belong to. And here they're pulled by oxen, you see, and there's the man, and he's elaborately decorated his cart, and you can see that the wheels and the sides are all very beautifully decorated. They're wonderful things. Los carros are what make it diferente. Los carros son diferentes. Be sure that you trill your R's. Los carros, ¿eh? Los carros son diferentes. Repitan. Los carros son diferentes. Los carros son diferentes. Los carros son diferentes. Los carros son diferentes. Si. And... [Dirk Gringhuis] Now where are we? We're up to the... Oh, there's something I forgot to tell you. In this copper group now, first we said the paleo hunted the mammoth, the old woodland people had the dugout canoe and the banner stones. The copper Indians were the first to use dogs. They had two types of dogs; they use them for hunting. And also, they were here at a time when the Great Lakes were very different from they are now. As a matter of fact, they have even found skeletons of whales in what was called the Huron Basin now the Lake Huron area. So, they were... they were living here a long time ago in a very different circumstance. Now we come up to the Hopewell tribe, or people I should say. These were the ones that were the exceptional makers of pottery and ornaments. Now this is called a bird stone. And they come in many many different shapes. They are drilled in the bottom, as you can see, and they're drilled at this end. Now what do you suppose that was used for? Have you any idea? Was it an ornament or could it have been a handle perhaps, fastened on to something? Well, your guess is as good as mine because archaeologists do not know exactly what the bird stones were used for. They found them in the various mounds that the mound builders built over their graves. They found many bird stones. But no one is absolutely sure what they were used for. And here, a rather familiar object is a spear point, Hopewell style out of flint. All of these edges were flaked and chipped out by hand to make this very handsome print. Now the Hopewell Indians built these mounds. They had many tools, ornaments. They had musical instruments as well. They had a flute made out of reeds. They had drums. They were the first farmers in Michigan. They raise squash and corn and many other products. And, uh, within the last two years, the biggest number of Indian mounds in Michigan have been near Grand Rapids, and the scientists have been over there digging into these mounds and finding some wonderful treasures. There are also some on the Jackson... around Jackson. So, this is... [science instructor] Well, how do we detect radioactivity, how do we know it's there? One way, of course, was a photographic film. And most of you have probably been able to recognize already that I've got something here that I haven't usually had with me on the lessons. This little gadget that's up on my coat here. Let me take this off. This is a little badge that's worn by anybody who is working around radioactivity. They have to register how much radioactivity goes into them and sticks inside and might do some damage. And, so, this is a piece of photographic film, and I'll slide this over here we look inside and see what it is. Now, every day or every week depending on how much radioactivity you're around, you'll have this piece of photographic film. Turn it over on the other side and we'll take this piece of photographic film out. Show what the inside looks like in here. And, of course, the more radioactivity that comes around you, the more this little piece of photographic film right here... the more that these things will be exposed. Now I've ruined this one, we can't use this anymore. But I would wear it if I were working in a radioactive lab I'd be wearing one of these. And every week the

person would come back and say "Mr. McClure this is just how much radioactivity you soaked up during the week." And if it was too much, they'd say "well you'd better change your job, or you'd better change something inside your lab, because you're getting too much radioactivity, and it can be dangerous." Now, I might not want to wait a whole week to find out if I was too radioactive. And so they've got another kind like this. And this one has a little needle inside. And if I get my eye right down to this little tube and look through it like this, I can see a little scale across there. It goes 0, 5, 10, 20, 30, 40, 50. And then I can look inside this and I watch a needle move. And so I might be doing an experiment. I would say, well, my gosh, that's too much for today. I'll quit for today. Now, the way that we usually discover radioactivity, or to measure it all, is by what we call a Geiger counter. That's our old friend here. Here's a tube that we have out here. Let me put some materials out here that are radioactive. Here's just an ordinary rock. I bring that in and bring it back. Now, inside of this, there are some radioactive atoms. Supposing that I would take a piece of lead and put this in the front of this. Let's put some lead in front of our Geiger counter tube and now we'll see what happens. Not much at all. I bring this close. Let's move the lead out. Quite a bit of radioactivity if the lead's not there. Put the lead back in, and it cuts it down. And so they will often use lead, which is very, very heavy, the atoms are very close together, as a way of shielding the radioactive material so that the radioactivity couldn't get into us.