BLUEBIRD MATH CIRCLE
Alliance of Indigenous Math Circles

Issue 19 Recap

Share your problems, solutions, models, stories, and art: https://aimathcircles.org/Bluebird

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January 24 2022, 5-6 PM MDT online.

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Introduction

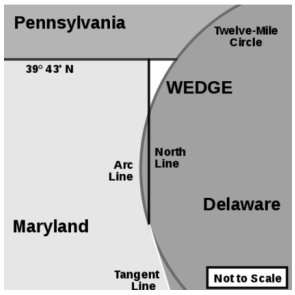
We returned in this session to the topic of maps and geometry. The word 'geometry' means 'earth measurement', and we can use maps to tie culture and geography to geometric concepts. For this session, we confined ourselves to 'Bluebird Distance': the distance in a straight line through the air, as a bluebird would fly.

Most of the participants in this session were teachers, so we talked not just about the geometry, but also about how to apply the geometry to problems of teaching.

Geometry and Politics: State Borders

We looked first at a map of Delaware. The King of England, who had never been to America, decreed three parts of its border: An east/west line as the state's southern border, a north/south line as its western border, and a circular arc as its northern border.

Theoretically, the state's border would look like the map on the right. It was intended that the western (red) border would be a tangent to the circle, part of which forms the northern border.

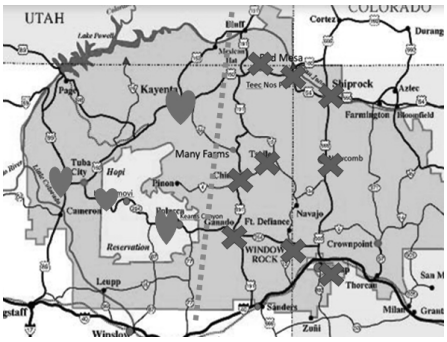


But surveyors made a mistake, and the red western border was not quite correct. Magnified, the situation looked like the map on the left. The blue part of Delaware, defined by a circle, bulges a bit into Maryland, because the western border is not quite tangent. And the circle does not go through the point of intersection of the three states Maryland, Delaware, Pennsylvania, creating a (white) wedge. The wedge is now part of Delaware, but that decision wasn't made (by the Supreme Court!) only in the twentieth century.

We talked a bit about how you would survey a circular border. How do you draw a circle whose radius is 12 miles? It's not an easy job, and it's not surprising that they didn't get it all quite right.

We talked about other state borders. Tammy Jones mentioned that the borders of her state, Tennessee, were partly defined by the Mississippi river, which would change its bed every so often. So that border is also interesting.

Next we went into breakout rooms and did some geometry on a map of northeast Arizona, starting with the following problem:



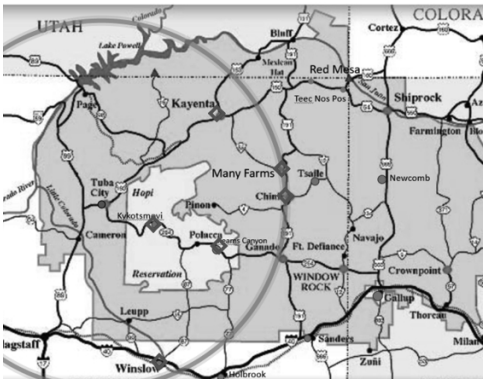
Suppose there is a certain store which has a branch in Tuba City and another in Gallup. Which towns are closer to the store in Tuba City? Which are closer to Gallup?

The discussion was similar in each of the two breakout rooms. On the right is a record of Room One. The red hearts show towns closer to Tuba City, and the blue crosses show towns closer to Gallup. Danielle U. drew a line similar to the dotted green line shown, which is the 'border' between towns closer to Tuba City and those closer to Gallup.

(nearest mile)	Chinle	Farmington	Gallup	Ganado	Holbrook	Kayenta	Keams Canyon	Kykotsmovi	Many Farms	Newcomb	Red Mesa	Sanders	Shiprock	Teec Nos Pos	Tsaile	Tuba City	Window Rock	Winslow
Chinle																		
Farmington	84																	
Gallup	53	50																
Ganado	31	100	46															
Holbrook	93	167	91	66														
Kayenta	55	111	115	78	126													
Keams Canyon	42	127	83	39	62	64												
Kykotsmovi	62	146	108	61	72	62	25											
Many Farms	13	80	73	45	106	43	49	66										
Newcomb	48	40	51	59	126	90	90	110	52									
Red Mesa	57	74	105	87	148	47	91	101	41	61								
Sanders	66	121	39	36	52	115	65	86	80	81	121							
Shiprock	65	25	50	87	154	86	108	124	60	34	41	113						
Teec Nos Pos	58	51	98	86	151	65	96	111	50	49	17	118	25					
Tsaile	21	86	59	44	111	64	64	83	23	46	48	75	80	43				
Tuba City	90	169	143	97	102	68	61	36	90	137	130	122	146	129	109			
Window Rock	44	86	20	26	83	99	55	89	56	46	92	36	80	85	45	124		
Winslow	100	181	115	80	31	120	60	59	108	141	152	77	166	158	121	82	103	

The (Bluebird) mileage chart at left, which we had used in the previous session, was used here to check the distances on the map.

Then we looked at this problem: Suppose we are thinking about the distance from each town to Tuba City. Which towns are closer to Tuba City than Chinle is to Tuba City?



Again, we looked at the map. This time the border between closer to Tuba City and further from Tuba City was a circle. (See the figure on the right.) Even if students know these ideas, it is interesting and novel for them to illustrate the ideas on a map.

Coming back into a plenary session, we looked at these results, then talked about how to use dynamic geometry software (Geometer's Sketchpad, Geogebra) to study them in class. These software packages have transformed the teaching of geometry. We didn't have time to enjoy them, because not everyone knew the syntax for the various commands. But some of us did know and showed the others how you can upload a map onto the software, then construct circles, perpendicular bisectors, and other geometric objects quickly and accurately.

Share your ideas with other Bluebird Math Circle participants at **https://aimathcircles.org/Bluebird**

New Questions for Bluebird

What is math?—from Tatiana Shubin

Why are the planets' orbits elliptical?—from Beth Cammarata

BLUEBIRD SAYS—Curious questions. I will fly around and seek an answer. Watch this space in the next flyers!

Submit your math-related questions at **https://aimathcircles.org/Bluebird**