Estimating the Speed of the Lunar Shadow

This image shows the shadow of our moon as it passed across Earth during the March 9, 2016, total solar eclipse. It was obtained by the DSCOVR spacecraft located 1 million kilometers from Earth.

Problem 1 – For the August 21, 2017 eclipse, the distance from Newport, Oregon to Madras, Oregon is 232 km, and the time at which the total solar eclipse is observed at these two locations differ by 0.0619 hours. What is the speed of the shadow between these towns?

Problem 2 - The towns of Carbondale and Hopkinsville are located 155 km apart. The exact time of totality at Carbondale is 18:21:56, but at Hopkinsville they see the maximum eclipse at 18:26:03. How fast was the lunar shadow moving on the ground near these towns?

Problem 3 – The following table gives the distances and times for the total solar eclipse viewed from several locations along the path of totality from Oregon to South Carolina.

	Latitude	Longitude	Time	Distance (km)	Speed (km/h)
Newport	44.8	-124.0	17:16:58	0	
Madras	44.7	-121.1	17:20:41	232	
Weiser	44.4	-117.0	17:26:21	328	
Idaho Falls	43.8	-111.9	17:34:14	417	
Riverton	43.2	-108.2	17:40:24	301	
Casper	42.8	-106.3	17:43:51	161	
Stapleton	41.5	-100.5	17:55:21	507	
St Joseph	39.8	-94.9	18:07:45	512	
Columbia	38.8	-92.3	18:13:57	247	
Carbondale	37.6	-89.1	18:21:56	313	
Hopkinsville	36.9	-87.5	18:26:03	161	
Anderson	34.6	-82.6	18:39:12	511	
Columbia	33.9	-81.1	18:43:10	156	
McClellanville	33.1	-79.5	18:47:30	172	

From the tabulated information, calculate the average lunar shadow speed between each consecutive pair of points along the path.

Problem 4 – From the table, what is the total length of the path of totality from Newport, Oregon to McClellanville, South Carolina?

Problem 5 – What is the average speed of the shadow from Oregon to South Carolina?