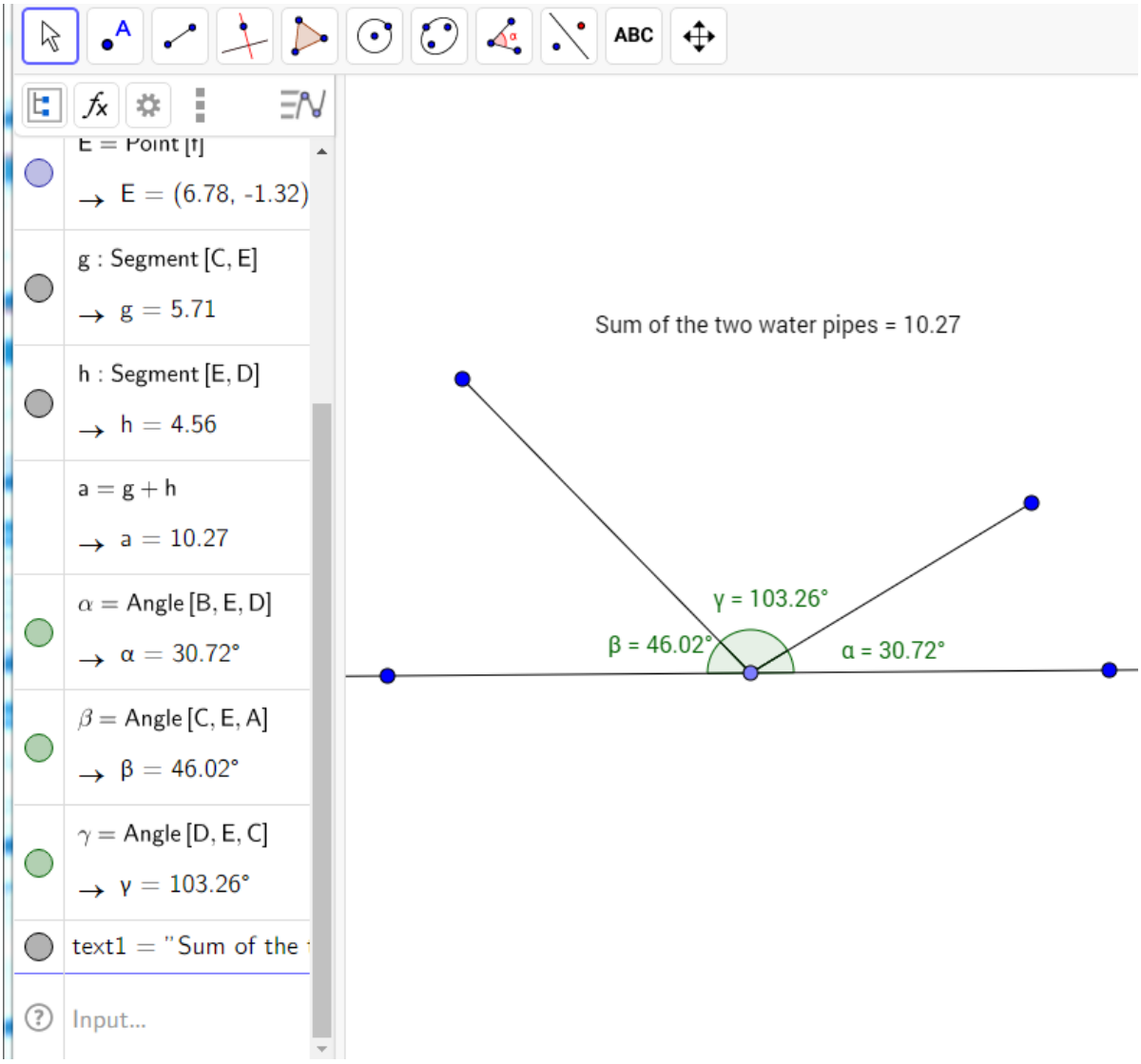
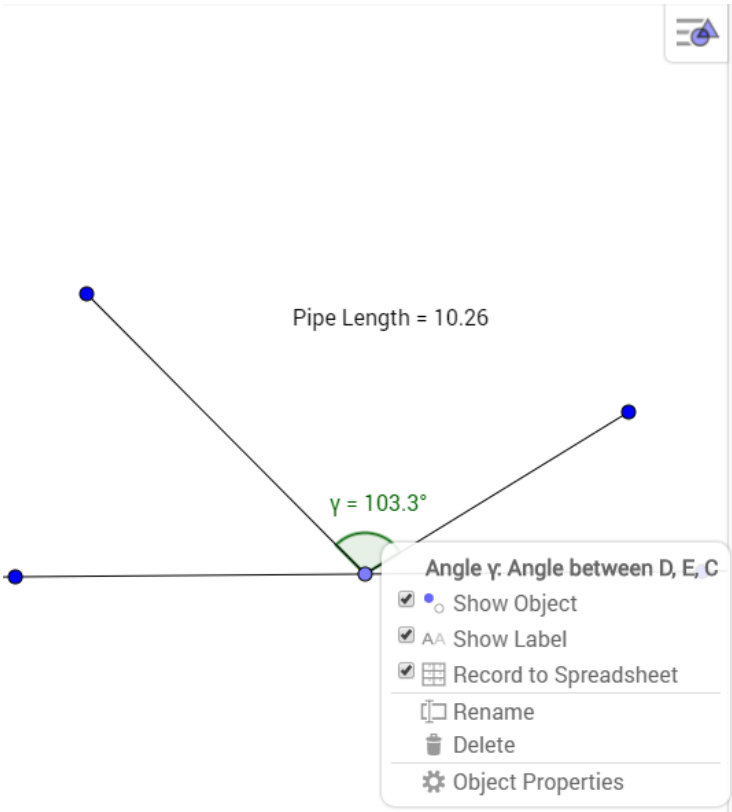
Water Pump Problem Solution Paths with GeoGebra

All of these solution paths were student generated.

1. Students may explore just using measuring tools in a geometry page.

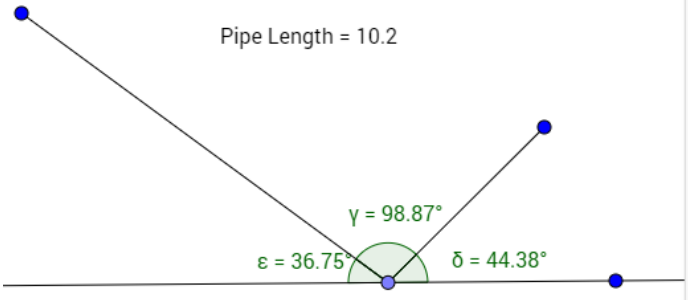


2. Students may explore by capturing measurement values to a spreadsheet. These students were testing the conjecture that the pipe length is minimized when the angle shown is 90 degrees.



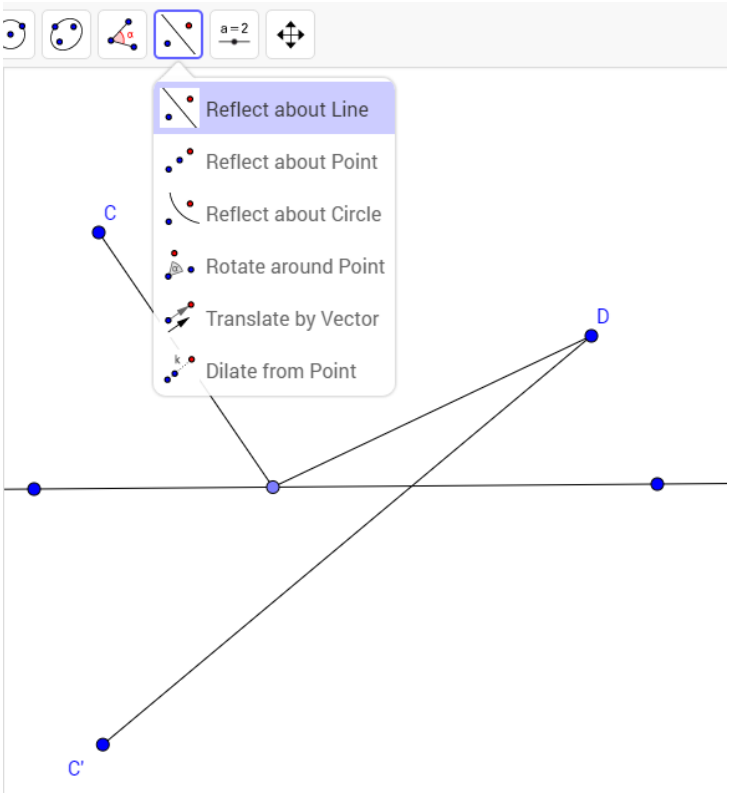
	A	B
1	Pipe Length =	γ
2	11.29	88.15°
3	11.26	88.74°
4	11.19	89.7°
5	11.15	90.45°
6	11.11	91°
7	11.08	91.54°
8	11.05	91.9°
9	11.02	92.42°
10	11	92.77°
11	10.96	93.44°
12	10.93	93.93°
13	10.91	94.25°
14	10.88	94.73°
15	10.86	95.04°
16	10.84	95.34°
17	10.82	95.64°
18	10.78	96.36°
19	10.71	97.45°
20	10.68	97.96°
21	10.62	98.81°
22	10.57	99.69°
23	10.54	100.1°
24	10.49	100.75°

This strategy led this group to measure other angles and make a conjecture that the pipe lengths will be minimized when the other two angles are congruent (see rows 15&16).

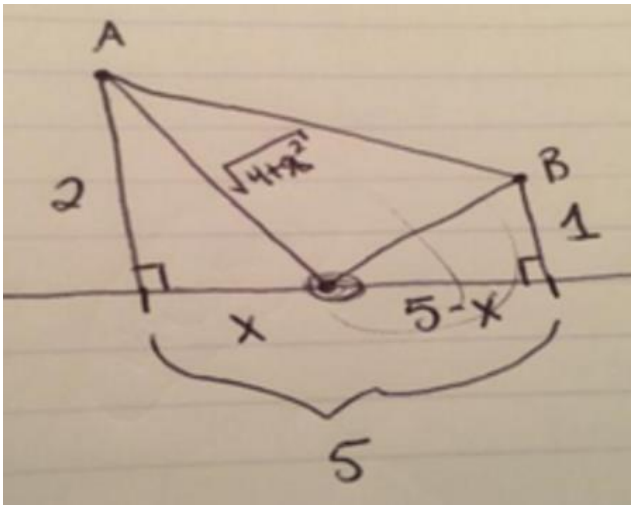


	Pipe Length =	γ	δ	ε
2	10.19	102.42°	36.93°	40.66°
3	10.19	102.36°	37.1°	40.54°
4	10.19	102.3°	37.28°	40.42°
5	10.18	102.23°	37.47°	40.3°
6	10.18	102.23°	37.46°	40.3°
7	10.18	102.17°	37.65°	40.19°
8	10.18	102.1°	37.83°	40.07°
9	10.18	102.03°	38.02°	39.96°
10	10.18	101.95°	38.2°	39.84°
11	10.18	101.88°	38.39°	39.73°
12	10.18	101.8°	38.58°	39.62°
13	10.18	101.72°	38.77°	39.5°
14	10.18	101.64°	38.97°	39.39°
15	10.18	101.56°	39.16°	39.28°
16	10.18	101.47°	39.36°	39.17°
17	10.18	101.3°	39.76°	38.95°
18	10.18	101.11°	40.16°	38.73°
19	10.18	101.01°	40.37°	38.62°
20	10.18	100.81°	40.78°	38.4°
21	10.18	100.71°	40.99°	38.3°
22	10.18	100.6°	41.21°	38.19°
23	10.19	100.5°	41.42°	38.08°
24	10.19	100.38°	41.64°	37.98°

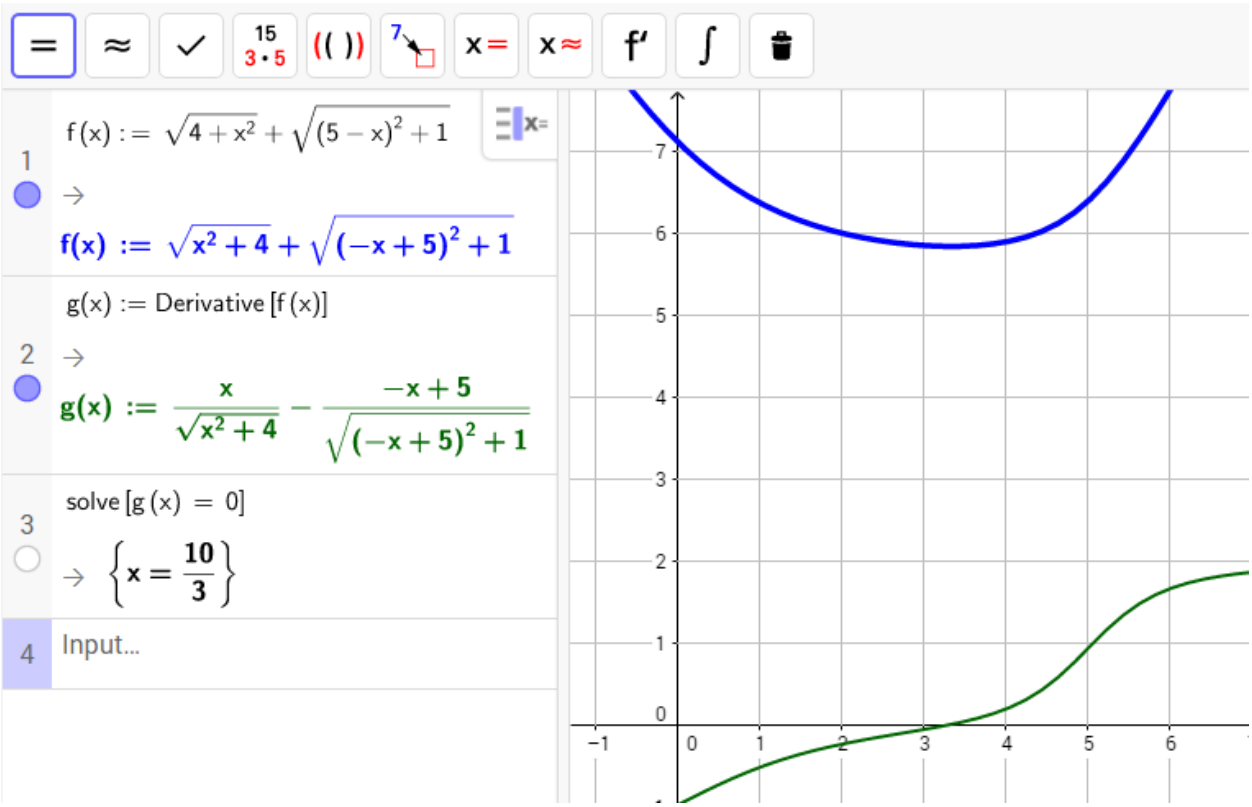
3. Other students may reason using a reflection to argue that the pump should be located where segment DC' intersects the main water line.



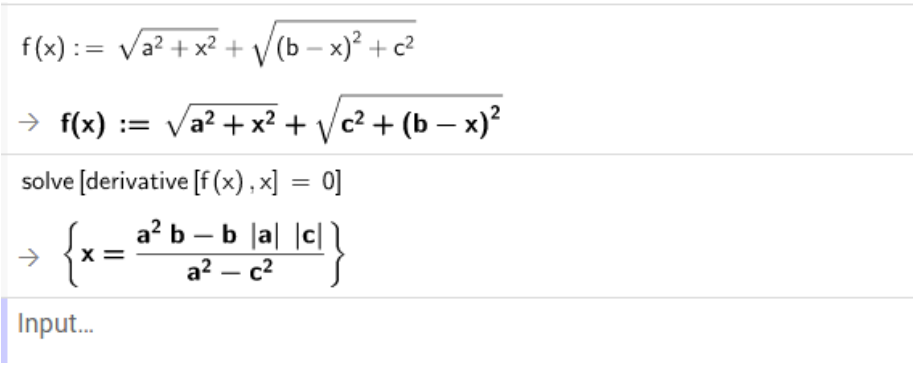
4. Other students fixed distances in the problem to explore what would happen algebraically as they let the location of the water pump vary.



These students represented the total length of the pipe in this instance with the function f(x) and used the CAS in GeoGebra to take the derivative and determine where the derivative is zero.



While exploring a general solution to the problem (representing the distances 2, 5, and 1 in the diagram above with constants a, b, and c respectively), students discovered that GeoGebra will perform the calculus to find a solution in terms of a, b, and c.



Finally, students found they could create a, b, and c sliders to explore relationships dynamically.