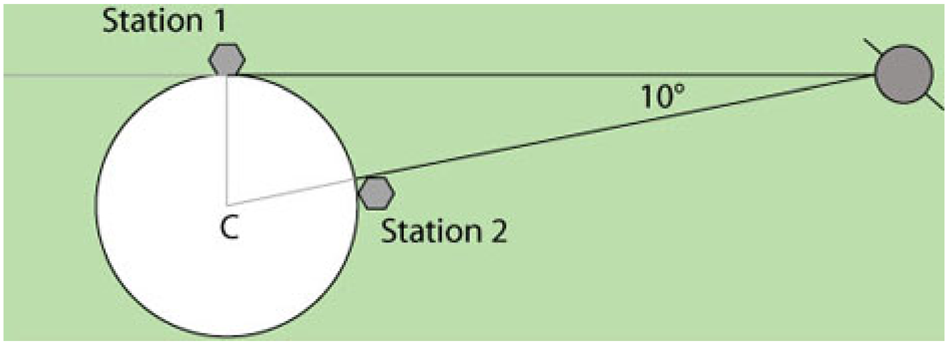
Name: ______________________________________________ Date: ________________

**Satellite**

A satellite orbiting the earth uses radar to communicate with two control stations on the earth's surface. The satellite's orbit maintains a 10-degree angle of separation between the two stations. Knowing that the earth's radius is 3,963 miles, answer the following questions. Round all answers to the nearest whole number.




1. Is there a right angle in the triangle shown by connecting the center of the earth, the satellite and Station 1? How do you know?

2. What is the distance from Station 1 to the satellite?

3. How many miles will a signal sent from Station 1 to the satellite and then to Station 2 have to travel? Explain your answer.

4. A satellite technician is traveling from one station to the other in a direct path along the earth's surface. What is the distance she will have to travel? If she travels an average of 50 mph, how long will the trip take? Explain your answer.

5. If a signal could travel through the earth's surface from one station to the other, what is the shortest distance the signal could travel to get from Station 1 to Station 2? Explain your answer.

| **Sattelite** | Rubric | |
|---|---|---|
| The core elements of performance required by this task are:<br>• Use trigonometric ratios and the Pythagorean Theorem to solve right triangles in applied problems.<br>Based on these, credit for specific aspects of performance should be assigned as follows | points | section points |
| 1. Gives correct answer:<br>Yes, there is a right angle at Station 1. The tangent to a circle is perpendicular to the radius. | 1 | 1 |
| 2. Gives correct answer: **22,475 miles** | 1 | 1 |
| 3 Gives correct answer: **41,334**<br>Gives correct explanation such as:<br>The distance from satellite to Station 2 = 22,822 – 3963 = 18,859 miles<br>The distance from Station 1 to the satellite is 22,475 miles and the distance from the satellite to Station 2 is 18,859 miles. Therefore the total distance from Station 1 to the satellite to Station 2 is 41,334. | 1<br>1<br>1 | 3 |
| 4. Gives correct answer: **5,533 miles and approximately 111 hours**<br>Gives correct explanation such as:<br>Measure of central angle = 180 – (90 + 10) = 80°<br>$2\pi(3963)\cdot\frac{80}{360}=5,533$<br>The distance from Station 1 to Station 2 is 5,533 miles.<br>$t=\frac{D}{r}=\frac{5,533\ mi}{50\ mph}=110.66$ | 2<br>1<br>1 | 4 |
| 5. Gives correct answer: **5095 miles**<br>Gives correct explanation such as:<br>If the signal could travel through the earth's surface, the distance the signal travels would be approximately 5095 miles. To find this distance, use the isosceles triangle with vertices at the center of the earth (point C), Station 1, and Station 2. The angle at the center of the earth is 80° and the other two angles each measure 50°. Construct a perpendicular bisector from point C to the line connecting Station 1 and Station 2. This creates two right triangles.<br>Calculating $\cos 50^\circ=\frac{z}{3,963}$, you find the measure from the perpendicular bisector to Station 1 to be 2547.37. The distance between Station 1 and Station 2 is twice this distance, or approximately 5095 miles. | 1<br>2 | 3 |
| **Total Points** | | **12** |