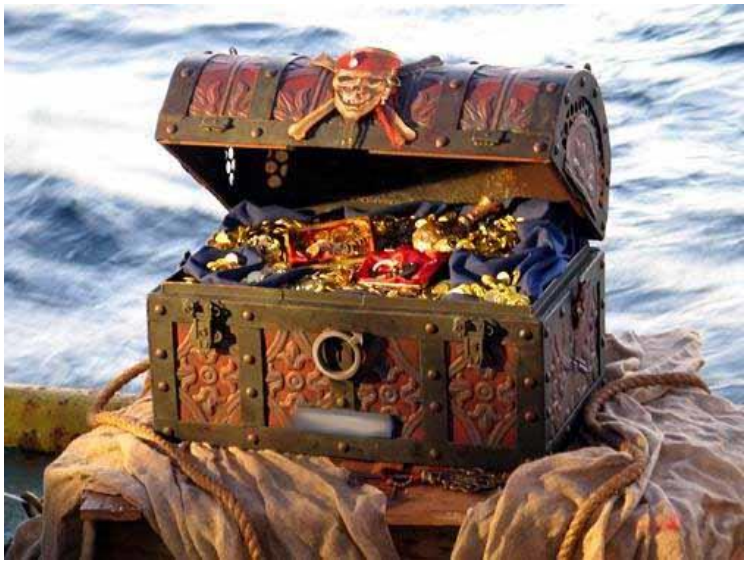


Pictured: Treasure Hunt
http://www.geocaching.com/geocache

2.10: Complex Treasure Hunt

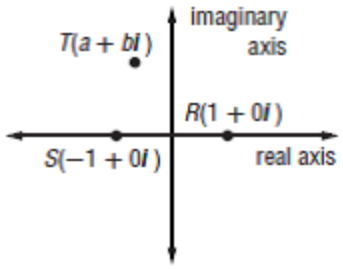
Unit Performance Assessment

A prospector buried a sack of gold dust. He then wrote instructions telling where the gold dust could be found.

- Start at the oak tree. Walk to the mineral spring, counting the number of paces.
- Turn 90° to the right and walk an equal number of paces. Place a stake in the ground.
- Go back to the oak tree. Walk to the red rock, counting the number of paces.
- Turn 90° to the left and walk an equal number of paces. Place a stake in the ground.
- Find the spot halfway between the stakes. There, you will find the gold dust.

Years later, an expert in complex numbers found the instructions in a rusty tin can. Some additional instructions told how to get to the general area where the oak tree, the mineral spring, and the red rock could be found. The expert hurried to the area and readily located the spring and the rock. Unfortunately, hundreds of oak trees had grown since the prospector's day and it was impossible to know which one was referred to in the instructions. Nevertheless, through prudent application of complex numbers, the expert found the gold dust. Especially helpful in the quest were the following facts.

- The distance between the graphs of two complex numbers can be represented by the absolute value of the difference between the numbers.
- Multiplication by $\boldsymbol{i}$ rotates the graph of a complex number 90° counterclockwise. Multiplication by $-\boldsymbol{i}$ rotates it 90° clockwise.



The expert drew a map on the complex plane, letting $S(-1+0i)$ be the spring and $R(1+0i)$ be the rock. Since the location of the oak tree was unknown, the expert represented it by $T(a+bi)$.

1. Find the distance from the oak tree to the spring. Express the distance as a complex number.

2. Write the complex number whose graph would be a 90° counterclockwise rotation of your answer to Exercise 1.
   This is where the first stake should be placed.

3. Repeat Exercises 1 and 2 for the distance from the tree to the rock. Where should the second stake be placed?

4. The gold dust is halfway between the stakes. Find the coordinates of the location.