# MATH CLUB: THREE PROBLEMS

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1. A traveler needs to cross the desert, which is 100 miles wide. The traveler can cover 20 miles a day, but he can't carry more than 3 days supply of food and water. However, he can store food and water creating supply depots in the desert (food is non-perishable).

How many days will he need to cross the desert? What if he needs to cross and return?

To give you some idea, here is the image describing a plan for a similar real-life problem: a Vulcan bomber flying from Britain to Falkland islands during the conflict between UK and Argentina in 1982. The distance is over 6,000 miles, much more than the range of the bomber, so a single bomber required assistance of 11 refueling planes, some of which were used to refuel each other. Google "operation Black Buck" to learn more about it.
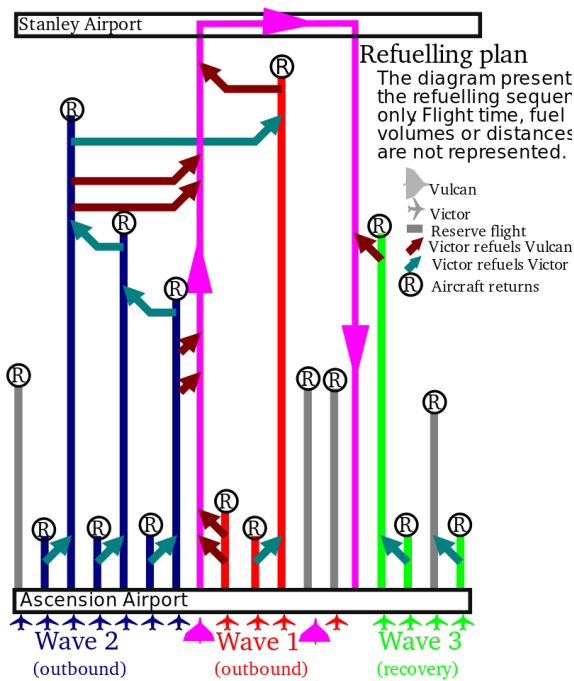
2. (This is a problem from last year (with minor modification) — if you remember how to solve it, skip it!)

You have 1000 blood samples; it is known that exactly one of them contains a dangerous virus. You have a test that can test for a virus in any sample, but it takes 2 hours to complete, and the lab can only run 1 such test at a time (this is limited by the equipment they have). However, the test is so sensitive that he can detect the virus in very small concentrations — for example, if you mix several blood samples together, and one of them contains the virus, then running the test on the mix will show the virus. The test only requires very small amount of material, so each blood sample contains enough for many tests.

Using this, how quickly can you find the infected sample?

3. In another disease outbreak, you have the same situation as in the previous problem, but you have 2048 samples, and each sample only has enough material to be used in at most three tests. How many tests you would need to find the infected sample?