

Etude 4 – Desert Crossing:

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Question 1: Using a vehicle without refuelling, how far into the desert can you safely go?

This would be 360km. Since the 'special desert vehicle' can hold 60 litres of fuel in its fuel tank and $60 * 12 = 720\text{km}$, then being able to travel into the desert safely would require the ability to return to base. Therefore $720/2 = 360\text{km}$ is the correct answer. This is the maximum safe distance you can achieve (with safe distance being a distance that still allows travel to base).

Question 2: Describe a procedure whereby you could cross the desert in the vehicle.

This procedure will allow crossing of the desert. It starts by moving using one trip to move 80 litres out to its safe travel distance that is intended for later trips. On the second trip the buggy moves 80 litres to 720km while using the fuel left at 360km to fuel along the way. Then on the third trip it goes all the way across the desert, it uses the remaining fuel at 360km then travels to 720km and fills its tank back to 60. From there the buggy travels forward by 13 and drops 20 litres then goes backwards by 13. After travelling backwards by 13 it fills its tank back up and picks up the fuel that will be used when it fills its tank shortly. Now it goes forward by 13 then fills up its tank then picks up the remaining fuel. Now the buggy has a full tank and is carrying maximum amount of allowing it to make the rest of the trip to 2413km away from base. The last of the trip is just going forward until the tank is empty then refuelling until it reaches 2413.

Question 3: Describe a procedure whereby you could cross the desert and return in the vehicle.

The idea for this question was to put down as many cans as possible to see if it was possible to do the return trip. This was a starting point for future solutions. We travel from the base, out to various points in the desert and drop fuel off. Then we make a long trip fuelling up along the way out going to the end of the desert, and then we make our long trip back, using remaining fuel on the way back.

Question 4: Describe a procedure whereby you could cross the desert using the minimum amount of fuel

This is a more efficient version of question two. The initial trip distance was shortened as much as much possible so that the entire 80 litres of fuel at the point 720km is used. This reduces fuel use since the initial trip is shorter therefore being less distance overall. We managed to reduce the amount of backward travel, and by moving our fuel stops around we achieved a slightly better result.

Question 5: Describe a procedure whereby you could cross the desert and return in the vehicle using the minimum amount of fuel.

This was a significant improvement on our initial return trip. We found that we did not need as much fuel at each 360 intervals as we had initially thought (we could cut some dumps out too!). Our second finding was that we could make our intervals smaller and having even less fuel, leading to less distance travelled.