



Then press ! to perform the calculation. TK! displays the message Direct Solver, and the unknown values appear in the OUTPUT column, as shown:

Direct Solver Results



This gives us a nice breakdown of all the information we want. But what if we want to use this model to solve a problem with less information given at the outset? Let's consider a calculation where we have a maximum budget of £50 to spend on fuel for a 1,000 mile trip. We know the price of fuel (say £1.75 per gallon) so we can easily determine how much we can spend per mile. It might be more difficult, however, to determine what speed we need to travel in order to achieve the mileage needed to complete the trip within our budget.

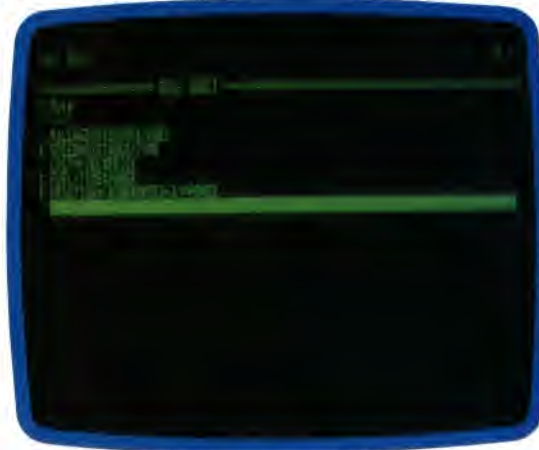
We begin by blanking the values already entered. We do this by typing RVY (for Reset Variables Yes). Then we type in the information that we know: 1000 for distance, 50 for cost, and 1.75 for price. We use a value of 1/3 for internal friction (which TK! evaluates to 0.333333) and 0.0000095 for wind resistance. Press ! to calculate and the following values appear:

Incomplete Model



Note that no values have been generated for speed, time or power — and speed is the specific value we need. If we shift the display from the Variable sheet to the Rule sheet, we will see that three of our equations remain unsatisfied (which is indicated by the * in the Status column):

Unsatisfied Equations



ITERATIVE SOLVER

Since we cannot solve the model using the Direct Solver, we must try the Iterative Solver. This takes a starting value, input as a guess, and fits it into the equation. If the value is not correct, TK!Solver uses a series of successive approximations (like the game of 'higher' and 'lower') to pinpoint the exact value.

The first thing we do is take the mileage value generated previously and move it into the Input column to give TK! one extra value to start with. We do this by typing I in the Status column next to mileage on the Variable sheet. Then we estimate a value for speed — say 50 — enter that number in the Input column, type G for guess in the Status column and press ! to calculate. TK! displays Iterative Solver at the top of the screen and counts off each approximation. On the fourth attempt, TK! arrives at the correct value for speed, time and power, as shown:

Iterated Values



According to TK!Solver, an average speed of just over 47 miles per hour is needed to complete the trip within our budget. The closer a guess is to the actual value, the sooner TK! finds a solution.

TK!Solver is available from Practicorp for the Apple II, IBM PC and compatible machines, and the ACT Apricot, for £195. Software Arts also publishes 'Solver Packs' at £95 each with predesigned models for specific applications.