

Note to use Excel to solve LP problems the Solver add-in must be installed (not usually installed). You will only have to do this once.

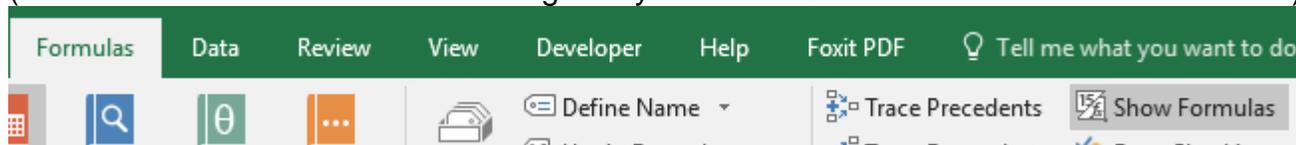
Load the Solver Add-in.

See also the Microsoft Support.

Set up the solver worksheet

For clarity display actual formulae rather than results of formulae.

(Formulas – Show Formulas. Select again if you want to see results rather than the formula)



Example:

MEI problem on cost minimisation for a vet treating a farm animal.

A vet is treating a farm animal. He must provide minimum daily requirements of an antibiotic, a vitamin and a nutrient.

He has two types of medicine available, tablets and liquid.

Table 6 summarises what the medicines contain and the requirements.

	Antibiotic	Vitamin	Nutrient
Tablets (units per tablet)	3	2	10
Liquid (units per dose)	2	4	50
Daily requirement (units)	18	16	100

Table 6

- (i) If x is the number of tablets which the vet prescribes per day, and y is the number of doses of liquid medicine, explain why $3x + 2y$ must not be less than 18.
Draw the inequality $3x + 2y \geq 18$ on a graph, with each axis labelled from 0 to 10. [5]

- (ii) Construct inequalities in terms of x and y relating to daily vitamin and nutrient requirements. Draw these two inequalities on your graph. [6]

The tablets cost £0.38 each and liquid medicine costs £1 per dose. The vet wants to find the cheapest way to treat the animal.

- (iii) Solve the linear programming (LP) problem, allowing x and y to take any values. [2]
- (iv) Solve the problem when x and y must be integers. [2]
- (v) Which solution should the vet adopt and why? [1]

Steps

1. Identify solver variables.

The variables here are the number of tablets and the amount of liquid medicine.

Set your spreadsheet up as follows

	A	B
1	Solver Variables	
2	Tablets	2
3	Liquid	2
4		

2. Starting values have been given for the optimal variable values (any wild guess!)

Guess here 2 for each variable in cells B2 and B3; these are only starting values. Solver will work out the optimal values.

To make the worksheet clearer you can name the variable value cells. The starting values here are in cells B2 and B3. Select each in turn and choose Formulas, Define Name



You will be able to name your chosen cell.

	A	B
1	Solver Variables	
2	Tablets	2
3	Liquid	2
4		

If you click on B3 for you should now see the variable name, liquid rather than B3.

3. Enter the objective function.

This is the formula to minimise the cost. Here enter the formula

$=0.38 \times \text{Tablets} + 1 \times \text{Liquid}$ (note this is $0.38 \times B2 + 1 \times B3$)

You should format this cell as a number with the required number of decimal places.

	A	B
1	Solver Variables	
2	Tablets	2
3	Liquid	2
4		
5	Objective Function	$=0.38 \times \text{Tablets} + 1 \times \text{Liquid}$
6		
7		

4. Enter the constraints.

Enter the constraints as follows:

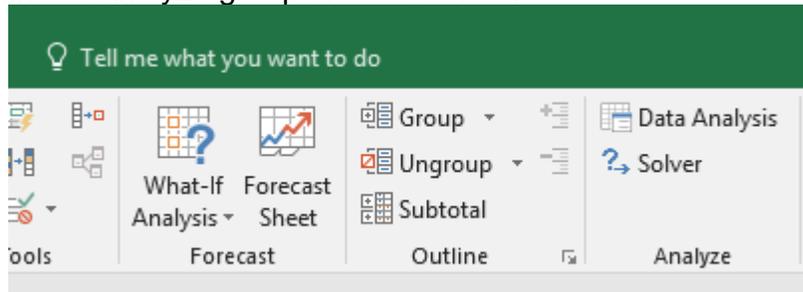
Note the formula in B8 is $3*B2+2*B3$ but having named these the names are shown.

	A	B	C
1	Solver Variables		
2	Tablets	2	
3	Liquid	2	
4			
5	Objective Function	=0.38*Tablets+1*Liquid	
6			
7	Constraints	Formula	Constant
8	Antibiotic	=3*Tablets+2*Liquid	18
9	Vitamin	=2*Tablets+4*Liquid	16
10	Nutrient	=10*Tablets+50*Liquid	100
11			
12			

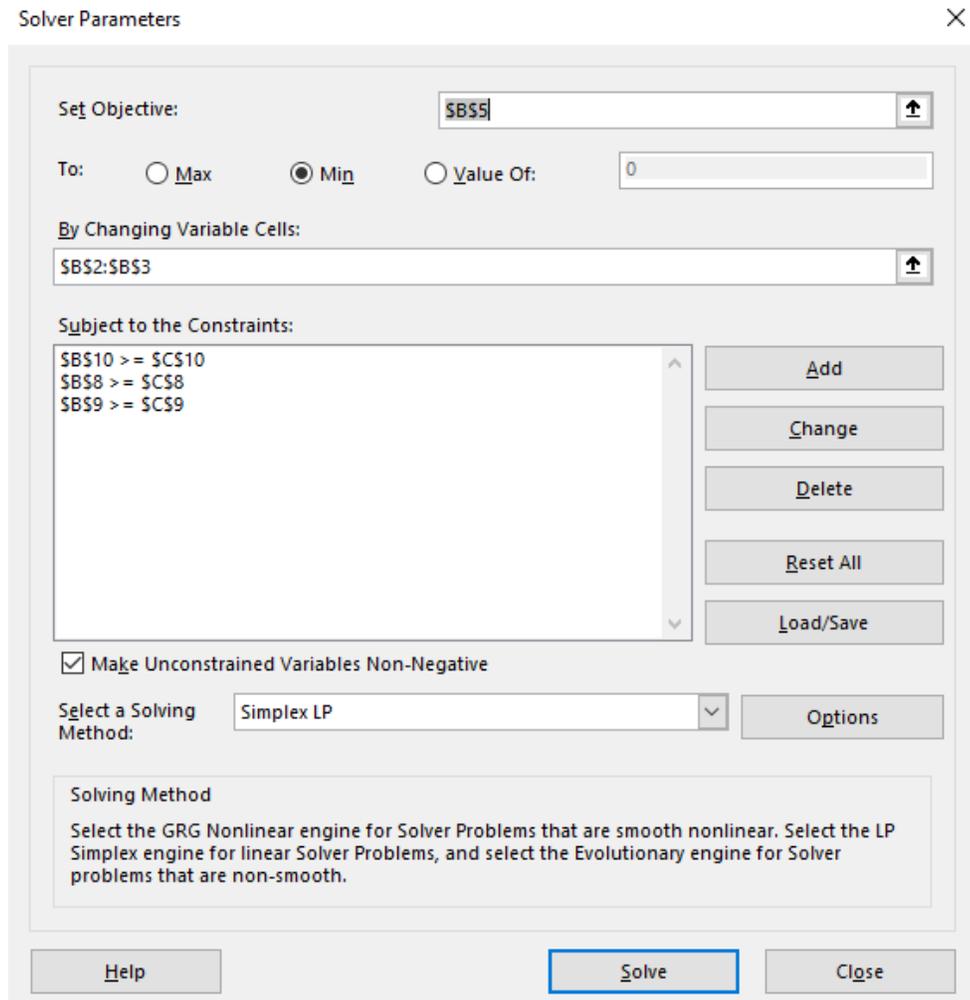
The worksheet is now set up.

5. Start Excel Solver

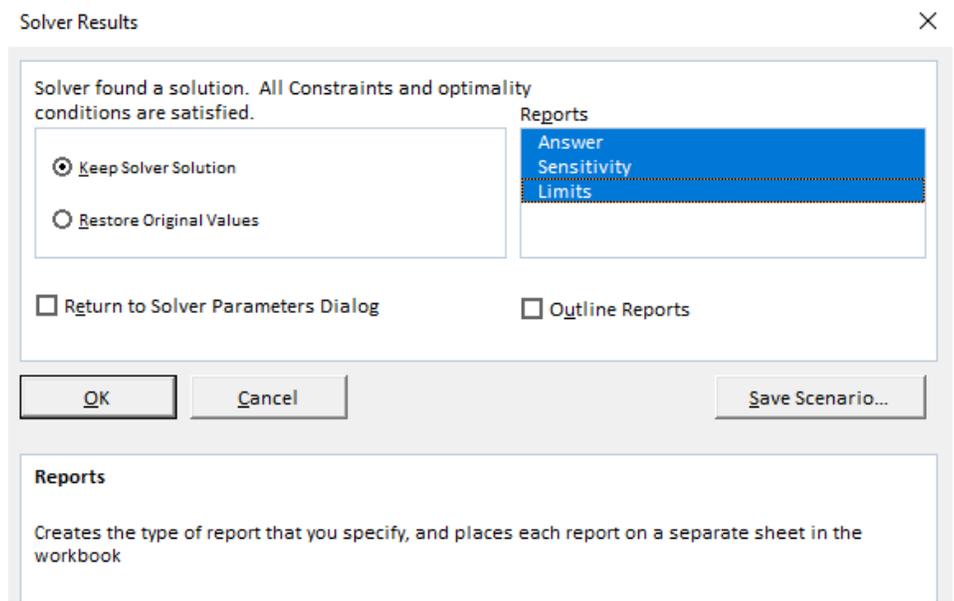
In the Analyze group choose Solver.



Then complete the resulting Solver parameters as follows, using the Add button to add constraints.



Then simply click the Solve button. The following should be displayed.

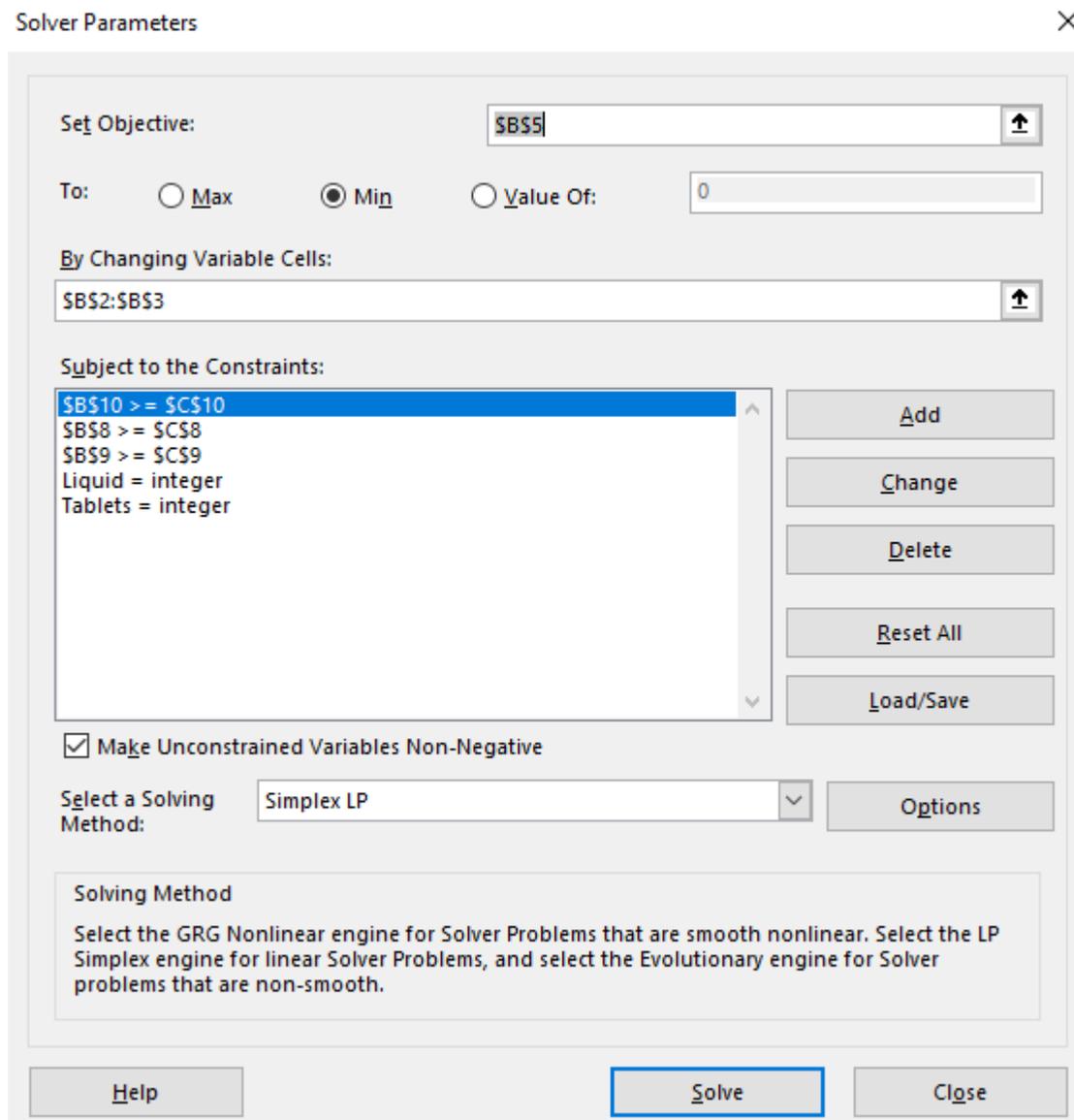


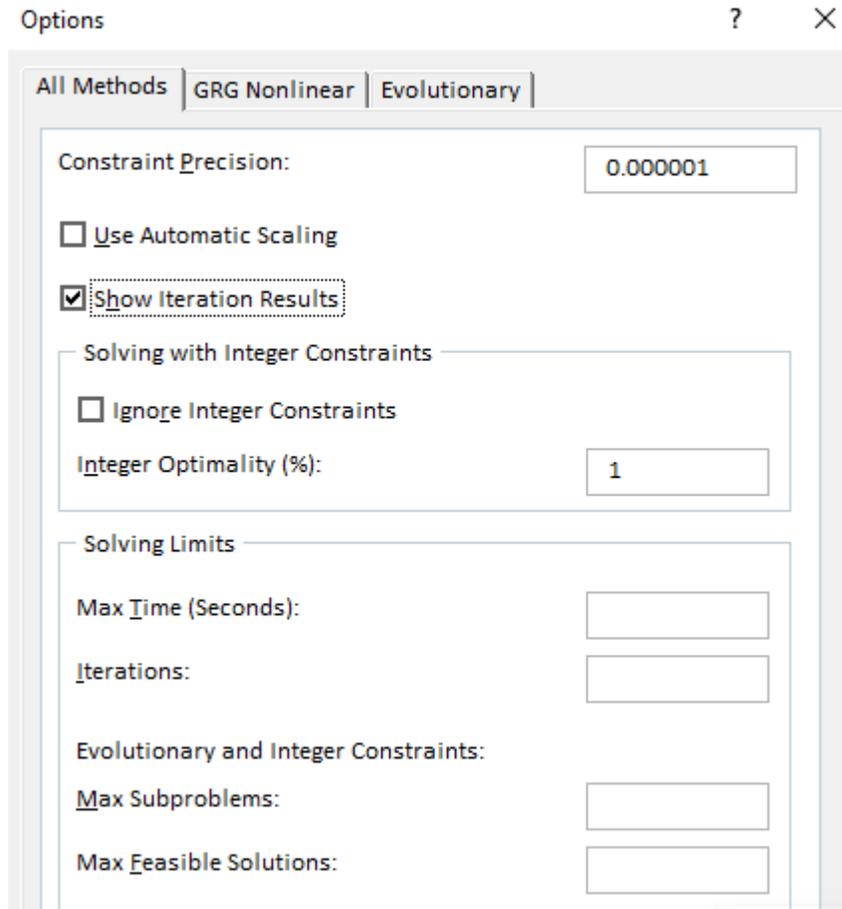
Note that solver has found a solution. Select all the Reports you want. Select Keep Solver Solution to keep this solution. Choose Solver again and you will see that the objective function and constraints are still the same. You could add constraints or change them.

Note that solver has found the solution $\frac{20}{3}$ and $\frac{2}{3}$.

The reports asked for will be new sheets in the workbook.

Try Solver again and by adding two new constraints, change the problem so that the variables must be integers.





By selecting Options you can chose for example to see the solution given at the end of each iteration of the Simplex method.