# Using Solver

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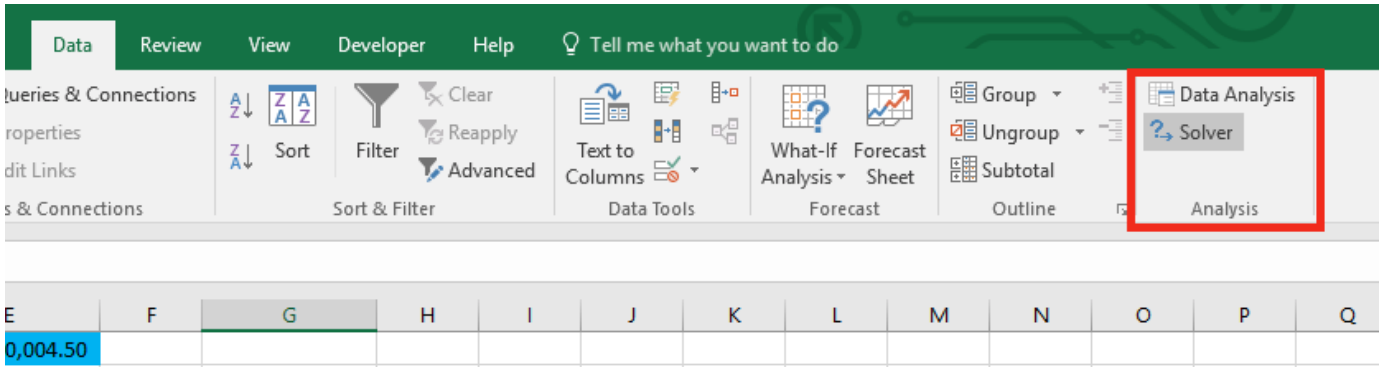
# Installing Solver for PC

## Excel Step-by-Step How-to for PC

**Instructions:** Use this guide to install Solver onto a PC computer.

| Step | Instructions + Screen Shot |
|---|---|
| 1. Check whether Solver is already installed. | Navigate to the Data tab and look for the Solver button under the Analysis category.  |





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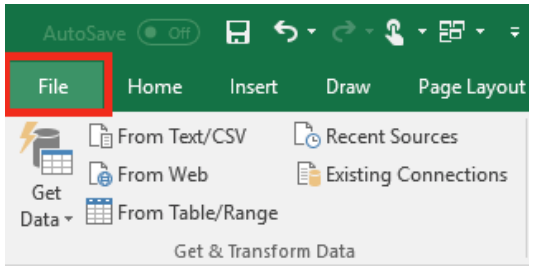
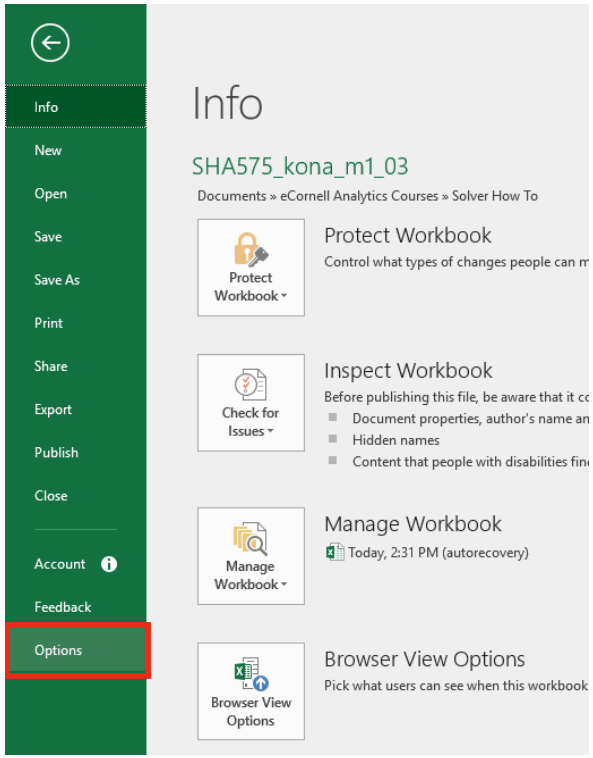
2. If Solver is not present, add Solver using Excel Options.

Start by clicking the File Button.




Navigate to the bottom of the list on the left of the screen and select Options.



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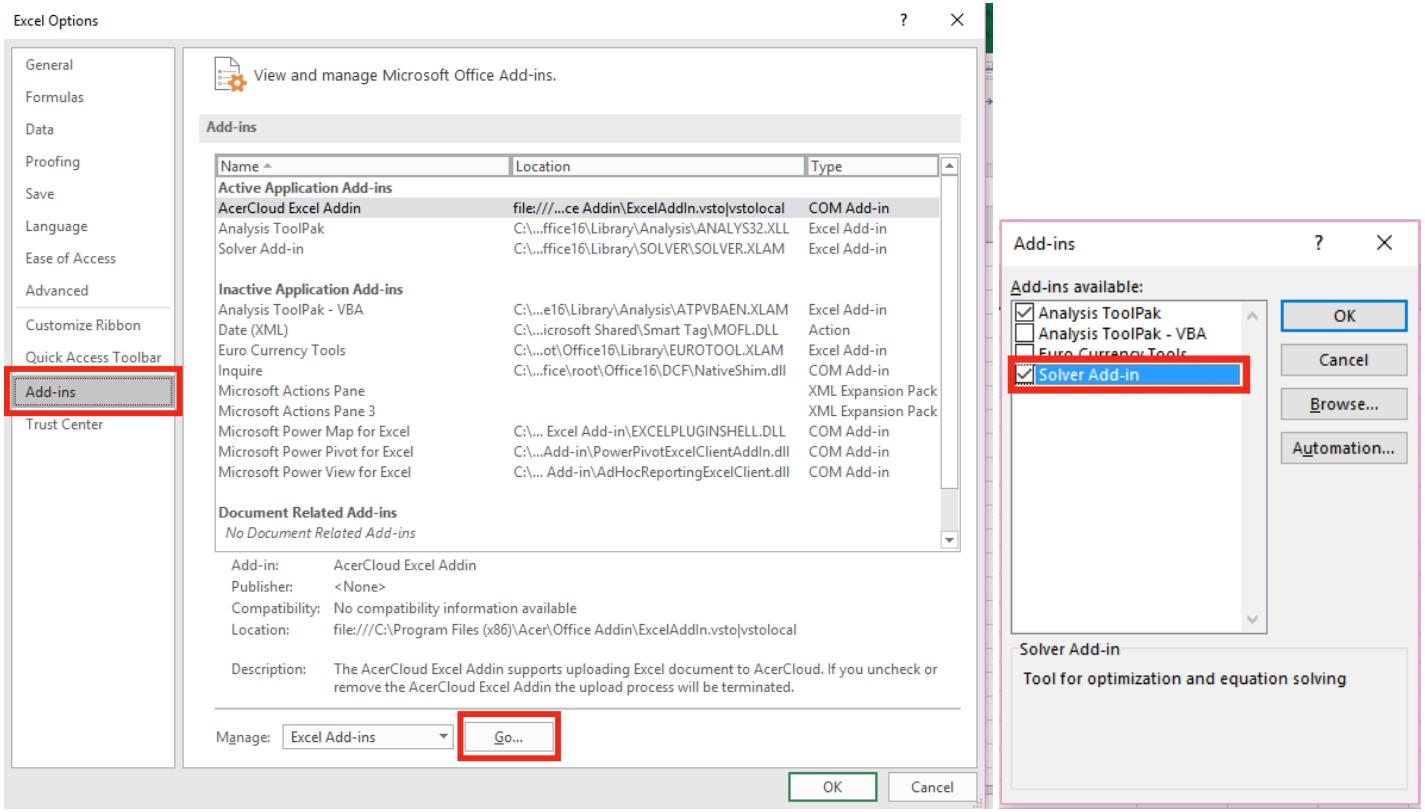
3. Add the Solver Excel Add-In.

Navigate to the Add-ins tab. Make sure that the “Manage” drop down is set to Excel Add-Ins and click Go. Check the box beside Solver Add-in and click OK.



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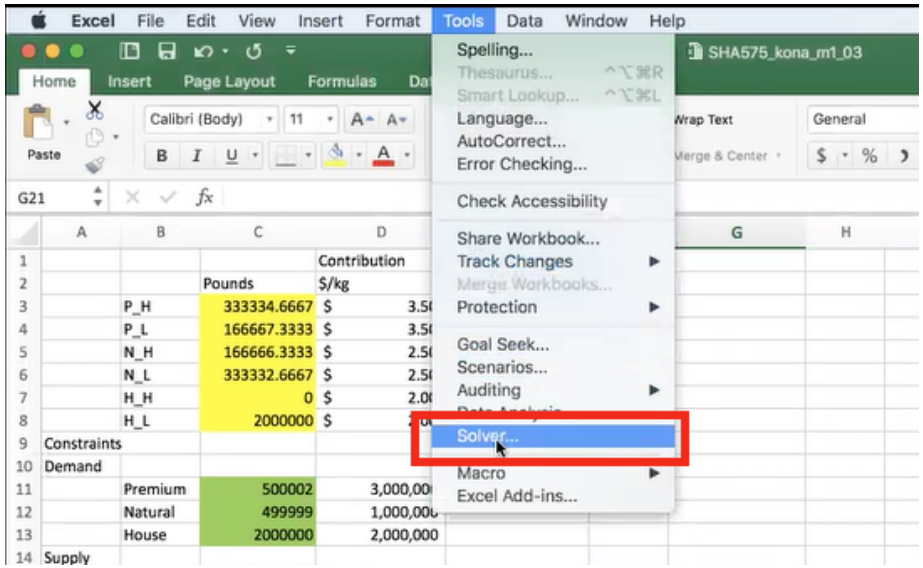
# Install Solver on Mac Computer

## Excel Step-by-Step How-to for Mac

**Instructions:** Use this guide to install Solver to a Mac computer.

| Step | Instructions + Screen Shot |
|---|---|
| 1. Check whether Solver is already installed. | Navigate to the tools tab and search for the Solver menu item.  |





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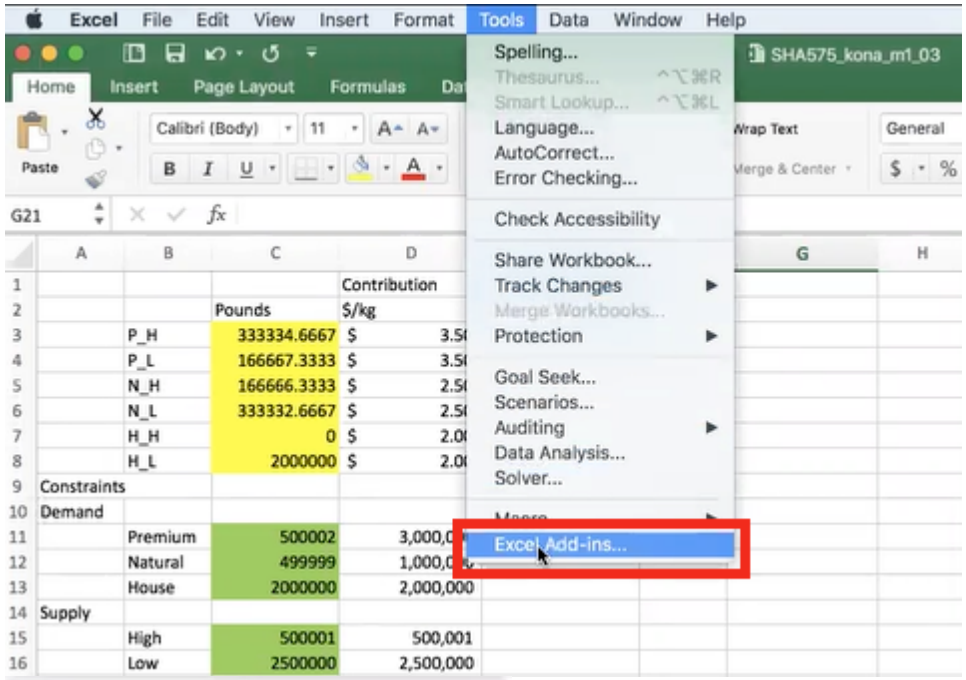
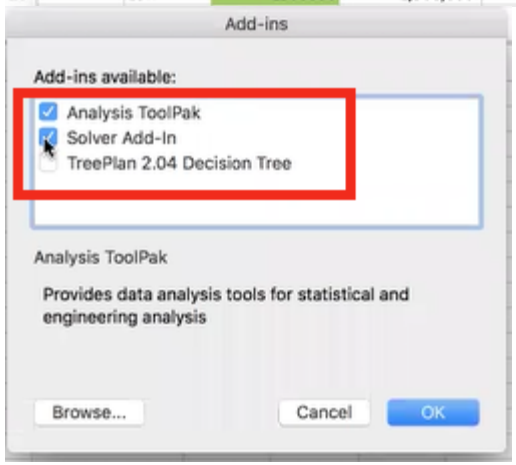
2. If Solver is not present, add it to the Excel Add-ins.

Navigate to the tools tab and select Excel Add-ins. Check the box for the Solver Add-in and click OK.



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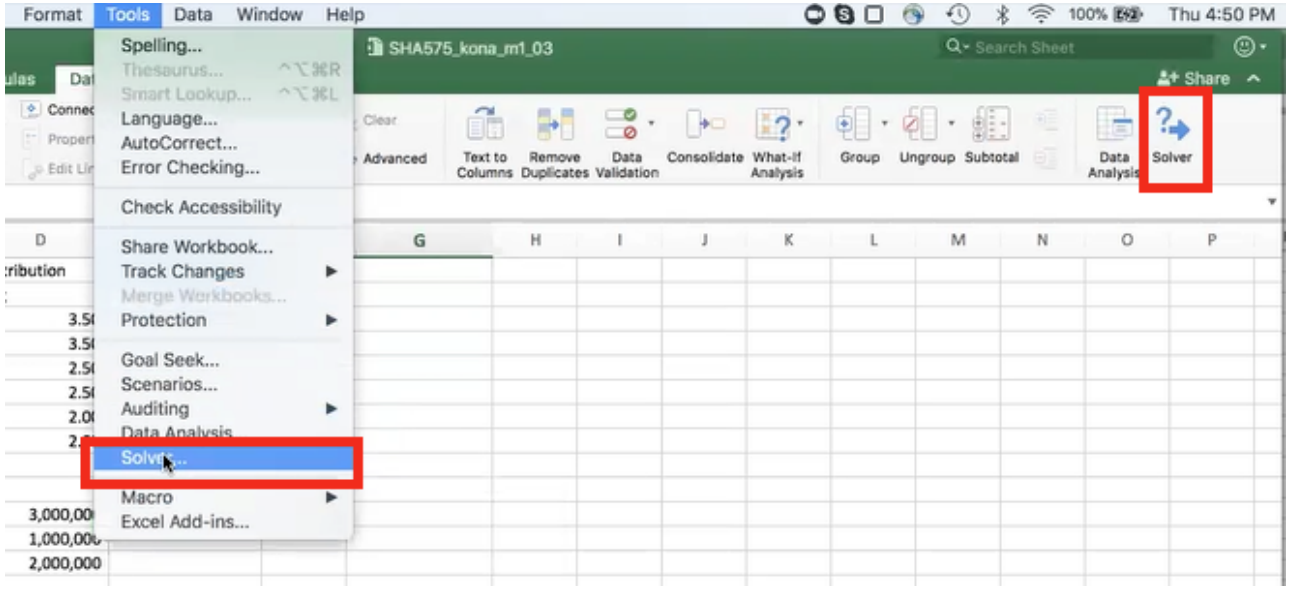
# Using Solver

## Excel Step-by-Step How-to

**Instructions:** Use this guide to learn how to use the functions of Solver.

**Data requirement:** fixed values, constraints, two or more decision variables, one or more dependent objective function
**Sample Data:** coffee blends

| Step | Instructions + Screen Shot |
|---|---|
| 1. Launch Solver. | Either select the Solver title under the tools tab or navigate to the Data tab on the ribbon and select the Solver button.  |





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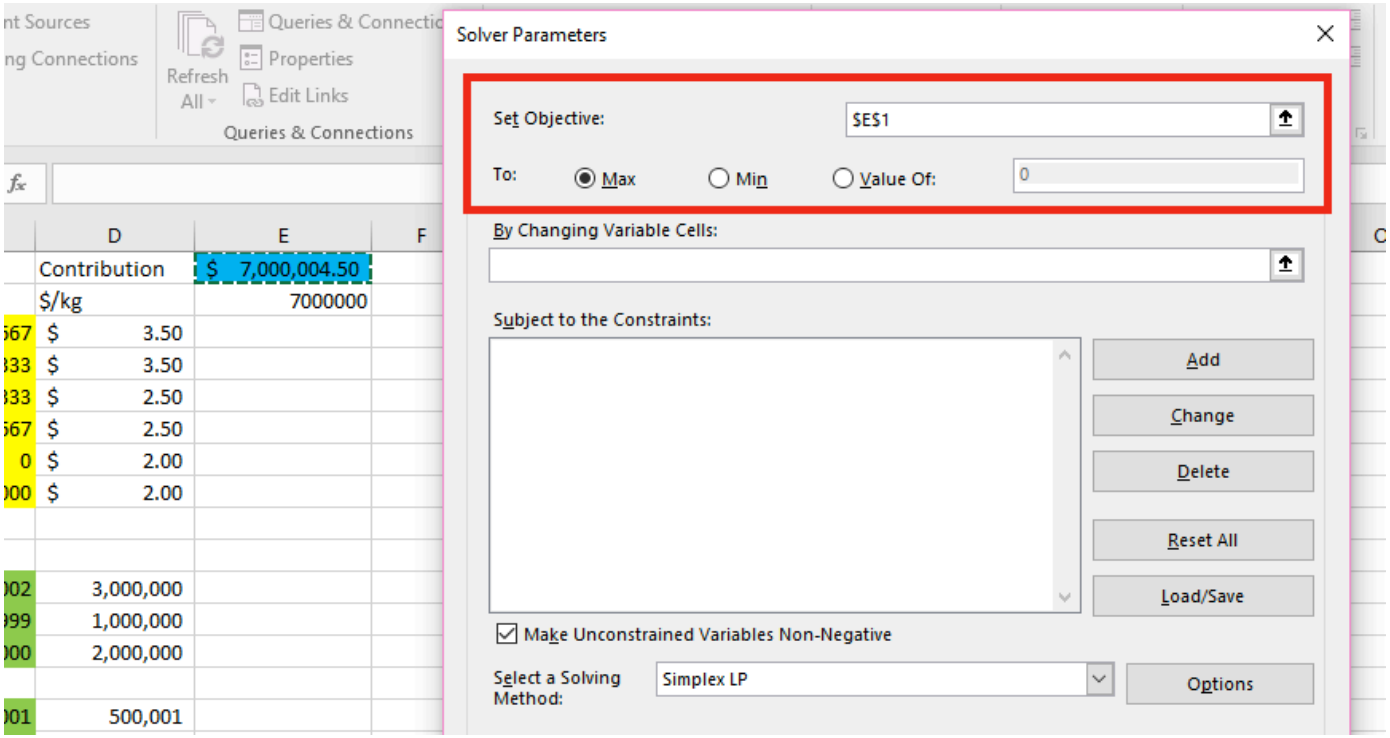
2. Select the objective cell and whether you would like the cell to be maximized, minimized, or equal to a value.

This example has the objective of maximizing the contribution in cell E1. In this case, contribution represents a total revenue based on the =SUMPRODUCT of prices for different products and sales figures for each product.



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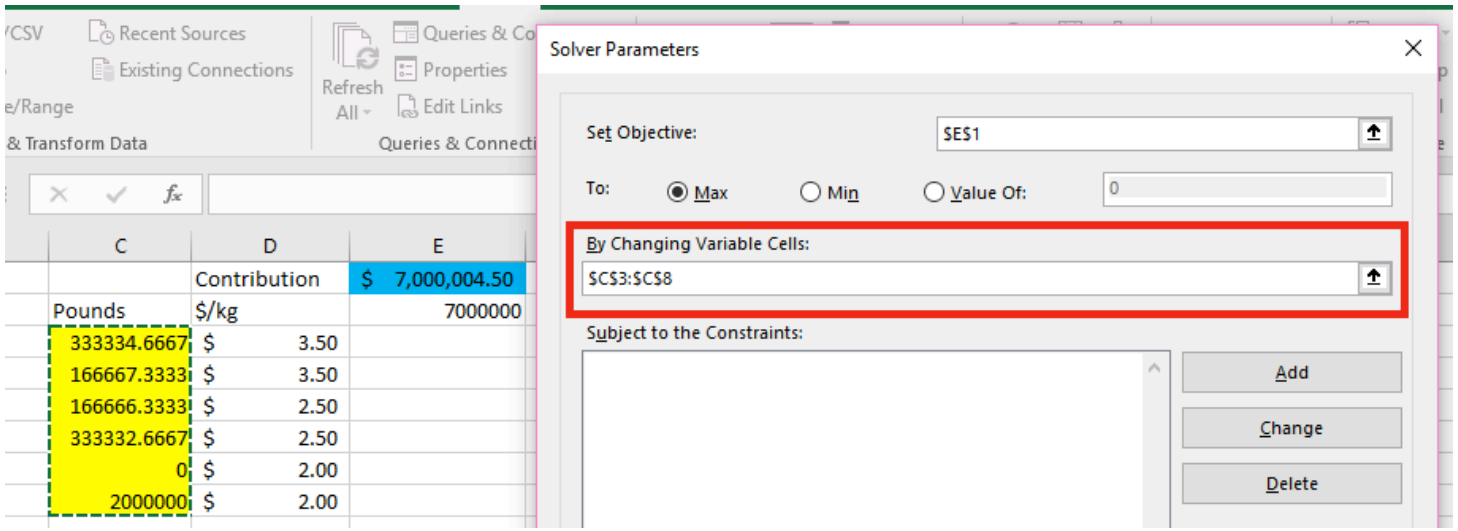
3. Specify the decision variable cells within the Solver dialog box.

This example has decision variables in cells C3:C8. While this screenshot shows values determined after Solver has been run, it is customary to pre-populate decision variable cells with a uniform value, such as 1. To specify the decision variables in Solver you can either key in the cell identifier (or range) in the "By Changing Variable Cells:" field, or select the RefEdit icon (short up arrow with the line below it) and then select the target cell(s) in the sheet.



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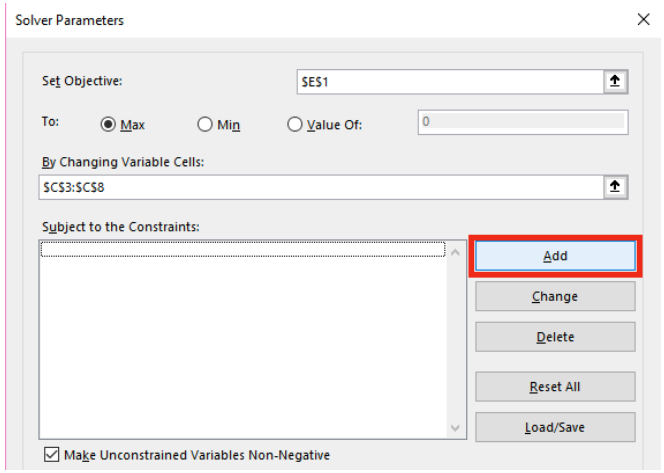
4. Add constraints.

**TIP:** You can add multiple constraints at a time if they are in adjacent cells and are of the same type.

Select the Add button.




Input the cells that apply to the constraints. This example states that the premium, natural, and house should be less than or equal to three, one, and two million respectively. Select OK.



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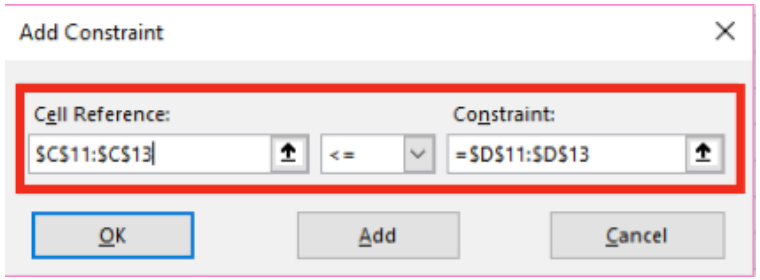
| | A | B | C | D | E | F |
|---|---|---|---|---|---|---|
| 1 | | | | | | |
| 2 | | | | Contribution | | |
| 3 | coffee blend | bean quality | kilograms | $ earned/kg of bean | | |
| 4 | premium | high | 333333.333 | $ 3.50 | | |
| 5 | | low | 166666.667 | $ 3.50 | | |
| 6 | natural | high | 166666.667 | $ 2.50 | | |
| 7 | | low | 333333.333 | $ 2.50 | | |
| 8 | house | high | 0 | $ 2.00 | | |
| 9 | | low | 2000000 | $ 2.00 | | |
| 10 | | | | | $ 7,000,000.00 | profit |
| 11 | Demand for each blend | | kilograms | maximum allowed | | |
| 12 | | Premium | 500000 | 3,000,000 | | |
| 13 | | Natural | 500000 | 1,000,000 | | |
| 14 | | House | 2000000 | 2,000,000 | | |
| 15 | Supply of each bean type | | | | | |
| 16 | | high quality | 500000 | 500,000 | | |
| 17 | | low quality | 2500000 | 2,500,000 | | |
| 18 | H/L bean quality balance | | | minimum allowed | | |
| 19 | | Premium | 0 | 0 | | |
| 20 | | Natural | 0 | 0 | | |
| 21 | | | | | | |




Add multiple constraints by selecting the Add button again. Constraints will accumulate in the identified box.



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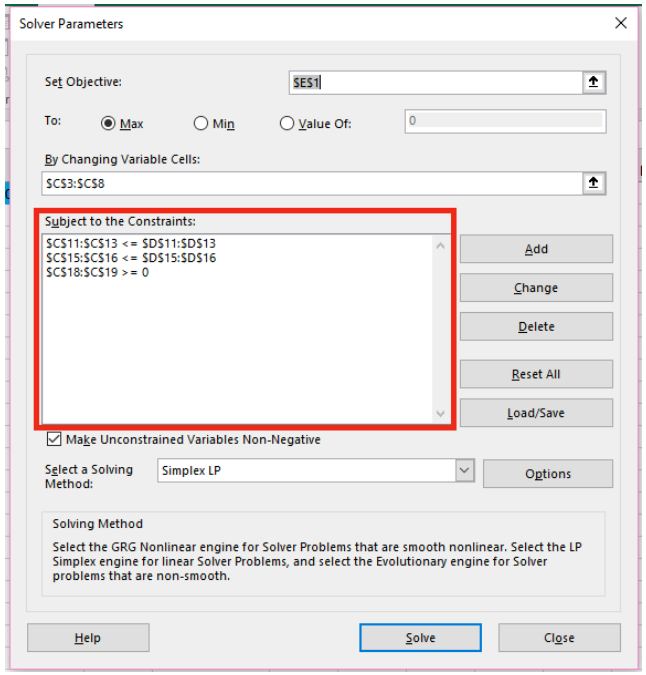
Note that in this example all three demand constraints can be added in a single add action because they are adjacent rows and all three have a ≤ relationship with the constraint limit cells.
The supply constraints cells also have a ≤ relationship with the constraint limit cells, but they must be added separately because they are not adjacent to the demand cells.



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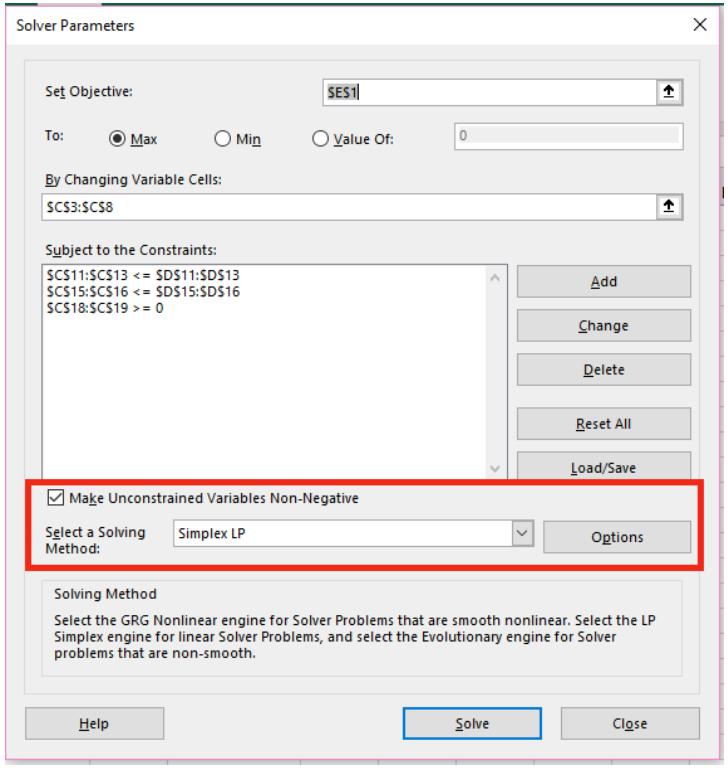
6. Select a solving method, and consider whether you need to make unconstrained variables non-negative.

Use the dropdown to select the appropriate solving method. If the decision variables for the model should be non-negative then select this check box.
Select Solve to initiate the Solver analysis.



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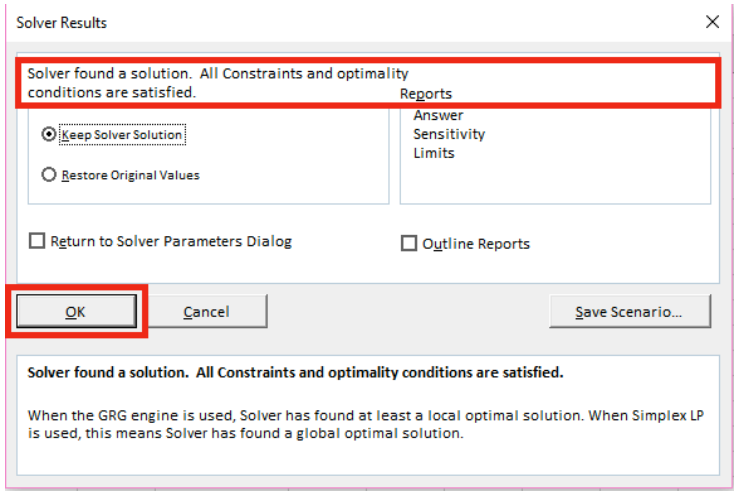
7. Review the outcome of the Solve attempt.

Note that the Solver has found a solution in this example. “Solver found a solution. All constraints and optimality conditions are satisfied.”
Select OK to see data.




| | A | B | C | D | E |
|---|---|---|---|---|---|
| 1 | | | | Contribution | $ 7,000,004.50 |
| 2 | | | Pounds | $/kg | 7000000 |
| 3 | | P_H | 333334.6667 | $ 3.50 | |
| 4 | | P_L | 166667.3333 | $ 3.50 | |
| 5 | | N_H | 166666.3333 | $ 2.50 | |
| 6 | | N_L | 333332.6667 | $ 2.50 | |
| 7 | | H_H | 0 | $ 2.00 | |
| 8 | | H_L | 2000000 | $ 2.00 | |
| 9 | Constraints | | | | |
| 10 | Demand | | | | |
| 11 | | Premium | 500002 | 3,000,000 | |
| 12 | | Natural | 499999 | 1,000,000 | |
| 13 | | House | 2000000 | 2,000,000 | |
| 14 | Supply | | | | |
| 15 | | High | 500001 | 500,001 | |
| 16 | | Low | 2500000 | 2,500,000 | |
| 17 | Quality | | | | |
| 18 | | Premium | 0 | - | |
| 19 | | Natural | 0 | - | |
| 20 | | | | | |

Some other typical result messages include:

| Message | Suggested action |
|---|---|
| The linearity conditions required by this LP Solver are not satisfied. (linear only) | Select a non-linear method (e.g. GRG or Evolutionary) |
| Solver cannot improve the current solution. All constraints are satisfied. (non-linear only) | Good result. Select OK to see data |
| Solver could not find a feasible solution. (non-linear only) | Adjust the parameters of the solve method and re-run Solver. |

For a more complete list of Solver result messages, see: https://www.solver.com/excel-solver-solver-result-messages



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# Using Solver to Run a Sensitivity Analysis

## Excel Step-by-Step How-to

**Instructions:** Use this guide to use Solver to run a sensitivity analysis.

**Data requirement:** A model that has been analyzed with Solver. See how-to on page 7.
**Sample Data:** coffee blends

| Step | Instructions + Screenshot |
|---|---|
| 1. Complete analysis from previous how-to. | Using Solver How-To |
| 2. Launch Solver.<br><br>TIP: On the Mac platform, avoid having more than one workbook that uses Solver | Either select the Solver title under the tools tab or navigate to the Data tab on the ribbon and select the Solver button. |



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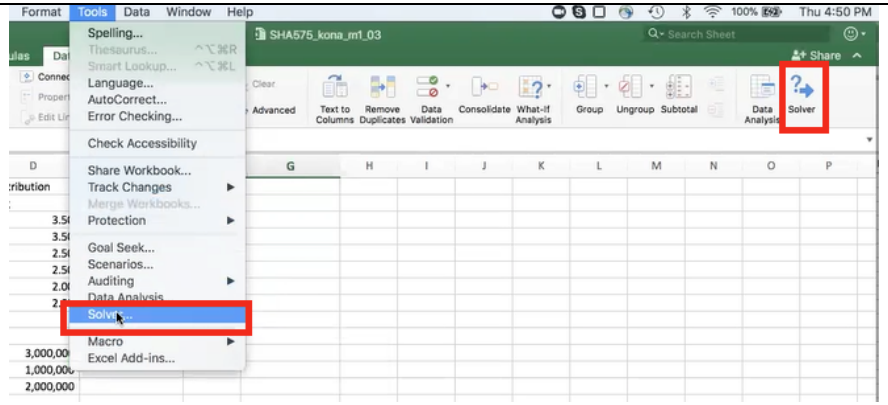
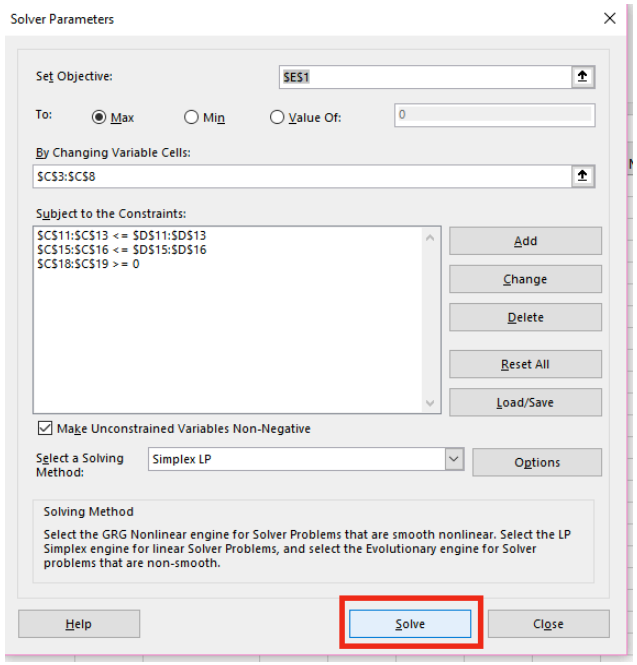
open at any given time. Solver sometimes jumps between workbooks when running, and this can lead to confusion.




3. Run a sensitivity analysis on the model.

Make sure your objective and constraints are specified correctly. Then select Solve.



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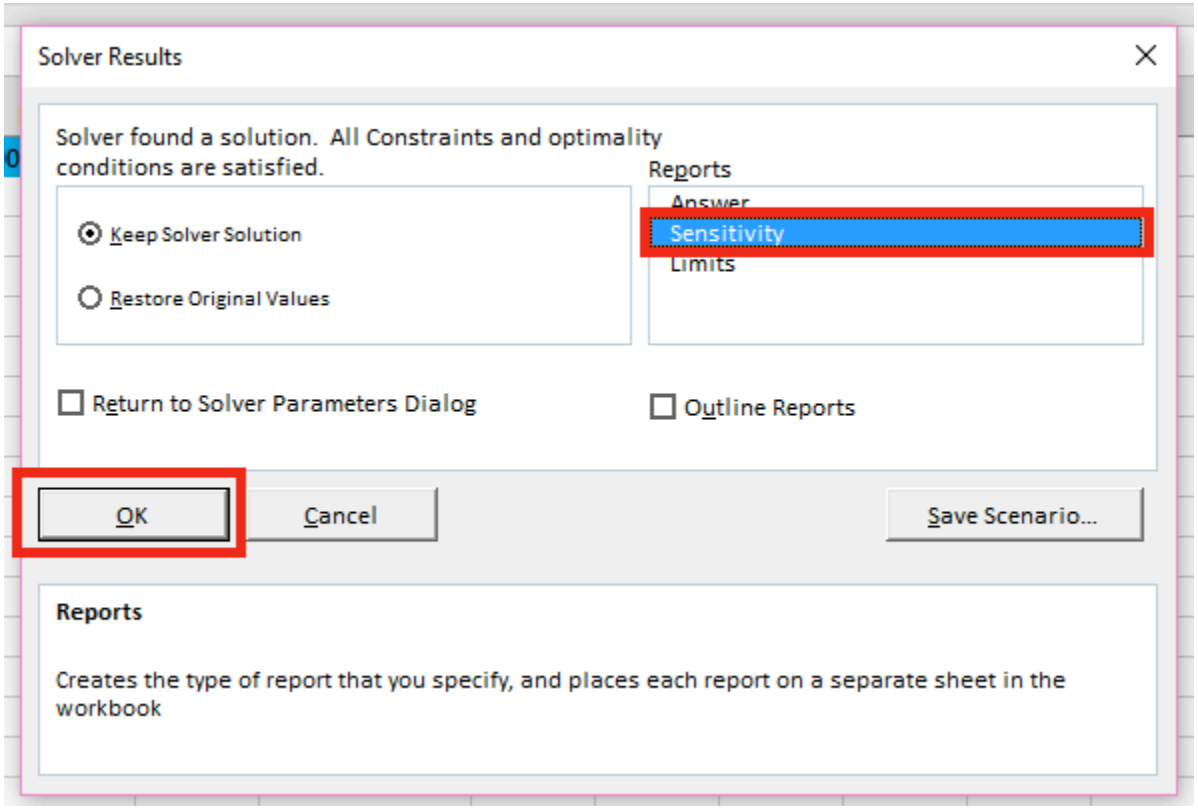
Select the Sensitivity Report option. Then select OK.



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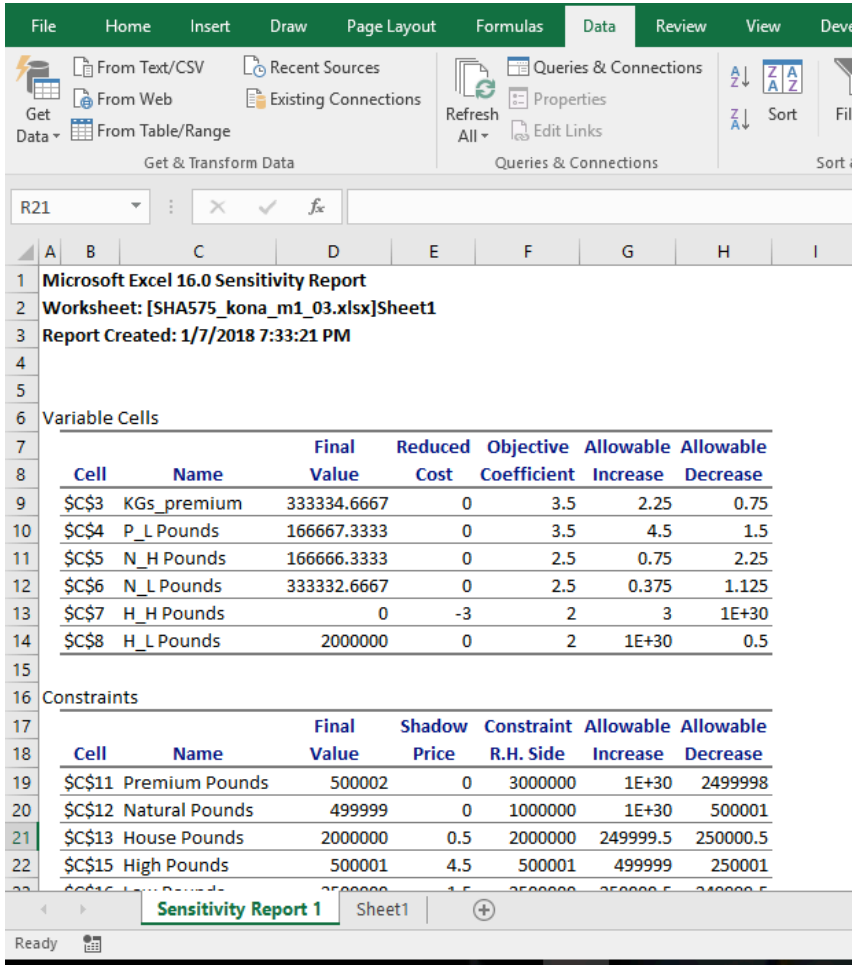
4. Review sensitivity report.

The sensitivity report will appear in a new sheet.
The first report you create in a workbook will appear in a sheet labeled Sensitivity Report 1.
Subsequent analyses will be placed in separate sheets labeled Sensitivity Report 2, Sensitivity Report 3, etc.



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