

Find the Point of Intersection in Excel

In this example we'll find the solution to the system of equations

$$-22x + 202y = 2020$$

$$-50x + 101y = 1403.9$$

by finding where the graphs of the equations intersect. To facilitate graphing each equation, solve each equation for y to yield

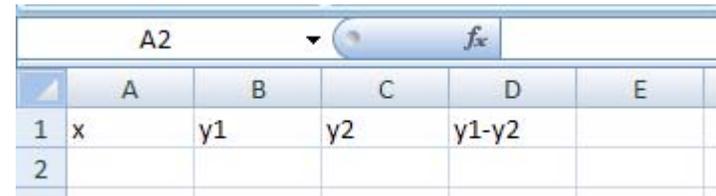
$$y = \frac{22}{202}x + 10$$

$$y = \frac{50}{101}x + 13.9$$

At the point of intersection, the difference between y values from the first equation and the second equation will be zero. We'll use Excel to find the x value that leads to a difference of zero.

Find the Point of Intersection in Excel

1. Open a new worksheet. To use Goal Seek in Excel you must first enter any value of x and each equation. In the fourth column we'll place the difference between the y values from each equation.
2. First enter a label for the first column, say x in cell A1. This column will correspond to x values for each equation. Enter labels like $y1$ and $y2$ for the y values from each equation in B1 and C1.
3. In cell D1, put a label like $y1-y2$ to represent the difference between the y values in column B and C.



| | A | B | C | D | E |
|---|---|----|----|-------|---|
| 1 | x | y1 | y2 | y1-y2 | |
| 2 | | | | | |

Find the Point of Intersection in Excel

4. Enter any value of x , say 1, into cell A2 and the first equation as $=(22/202)*A2+10$ into cell B2.

5. Press Enter. You will see the value 10.10891 in cell B2.

The screenshot shows the Excel formula bar with the formula $=(22/202)*A2+10$. The spreadsheet grid below shows the following data:

| | A | B | C | D | E |
|---|---|----|-------------------|-------|---|
| 1 | x | y1 | y2 | y1-y2 | |
| 2 | | 1 | $=(22/202)*A2+10$ | | |
| 3 | | | | | |

The screenshot shows the result of the first equation in cell B2. The spreadsheet grid below shows the following data:

| | A | B | C | D |
|---|---|----|----------|-------|
| 1 | x | y1 | y2 | y1-y2 |
| 2 | | 1 | 10.10891 | |
| 3 | | | | |

6. Enter the second equation as $=(50/101)*A2+13.9$ into cell C2.

7. Press Enter. You will see the value 14.39505 in cell C2.

The screenshot shows the Excel formula bar with the formula $=(50/101)*A2+13.9$. The spreadsheet grid below shows the following data:

| | A | B | C | D |
|---|---|----|----------|---------------------|
| 1 | x | y1 | y2 | y1-y2 |
| 2 | | 1 | 10.10891 | $=(50/101)*A2+13.9$ |
| 3 | | | | |

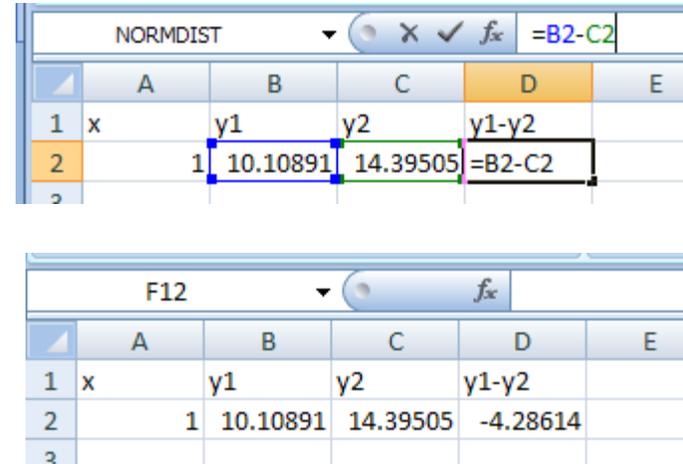
The screenshot shows the results of both equations in cells B2 and C2. The spreadsheet grid below shows the following data:

| | A | B | C | D |
|---|---|----|----------|----------|
| 1 | x | y1 | y2 | y1-y2 |
| 2 | | 1 | 10.10891 | 14.39505 |
| 3 | | | | |

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8. In cell D2, enter the formula $=B2-C2$.

9. Press Enter. You should see the difference between the y values from each equation at the x value corresponding to A2. For $x=1$, the difference is -4.26814.



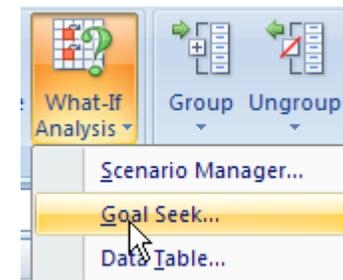
| | A | B | C | D | E |
|---|---|----------|----------|--------|---|
| 1 | x | y1 | y2 | y1-y2 | |
| 2 | 1 | 10.10891 | 14.39505 | =B2-C2 | |
| 3 | | | | | |

| | A | B | C | D | E |
|---|---|----------|----------|----------|---|
| 1 | x | y1 | y2 | y1-y2 | |
| 2 | 1 | 10.10891 | 14.39505 | -4.28614 | |
| 3 | | | | | |

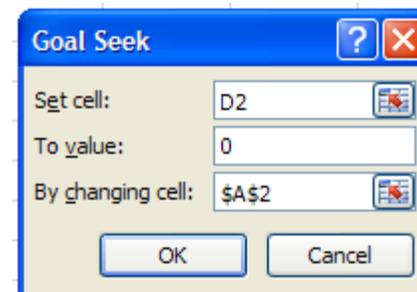
10. Place the cursor back into D2, the cell that contains the formula.

11. Select the Data tab.

12. From the What-If Analysis button, select Goal Seek.

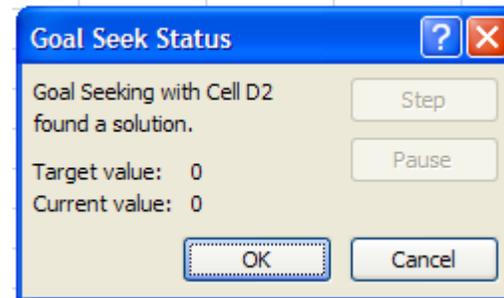


13. A dialog box appears. Fill in the dialog box as shown. You can type the values in or click in the cells to put the entries into this box.



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14. Click OK. Another dialog box appears that tells you a solution has been found.



15. Click OK.

16. Cell A2 now contains the value -10.1 and cell D2 contains 0. Since the difference in y values is zero, this solution corresponds to the point of intersection.

17. According to the worksheet, the solution to the system of equations is approximately $(x, y) = (-10.1, 8.9)$.

| | | D2 | fx =B2-C2 | | |
|---|---|-------|-----------|-------|---|
| | A | B | C | D | |
| 1 | x | y1 | y2 | y1-y2 | |
| 2 | | -10.1 | 8.9 | 8.9 | 0 |
| 3 | | | | | |