

Computer Algebra Systems Activity: Solving Linear Equations

© R. Meisel, Feb 19, 2005
rollym@vaxxine.com

Topic: Solving Linear Equations

Ontario Expectations: (To be added when finalized by MOE.)

Notes to the Teacher:

a) This activity is designed to use the CAS on the TI-89 calculator to enhance understanding and instruction. Other CAS systems may be used in place of the TI-89. All screen shots are from the TI-89.

b) The activity is presented in a Teacher Version, with all screen shots and solutions present, as well as a Student Version, which can be duplicated and handed out to students.

c) This material may be used freely by teachers in their classrooms. The copyright message must not be removed. Any other use or publication without the consent of the author is a breach of copyright.

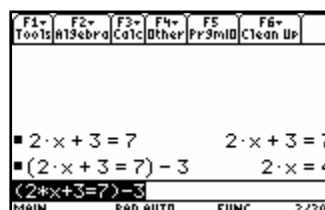
Teacher Version:

Introduction: Computer Algebra Systems contain powerful algorithms for solving equations. These may have a numerical solution, such as $2x + 3 = 7$, solve for x , or they may result in a rearranged "formula", such as $C = 2\pi r$, solve for r . CAS can handle both of these.

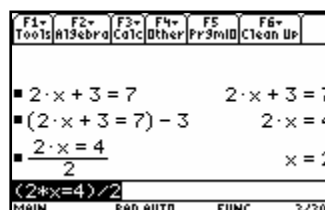
1. To begin, you will use CAS to solve $2x + 3 = 7$ in a stepwise fashion. Turn on your TI-89, and enter the equation.



The first step in the solution is to subtract 3 from both sides. Note that the equation has been copied to the command bar. Use the arrow keys to insert brackets around the equation, as shown. Then, use the **subtract** key (not the **minus** key) to subtract 3. Note that 3 has now been subtracted from both sides.



The next step in the solution is to divide both sides of the equation by 2. Use the blue up-arrow key to highlight $2x = 4$. Use the green \blacklozenge key followed by the **COPY** key to copy this equation to the clipboard. Return to the command bar using the blue down-arrow

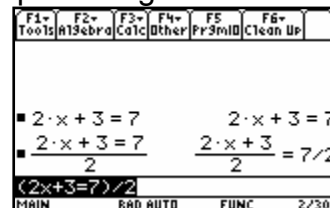


key. Use the green \blacklozenge key followed by the green **PASTE** key to insert $2x = 4$.
 Note: you can also retype the equation in the command line. Use your judgment as to which is most appropriate for a given case.

Insert brackets around the equation, and then divide by 2. Note the correct solution. [Answer: $x = 2$]

2. When using CAS to solve an equation in a step-wise fashion, you need to know the correct steps to follow. If you instruct CAS with an incorrect step, it will perform the action that you asked for, but it will become obvious that you have made an error. To see how this works, clear your work area. Press F1 and select **8: Clear Home**. Then, press the **CLEAR** key. Enter the equation again.

Let's assume that you make an error, and decide that the correct first step in the solution is to divide both sides by 2. Insert brackets around the equation, and divide by 2.



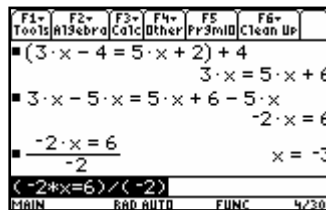
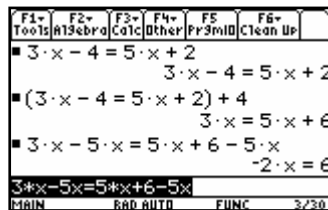
Note that both sides of the equation have become more complicated. It is not at all obvious where to go from here. Return to the command line, backspace to eliminate the division by 2, and insert the correct operation. Note that CAS allows you to correct errors easily.

3. CAS can also solve the equation for you automatically. Clear your work area. Press F2 and select option **1: solve(**. Enter the equation, followed by a comma, and then an x. Close the bracket, and press **ENTER**. Note that CAS has solved for x automatically.

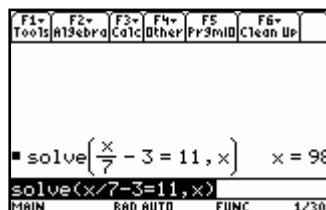
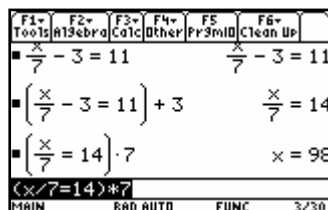


4. Use CAS to solve the following equations. Solve each one first in a step-wise fashion, and then use the **solve(** function under F2.

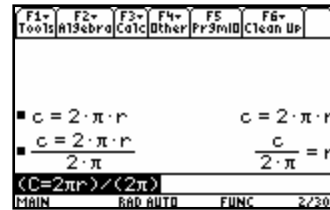
a) $3x - 4 = 5x + 2$



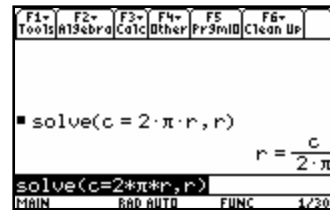
b) $\frac{x}{7} - 3 = 11$



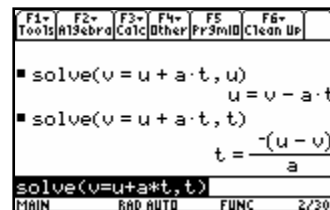
5. CAS can also solve equations that include several variables, such as $C = 2\pi r$. To solve for r , divide both sides by 2π . Note: to enter a C or other letter, use the **alpha** key.



Now, use the **solve()** function to solve for r .

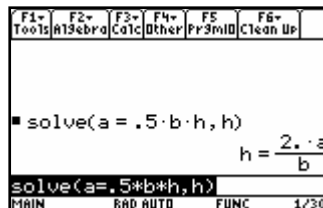
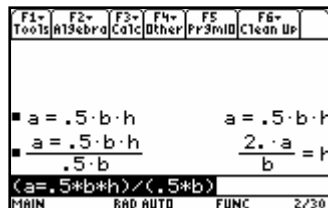


Try a more complicated formula, such as $v = u + at$. Solve for u . Then, solve for t .

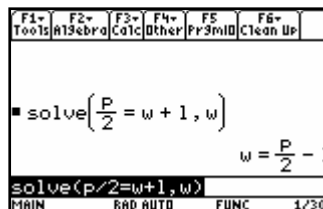
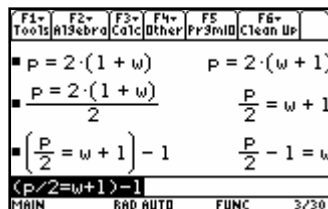


6. Solve each of the following for the variable indicated. Use a step-wise solution, and then the **solve()** function.

a) Solve $A = \frac{1}{2}bh$ for h .



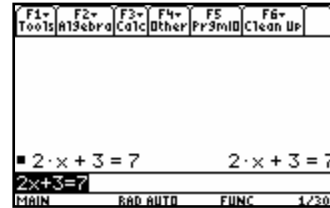
b) Solve $P = 2(l + w)$ for w .



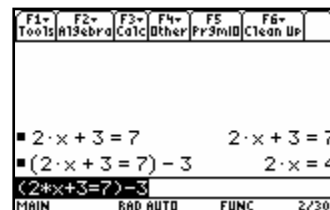
Student Version:

Introduction: Computer Algebra Systems contain powerful algorithms for solving equations. These may have a numerical solution, such as $2x + 3 = 7$, solve for x , or they may result in a rearranged "formula", such as $C = 2\pi r$, solve for r . CAS can handle both of these.

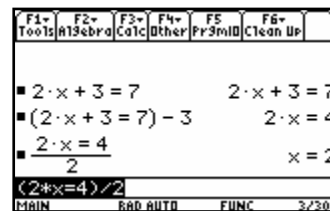
1. To begin, you will use CAS to solve $2x + 3 = 7$ in a stepwise fashion. Turn on your TI-89, and enter the equation.



The first step in the solution is to subtract 3 from both sides. Note that the equation has been copied to the command bar. Use the arrow keys to insert brackets around the equation, as shown. Then, use the **subtract** key (not the **minus** key) to subtract 3. Note that 3 has now been subtracted from both sides.



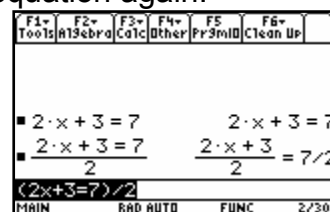
The next step in the solution is to divide both sides of the equation by 2. Use the blue up-arrow key to highlight $2x = 4$. Use the green \blacklozenge key followed by the **COPY** key to copy this equation to the clipboard. Return to the command bar using the blue down-arrow key. Use the green \blacklozenge key followed by the green **PASTE** key to insert $2x = 4$. Note: you can also retype the equation in the command line. Use your judgment as to which is most appropriate for a given case.



Insert brackets around the equation, and then divide by 2. Note the correct solution.

2. When using CAS to solve an equation in a step-wise fashion, you need to know the correct steps to follow. If you instruct CAS with an incorrect step, it will perform the action that you asked for, but it will become obvious that you have made an error. To see how this works, clear your work area. Press F1 and select **8: Clear Home**. Then, press the **CLEAR** key. Enter the equation again.

Let's assume that you make an error, and decide that the correct first step in the solution is to divide both sides by 2. Insert brackets around the equation, and divide by 2.



Note that both sides of the equation have become more complicated. It is not at all obvious where to go from here. Return to the command line, backspace to eliminate the division by 2, and insert the correct operation. Note that CAS allows you to correct errors easily.



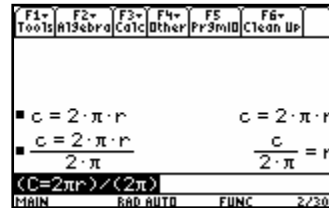
3. CAS can also solve the equation for you automatically. Clear your work area. Press F2 and select option **1: solve(**. Enter the equation, followed by a comma, and then an x. Close the bracket, and press **ENTER**. Note that CAS has solved for x automatically.

4. Use CAS to solve the following equations. Solve each one first in a step-wise fashion, and then use the **solve(** function under F2.

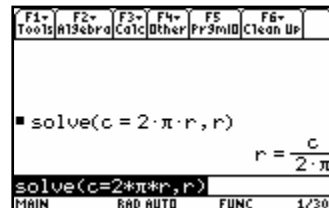
a) $3x - 4 = 5x + 2$

b) $\frac{x}{7} - 3 = 11$

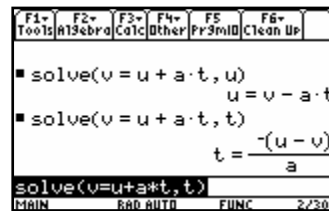
5. CAS can also solve equations that include several variables, such as $C = 2\pi r$. To solve for r , divide both sides by 2π . Note: to enter a C or other letter, use the **alpha** key.



Now, use the **solve(** function to solve for r .



Try a more complicated formula, such as $v = u + at$. Solve for u . Then, solve for t .



6. Solve each of the following for the variable indicated. Use a step-wise solution, and then the **solve()** function.

a) Solve $A = \frac{1}{2}bh$ for h .

b) Solve $P = 2(l + w)$ for w .