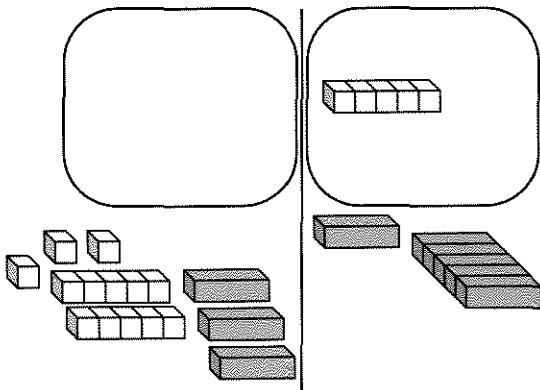# Solving Techniques: Addition and Subtraction

One key to solving linear equations is a technique based on this fact: If two quantities are equal, and you **add or subtract the same quantity from both**, you end up with equal quantities. This provides you with a method for simplifying equations.
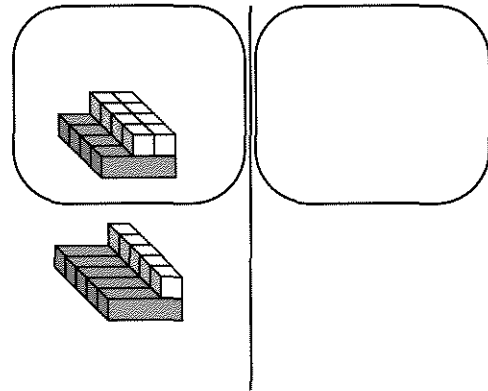
USING THE LAB GEAR

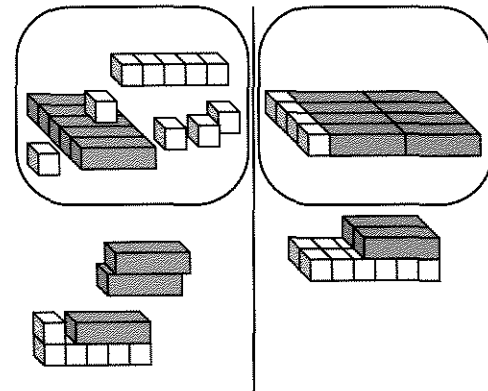1. Write the equation shown by this figure.

2. Remove three x-blocks from each side. Add 5 to each side and simplify. Finally, form rectangles on both sides, setting them up to show a common side.

3. Write the solution to the equation. Explain.

For each figure in problems 4-7, write the equation, then solve for x. Use the method shown in problem 2.
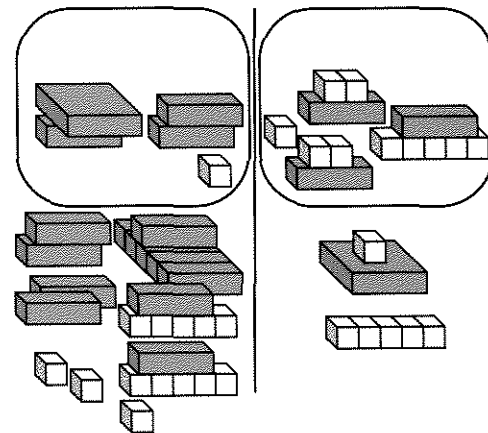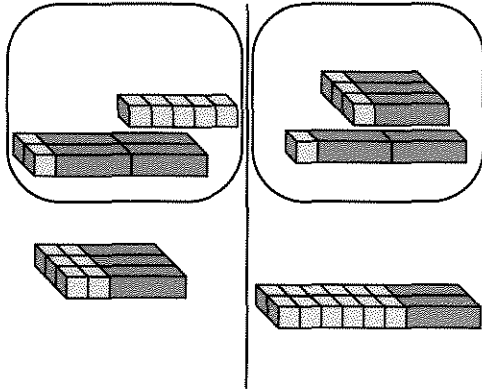
4.

5.

6.

7.

For each problem, 8-11,
  a. Model the equation with the Lab Gear.
  b. Solve it using the techniques you have learned with the blocks. Record algebraically at least two of the intermediate steps.
  c. Write the final answer.

8. $5x + 3(x + 3) = 25$

9. $5x = 25 + 3(x + 3)$

10. $0 = 3(6 - x) + 6x$

11. $15 - 4(x - 2) + 2x = 3$

12. Start with the equation $x = 3$.
  a. Add and/or subtract the same amount from both sides repeatedly, getting the equation to be more and more complicated. (The quantities you add and subtract may include x. You may use the Lab Gear. If you do, record some of the steps.) Write the final equation on paper and give it to a classmate.
  b. Solve a classmate's equation. If you both do your work correctly, the solution should be $x = 3$. (Again, you may use the Lab Gear.)

════════ SAVINGS PLANS ════════

In this section, you can apply equation solving to real-life problems.

13. **Exploration** Tania Rhine had $123. For her birthday, she received $175 from her grandparents, and her allowance was raised to $11 a week. What is the largest amount she can spend every week, if
  a. she wants to have a total of $600 by her next birthday?
  b. she wants to have $100 left by her next birthday?

Beatrice had $321 in her savings account on September 1. She planned to save $14 a week.

14. Make a table or graph showing how her total savings change as a function of the number of weeks that have passed.

15. Look for a pattern in your table or graph. How much would Bea have at the end of:
  a. 4 weeks?   b. 52 weeks?
  c. n weeks?   d. 2 years?
  e. n years?

16. Beatrice is considering another possible savings plan. She wants to go to a movie every week, which means she would spend $5 out of the $14. She would deposit the rest in her savings account. Make a table or graph of this savings plan to compare with your first one.

17. With the second savings plan, how much would Beatrice have at the end of:
  a. 4 weeks?
  b. n weeks?

18. Beatrice is saving for a stereo that costs $549. How long will it take to reach her goal under each savings plan? Try to answer this question without extending your tables or graphs. Instead, try to write and solve equations.

19. Abraham is also saving for the stereo. He has $235 in his savings account on October 1 and deposits $21 per week. Write an expression that gives the amount of money that Abraham has after n weeks.

20. 🔑 Use tables, graphs, or equations to answer these questions. Show your work. Who will have enough to buy the stereo first, Abraham or Beatrice,
  a. if Beatrice has been following her first plan?
  b. if Beatrice has been following her second plan?

21. 🔑 On January 15, Bea and Abe see an advertisement about the stereo. For two weeks, it will be on sale for $499. Will either one of them have enough money to buy the stereo then? Do you think one of

them will already have bought the stereo? Will your answer depend on what savings plan Bea was following? Explain, showing all your work.

MORE EQUATION SOLVING

Use any of the methods you have learned to solve these equations. Show your work.

22. $3x + 3 - 5x + 6 = 9x - 3x + 23$

23. $5x - 6 = 13x - 5 - 9x$

24. $10x + 23 = 6x + 27$

25. $2 - 3x + 5 = 7x - 4 - 8x$

26. $4x + 5 = 4x + 7$

27. $3x + 4x = 8 + 7x - 8$

DISCOVERY HARDER FACTORING

Factor these trinomials by making a rectangle with the Lab Gear and writing a multiplication equation relating length, width, and area.

28. $x^2 + xy + x + y$

29. $3x^2 + 5x + 2$

30. $6x^2 + 7x + 2$

31. $6x^2 + 19x + 10$

32. $3x^2 + 16x + 5$

33. $4x^2 + 20x + 25$