



## Math Worksheet for 9th Grade

### Linear equations with unknown coefficients

Name: \_\_\_\_\_

Due Date: \_\_\_\_\_

Teacher: \_\_\_\_\_

Parent Sign: \_\_\_\_\_

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2. Solve for  $x$  in terms of  $k$ :  $5x - k = 15$ .
3. For which values of  $a$  does the equation  $ax + 2 = 10$  have a unique solution? What is the solution then?
4. For which value(s) of  $b$  does the equation  $0x + b = 3$  have (a) no solution, (b) infinitely many solutions?
5. Solve for  $x$  and find  $a$  if both must be integers:  $ax = 12$  and  $x = 3$ .
6. Find  $k$  so that the equation  $7x + k = 0$  has solution  $x = -2$ .
7. Given the equation  $(m + 1)x = 8$ , for what  $m$  is the equation undefined in terms of having no unique solution? Solve  $x$  when possible.
8. Determine the number of solutions of the equation  $0x + 0 = 0$ . Explain.
9. Determine the number of solutions of the equation  $0x + 5 = 0$ . Explain.
10. Solve for  $x$  in terms of  $p$ :  $px - 4 = 2p$ .
11. Find all values of  $t$  such that the equation  $(2t)x = 6$  has exactly one solution and give that solution.
12. If  $ax + 4 = a$ , find  $x$  in terms of  $a$ . For which  $a$  is this valid? For which  $a$  does the equation have no solution or infinitely many?
13. Find  $a$  so that  $x = 2$  is a solution of  $ax - 3 = 5$ .
14. The equation  $(a)x + 2 = (a)x + 5$ . For what  $a$  is this possible? Determine number of solutions for each case.
15. Find  $k$  such that the equation  $kx + 6 = 18$  has solution  $x = 2$ .
16. Solve the equation  $(3 + a)x = 9$  for  $x$  in terms of  $a$ . State any restrictions.
17. For which value(s) of  $c$  does the equation  $cx + 4 = 4$  have (a) a unique solution, (b) no solution, (c) infinitely many solutions?
18. Determine  $a$  so that the linear equation  $a(x - 1) = 3$  has integer solution  $x$ .
19. If  $4x + b = 20$  and  $x = 3$  is the solution, what is  $b$ ?
20. A linear equation  $kx + 5 = 5$  has how many solutions depending on  $k$ ? Explain and give solutions where appropriate.
21. Solve for  $x$  and  $a$  simultaneously if possible:  $ax = 20$  and  $x = 4$ .
22. Find the value(s) of  $m$  so that the equation  $(m)x + 2 = 2$  has infinitely many solutions.
23. Determine all  $k$  for which  $kx + 1 = kx + 1$  holds. How many solutions does it have?
24. For which value of  $a$  does the equation  $(a - 2)x = 0$  have infinitely many solutions? Explain.
25. Solve for  $x$  in terms of  $a$ :  $2ax + 3 = 11$ .
26. A recipe calls for  $a$  liters of milk per batch. If  $3a + 2 = 11$  and  $a$  is the same coefficient in the equation for batches, find  $a$ . (Translate and solve.)
27. Suppose  $ax + 3 = bx + 7$ . For what values of  $a$  and  $b$  does the equation have (a) exactly one solution, (b) no solution, (c) infinitely many solutions? Explain.
28. Find all  $a$  such that  $5x + a = 5x$  has (a) no solution, (b) infinitely many solutions.
29. Solve the equation for  $x$ :  $(1 + k)x - 4 = 2k + x$ . Find  $x$  in terms of  $k$ , and state any restrictions.



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30. The total cost  $C$  for buying  $x$  items is given by  $C = px + 4$ , where  $p$  is price per item. If buying 3 items costs \$19, find  $p$ . Then write the equation and find  $x$  when  $C = \$31$ .
31. Find  $a$  so that the equation  $a(x + 1) = ax + 3$  is true. How many solutions does the resulting equation in  $x$  have?
32. For which values of  $a$  and  $b$  does the equation  $ax + b = 0$  have solution  $x = -2$ ? Give relation between  $a$  and  $b$ .
33. Solve for  $x$ :  $(a/2)x = 6$ . State condition(s) on  $a$ .
34. A taxi fare equals  $m$  dollars per mile plus a \$3 flag drop:  $\text{Fare} = mx + 3$ . If a 4-mile trip costs \$11, find  $m$ . Then find distance for a \$19 fare.
35. If  $ax + 2 = bx + 2$ , what can you say about  $a$  and  $b$  for the equation to be true for all  $x$ ? For exactly one  $x$ ? Explain.
36. Determine  $k$  so that the equation  $2x + k = 2(x + 1)$  has (a) no solution, (b) infinitely many solutions, (c) exactly one solution.
37. Solve for  $x$  in terms of  $a$ :  $ax + 5 = 15$ .
38. Find all  $a$  such that the equation  $a(2x + 1) = 4x + 2$  holds for every  $x$  (i.e., is an identity). If no such  $a$  exists, explain.
39. Given the equation  $ax + 7 = 2x + a$ , find  $a$  so that the equation has (a) one solution, (b) infinitely many solutions, (c) no solution.
40. A linear model for temperature  $T$  after  $t$  minutes is  $T = mt + b$ . If after 0 min  $T = 20$  and after 10 min  $T = 40$ , find  $m$  and  $b$ . Write the equation and find  $T$  after 25 minutes.
41. Find  $k$  so that the equation  $(k + 2)x - 3 = k$  has solution  $x = 1$ .
42. Consider the equation  $(a)x + 2 = 2x + a$ . Rearrange and find  $x$  in terms of  $a$ . For which  $a$  is there no unique solution? Give examples.
43. A phone plan charges  $p$  per minute plus \$5 monthly fee. If 100 minutes cost \$45, find  $p$ . Then find minutes for a \$65 bill.
44. Determine all  $a$  for which the equation  $(3a)x = 12$  has (a) a unique solution, (b) no solution, (c) infinitely many solutions.
45. Let  $ax + 4 = bx + 6$ . Find  $x$  in terms of  $a$  and  $b$  when  $a \neq b$ . What happens when  $a = b$ ?
46. Solve for  $a$  so that the equation  $ax - 9 = 0$  has solution  $x = 3$ .
47. A car's rental cost is  $c$  daily plus \$20 insurance. If 3 days cost \$140, find  $c$ . Then find days for \$200.
48. Explain in a short paragraph: Why is algebra important to learn? (Give at least three distinct reasons or applications.)
49. Worked-example style question: Consider the equation  $(k - 1)x + 4 = kx - 2$ . Determine the number of solutions depending on  $k$ ; for each case show algebraic steps and give the solution(s).
50. Create your own linear equation with one unknown coefficient that has infinitely many solutions. State the equation and explain why it has infinitely many solutions.