5

Two Step Equations With Four Terms - move the smaller number of x's to the side of the larger number of x's. Move the integers to the other side. Note that in one of the examples the solution is a fraction.

Examples

a. $5x - 3 = 7x + 12$

$-5x \quad -12 \qquad -5x \quad -12$

$\frac{-15}{2} \qquad \frac{2x}{2}$

$-7\frac{1}{2} = x$

b. $6x - 3 = 4x + 9$

$-4x \quad +3 \qquad -4x \quad +3$

$\frac{2x}{2} = \frac{+12}{2}$

$x = 6$

Solve:

1. $4x + 9 = 6x + 7$
2. $8x + 18 = 10x - 10$
3. $5x - 3 = 8x + 15$
4. $6x - 11 = 10x + 17$
5. $4x + 13 = 9x - 27$
6. $11x + 2 = 14x - 10$
7. $7x - 3 = 13x + 33$
8. $6x + 12 = 4x + 22$
9. $8x - 3 = 4x + 21$
10. $8x - 1 = 2x - 37$
11. $10x + 3 = 7x - 39$
12. $7x - 13 = 2x - 18$
13. $12x + 20 = 2x + 40$
14. $5x - 18 = x - 2$
15. $8x + 2 = 7x - 1$
16. $4x - 3 = 3x + 5$
17. $5x + 9 = 4x + 16$
18. $10x - 3 = 9x - 7$
19. $8x + 2 = 9x + 6$
20. $7x - 3 = 8x + 9$
21. $5x + 15 = 6x - 9$
22. $7x - 11 = 6x + 3$
23. $6x - 3 = 4x + 10$
24. $8x + 9 = 3x - 25$

M

5

Multi-Term Equations - if there is more than one <u>like</u> term on any side of the equation, those like terms must be combined <u>before</u> you start to solve the equation.

Example

$$8x - 14 + 23 = 2x - 16 + 3x$$
$$8x + 9 = 5x - 16$$
$$\underline{-5x - 9 \quad -5x - 9}$$
$$\frac{3x}{3} = \frac{-25}{3}$$
$$x = -\frac{25}{3} \text{ or } -8\frac{1}{3}$$

(the -14 & the 23 have been combined of the left side of the equation, and the 2x & the 3x have been combined on the right side of the equation.)

Solve:

1. $10x - 3 + 5 = 8x + 26 + 4x$
2. $4x - 7 + 3x = 14 + 2x - 11$
3. $19 + 3x - 6 = 2x - 31 + 3x$
4. $5x + 8 - 2x = 19 + 4x + 5$
5. $15 + 6x - 10 = x - 18 + 3x$
6. $26 + 4x - 3 = 7x + 7 - 2x$
7. $7x - 16 + 2x = 25 + 5x - 3$
8. $12x + x - 3 = 5x - 14 + 10$
9. $7x - 14 - 6 = 6x + 5x + 18$
10. $14 + 7 + 5x = 6x + x - 9$
11. $8x - 3x + 2x = 27 + 11 - 9$
12. $6 - 3x + 2x = 5x + 21 - 3$
13. $6x - 14 - 3x = 14 - 2x + 8$
14. $7x - 2x = 21 + 3$
15. $35 - 9x + 14 = 30 - 9x + 3x$

N

5

Equations With Parentheses - all parentheses must be removed before solving the equation. After removing the parentheses, combine any like terms that are on the same sides of the equation.

Example

$4 + 3(x - 2) = 6x - (2x + 9)$ {remove the parentheses}
$4 + 3x - 6 = 6x - 2x - 9$ {combine the like terms}
$3x - 2 = 4x - 9$ {solve the equation}
$-3x + 9 \quad -3x + 9$
$+7 = x$

Solve:

1. $10 + 5(x - 4) = 8x - (5x + 4)$
2. $20 + 3(x - 8) = 19 - (3x - 17)$
3. $5(x + 9) = 7 - (x - 4)$
4. $3(x - 9) = 2(x + 6)$
5. $10x - 3(x - 8) = 19 - (3x - 17)$
6. $4(x + 2) + 10 = 6x - (x + 9)$
7. $5(2x + 6) = 2(x - 6)$
8. $3x + (13 - x) = 15 - (9 - x)$
9. $5(6x + 4) = 4(2x - 9)$
10. $5 + 3(2x - 3) = 6x - (x - 3)$
11. $6x - 3(x + 9) = 9 + 2(3x - 1)$
12. $8x + 3(x + 9) = 27 - 3(x + 6)$
13. $6x + (4x - 1) = 15 - (3x + 6)$
14. $25 - 9(x + 1) = 17 + 2(4x + 7)$
15. $3(x + 1) = 11 + 3(2x - 3)$

4.2 Solve Multi-Step Equations Part 1

Principles of Mathematics 9, pages 196–203

A

1. Solve using pencil and paper.

a) $5 + 3x + 4x = 19$

b) $15y - 6 - 10y = 9$

c) $32 = 5 - 4a - 5a$

d) $5m + 3 - 9m + 13 = 0$

2. Solve using pencil and paper.

a) $6w + 8 = 4w + 18$

b) $-8k - 5 = 2k + 15$

c) $3b - 6 = -b - 2$

d) $5 + 4d = -13 - 2d$

3. Solve using a Computer Algebra System (CAS). Use at least two steps.

a) $7t + 8 = 3t - 12$

b) $5c - 3 - 4c = 2c + 2$

c) $0 = 4x + 3 - x - 9$

d) $14 - n - 7 = 5n + 1$

4. Find the root of each equation using pencil and paper. Check each solution.

a) $5(x + 4) = 3x + 14$

b) $5q - 6 = 2(q + 3)$

c) $4t + 3(2 - t) = 13$

d) $u = 3(5 - u) + 1$

5. Find the root of each equation using pencil and paper. Check each solution.

a) $3(r + 4) + 2(r + 5) = 32$

b) $5(y - 3) - 3(y - 4) = 12$

c) $4(v + 3) = 2(v + 6) - 8$

d) $2(y - 4) = -3(y + 2) + 8$

B

6. Two or more angles are supplementary if their sum is 180°. An angle is four times the value of its supplement. Set up and solve an equation to find the measures of the two angles.

7. Two or more angles are complementary if their sum is 90°. Three angles are complementary. One angle is three times the value of the smallest angle. The largest angle is five times the value of the smallest angle. Find the measures of the three angles.

8. Solve each equation using the method of your choice. Express fraction answers in lowest terms. Check your answers.

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

b) $4 + 5h = h - 2$

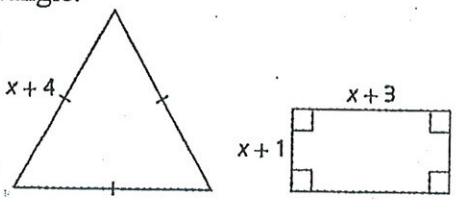
c) $4(m + 3) + 2(m - 3) = 3(m - 2)$

d) $7 - (4p + 3) = -3(p + 2) - (2p + 3)$

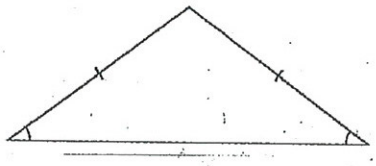
Solve Multi-Step Equations Part 2

(6)

9. An equilateral triangle and a rectangle have the same perimeter. Find the side lengths of the equilateral triangle and the rectangle.



10. A family of isosceles triangles has the property that the two equal angles are each one third the value of the third angle. Find the measures of the angles.



11. The following shows that $x = -3$ is the correct solution to the equation $3(x + 4) + 6 = 9 - (x + 3)$. Copy this check and explain each step. The first step has been done for you.

Step	Explanation
L.S. $= 3(x + 4) + 6$	
$= 3[(-3) + 4] + 6$	Substitute the root into the left side.
$= 3(1) + 6$	
$= 3 + 6$	
$= 9$	
R.S. $= 9 - (x + 3)$	
$= 9 - [(-3) + 3]$	
$= 9 - (0)$	
$= 9$	
L.S. = R.S.	
Therefore, $x = -3$ is correct.	

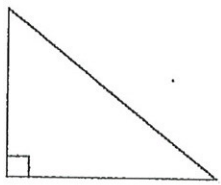
C

12. A family of isosceles triangles has side lengths in the ratio 2:2:3. A triangle belonging to this family has a perimeter of 70 cm.

a) Find the length of each side.

b) Explain how you solved this.

13. A family of right triangles has side lengths in the approximate ratio 3:4:5. One right triangle belonging to the family has a perimeter of 180 cm. Find its area.



14. Solve each equation. Express fraction answers in lowest terms.

a) $\frac{1}{3}(x+3) = \frac{1}{5}(x-3)$

b) $\frac{1}{5}k + \frac{1}{3} = \frac{1}{4}k + \frac{1}{2}$

c) $m(m + 3) + 5m = 3 + m(m - 4)$

d) $8 - d(d + 4) = 3d - d(d + 2) + 5$