

1-1 Solving Multi-Step Equations

Quick Review

To solve some equations, you may need to combine like terms or use the Distributive Property to clear fractions or decimals.

Example

What is the solution of $12 = 2x + \frac{4}{3} - \frac{2x}{3}$?

$$\begin{aligned} 3 \cdot 12 &= 3 \left(2x + \frac{4}{3} - \frac{2x}{3} \right) && \text{Multiply by 3.} \\ 36 &= 6x + 4 - 2x && \text{Simplify.} \\ 36 &= 4x + 4 && \text{Combine like terms.} \\ 36 - 4 &= 4x + 4 - 4 && \text{Subtract 4.} \\ 32 &= 4x && \text{Combine like terms.} \\ \frac{32}{4} &= \frac{4x}{4} && \text{Divide each side by 4.} \\ 8 &= x && \text{Simplify.} \end{aligned}$$

Exercises

Solve each equation. Check your answer.

6. $7(s - 5) = 42$ 7. $3a + 2 - 5a = -14$
8. $-4b - 5 + 2b = 10$ 9. $3.4t + 0.08 = 11$
10. $10 = \frac{c}{3} - 4 + \frac{c}{6}$ 11. $\frac{2x}{7} + \frac{4}{5} = 5$

Write an equation to model each situation. Then solve the equation.

12. **Apply Mathematics (1)(A)** You work for 4 h on Saturday and 8 h on Sunday. You also receive a \$50 bonus. You earn \$164. How much did you earn per hour?
13. **Apply Mathematics (1)(A)** Online concert tickets cost \$37 each, plus a service charge of \$8.50 per ticket. The Web site also charges a transaction fee of \$14.99 for the purchase. You paid \$242.49. How many tickets did you buy?

1-2 Solving Equations With Variables on Both Sides

Quick Review

When an equation has variables on both sides, you can use properties of equality to isolate the variable on one side. An equation has no solution if no value of the variable makes it true. An equation is an **identity** if every value of the variable makes it true.

Example

What is the solution of $3x - 7 = 5x + 19$?

$$\begin{aligned} 3x - 7 - 3x &= 5x + 19 - 3x && \text{Subtract } 3x. \\ -7 &= 2x + 19 && \text{Simplify.} \\ -7 - 19 &= 2x + 19 - 19 && \text{Subtract 19.} \\ -26 &= 2x && \text{Simplify.} \\ \frac{-26}{2} &= \frac{2x}{2} && \text{Divide each side by 2.} \\ -13 &= x && \text{Simplify.} \end{aligned}$$

Exercises

Solve each equation. If the equation is an identity, write *identity*. If it has no solution, write *no solution*.

14. $\frac{2}{3}x + 4 = \frac{3}{5}x - 2$ 15. $6 - 0.25f = f - 3$
16. $3(h - 4) = -\frac{1}{2}(24 - 6h)$ 17. $5n = 20(4 + 0.25n)$
18. **Apply Mathematics (1)(A)** Two buildings have the same total height. One building has 8 floors with height h . The other building has a ground floor of 16 ft and 6 other floors with height h . Write and solve an equation to find the height h of these floors.
19. **Apply Mathematics (1)(A)** A train makes a trip at 65 mi/h. A plane traveling 130 mi/h makes the same trip in 3 fewer hours. Write and solve an equation to find the distance of the trip.

1-3 Literal Equations

Quick Review

A **literal equation** is an equation that involves two or more variables. A **formula** is an equation that states a relationship among quantities. You can use properties of equality to solve a literal equation for one variable in terms of the others.

Example

What is the width of a rectangle with area 91 ft^2 and length 7 ft ?

$$A = \ell w \quad \text{Write the appropriate formula.}$$

$$\frac{A}{\ell} = w \quad \text{Divide each side by } \ell.$$

$$\frac{91}{7} = w \quad \text{Substitute 91 for } A \text{ and 7 for } \ell.$$

$$13 = w \quad \text{Simplify.}$$

The width of the rectangle is 13 ft .

Exercises

Solve each equation for x .

$$20. ax + bx = -c$$

$$21. \frac{x+r}{t} + 1 = 0$$

$$22. m - 3x = 2x + p$$

$$23. \frac{x}{p} + \frac{x}{q} = s$$

Solve each problem. Round to the nearest tenth, if necessary. Use 3.14 for π .

24. What is the width of a rectangle with length 5.5 cm and area 220 cm^2 ?

25. What is the radius of a circle with circumference 94.2 mm ?

26. A triangle has height 15 in. and area 120 in.^2 . What is the length of its base?

1-4 and 1-5 Solving Proportions and Proportions and Similar Figures

Quick Review

The **cross products** of a proportion are equal.

If $\frac{a}{b} = \frac{c}{d}$, where $b \neq 0$ and $d \neq 0$, then $ad = bc$.

If two figures are **similar**, then corresponding angles are congruent and corresponding side lengths are in proportion. You can use proportions to find missing side lengths in similar figures and for indirect measurement.

Example

A tree casts a shadow 10 m long. At the same time, a signpost next to the tree casts a shadow 4 m long. The signpost is 2.5 m tall. How tall is the tree?

$$\frac{x}{10} = \frac{2.5}{4} \quad \text{Write a proportion.}$$

$$4x = 10(2.5) \quad \text{Cross Products Property}$$

$$4x = 25 \quad \text{Simplify.}$$

$$x = 6.25 \quad \text{Divide each side by 4.}$$

The tree is 6.25 m tall.

Exercises

Solve each proportion.

$$27. \frac{3}{7} = \frac{9}{x}$$

$$28. \frac{-8}{10} = \frac{y}{5}$$

$$29. \frac{6}{15} = \frac{a}{4}$$

$$30. \frac{3}{-7} = \frac{-9}{t}$$

$$31. \frac{b+3}{7} = \frac{b-3}{6}$$

$$32. \frac{5}{2c-3} = \frac{3}{7c+4}$$

33. **Apply Mathematics (1)(A)** An airplane has a wingspan of 25 ft and a length of 20 ft . You are designing a model of the airplane with a wingspan of 15 in. What will the length of your model be?

34. **Apply Mathematics (1)(A)** You project a drawing 7 in. wide and $4\frac{1}{2} \text{ in.}$ tall onto a wall. The projected image is 27 in. tall. How wide is the projected image?

1-6 Solving Multi-Step Inequalities

Quick Review

When you solve inequalities, sometimes you need to use more than one step. You need to gather the variable terms on one side of the inequality and the constant terms on the other side.

Example

What are the solutions of $3x + 5 > -1$?

$$3x + 5 > -1$$

$$3x > -6 \quad \text{Subtract 5 from each side.}$$

$$x > -2 \quad \text{Divide each side by 3.}$$

Exercises

Solve each inequality.

35. $4k - 1 \geq -3$

36. $6(c - 1) < -18$

37. $3t > 5t + 12$

38. $-\frac{6}{7}y - 6 \geq 42$

39. $4 + \frac{x}{2} > 2x$

40. $3x + 5 \leq 2x - 8$

41. $13.5a + 7.4 \leq 85.7$

42. $42w > 2(w + 7)$

43. **Apply Mathematics (1)(A)** A salesperson earns \$200 per week plus a commission equal to 4% of her sales. This week her goal is to earn no less than \$450. Write and solve an inequality to find the amount of sales she must have to reach her goal.

1-7 Compound Inequalities

Quick Review

Two inequalities that are joined by the word *and* or the word *or* are called **compound inequalities**. A solution of a compound inequality involving *and* makes both inequalities true. A solution of an inequality involving *or* makes either inequality true.

Example

What are the solutions of $-3 \leq z - 1 < 3$?

$$-3 \leq z - 1 < 3$$

$$-2 \leq z < 4 \quad \text{Add 1 to each part of the inequality.}$$

Exercises

Solve each compound inequality.

44. $-2 \leq d + \frac{1}{2} < 4\frac{1}{2}$

45. $0 < -8b \leq 12$

46. $2t \leq -4$ or $7t \geq 49$

47. $5m < -10$ or $3m > 9$

48. $-1 \leq a - 3 \leq 2$

49. $9.1 > 1.4p \geq -6.3$

50. **Apply Mathematics (1)(A)** A town's high temperature for a given month is 88°F and the low temperature is 65°F. Write a compound inequality to represent the range of temperatures for the given month.

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2. rate 4. cross products 6. 11 8. -7.5 10. 28
12. $4h + 8h + 50 = 164$; \$9.50 14. -90 16. identity
18. $8h = 16 + 6h$; 8 ft 20. $x = \frac{-c}{a+b}$ 22. $x = \frac{m-p}{5}$
24. 40 cm 26. 16 in. 28. -4 30. 21 32. -1 34. 42 in.
36. $c < -2$ 38. $y \leq -56$ 40. $x \leq -13$ 42. $w > 0.35$
44. $-2\frac{1}{2} \leq d < 4$ 46. $t \leq -2$ or $t \geq 7$ 48. $2 \leq a \leq 5$
50. $65 \leq t \leq 88$

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1. identity 3. scale 5. compound inequalities 7. 8
9. $3\frac{18}{85}$ 11. 14.7 13. $37t + 8.50t + 14.99 = 242.49$;
5 tickets 15. 7.2 17. no solution 19. $\frac{d}{65} = \frac{d}{130} + 3$;
390 mi 21. $x = -t - r$ 23. $x = \frac{pqs}{p+q}$ 25. 15 mm
27. 21 29. 1.6 31. 39 33. 12 in. 35. $k \geq -0.5$
37. $t < -6$ 39. $x < 2\frac{2}{3}$ 41. $a \leq 5.8$
43. $200 + 0.04s \geq 450$; $s \geq 6250$ 45. $-1.5 \leq b < 0$
47. $m < -2$ or $m > 3$ 49. $6.5 > p \geq -4.5$