

Name _____

Date _____ Class _____



California Standards

NS 1.2 Add, subtract, multiply, and divide rational numbers (integers, fractions, and terminating decimals) and take positive rational numbers to whole-number powers.

Also covered: AF 1.0 and AF 1.1.

LESSON

9-5

Solve Equations with Fractions

Adding Fractions

Making the Connection

Solving Subtraction Equations

Warm Up

Add.

1. $\frac{1}{5} + \frac{1}{2}$ _____
2. $\frac{3}{5} + \frac{1}{6}$ _____
3. $\frac{3}{10} + \frac{2}{5}$ _____
4. $\frac{1}{2} + \frac{1}{3}$ _____

You can write the addition problem with fractions below as an equation.

$$\frac{1}{2} + \frac{1}{3}$$

$$x = \frac{1}{2} + \frac{1}{3}$$

To find the value of x , add the fractions.

The equation below also contains fractions.

$$x - \frac{1}{2} = \frac{1}{3}$$

To solve it, add $\frac{1}{2}$ to both sides.

$$x - \frac{1}{2} + \frac{1}{2} = \frac{1}{3} + \frac{1}{2}$$

$$x = \frac{2}{6} + \frac{3}{6}$$

$$x = \frac{5}{6}$$

Remember...

To solve an addition equation, subtract.

Remember...

To solve a subtraction equation, add.

Remember...

To solve a multiplication equation, divide.

Remember...

To solve a division equation, multiply.

Example 1 Solving an Addition or Subtraction Equation Involving Fractions

Solve.

A. $x + \frac{1}{4} = \frac{2}{3}$

$$x + \frac{1}{4} - \frac{1}{4} = \frac{2}{3} - \frac{1}{4}$$

$$x = \frac{8}{12} - \frac{3}{12}$$

$$x = \frac{5}{12}$$

Subtract $\frac{1}{4}$ from each side of the equation. Subtract fractions.

B. $a - \frac{2}{3} = \frac{5}{7}$

$$a - \frac{2}{3} + \frac{2}{3} = \frac{5}{7} + \frac{2}{3}$$

$$a = \frac{15}{21} + \frac{14}{21}$$

$$a = \frac{29}{21}$$

$$a = 1\frac{8}{21}$$

Add $\frac{2}{3}$ to each side of the equation. Add fractions.

Change an improper fraction to a mixed number.

Check It Out

Solve.

1. $n + \frac{2}{5} = \frac{9}{10}$

2. $p - \frac{3}{7} = \frac{16}{21}$

Example 2 Solving a Multiplication or Division Equation Involving Fractions

Solve.

A. $\frac{m}{3} = 2\frac{1}{3}$

$$3 \cdot \frac{m}{3} = 3 \cdot 2\frac{1}{3}$$

$$m = \frac{3}{1} \cdot \frac{7}{3}$$

$$m = 7$$

Multiply each side of the equation by 3.

Multiply a whole number and a mixed number.

B. $\frac{3b}{4} = \frac{9}{16}$

$$\frac{3b}{4} = \frac{9}{16}$$

$$\frac{4}{3} \cdot \frac{3b}{4} = \frac{4}{3} \cdot \frac{9}{16}$$

$$b = \frac{\overset{2}{\cancel{3}} \cdot \overset{2}{\cancel{3}} \cdot \overset{3}{\cancel{3}} \cdot 3}{\underset{3}{\cancel{3}} \cdot \underset{2}{\cancel{2}} \cdot \underset{2}{\cancel{2}} \cdot 2 \cdot 2}$$

$$b = \frac{3}{4}$$

Write $\frac{3b}{4}$ as $\frac{3}{4}b$.

Multiply each side of the equation by $\frac{4}{3}$.

Divide out common factors.

Check It Out

Solve.

3. $\frac{m}{4} = 1\frac{3}{4}$

4. $\frac{4c}{5} = \frac{2}{15}$

Example 3 Writing and Solving an Equation Involving a Fraction

Edna's family is planning a short trip to Catalina Island not far off the California coast. Write and solve an equation to find the speed of a boat traveling from San Pedro to Catalina Island. Use $\text{time} \times \text{speed} = \text{distance}$.

$\text{time} \times \text{speed} = \text{distance}$

Let $s = \text{speed}$

$$1\frac{1}{2} \cdot s = 26$$

Write the equation.

$$\frac{3}{2} \cdot s = 26$$

Write an improper fraction.

$$\frac{2}{3} \cdot \frac{3}{2} \cdot s = 26 \cdot \frac{2}{3}$$

Multiply each side by $\frac{2}{3}$.

$$s = 17\frac{1}{3}$$

The speed would be $17\frac{1}{3}$ miles per hour.



Travel time from San Pedro to Catalina Island:

$\frac{1}{4}$ hour by plane, $1\frac{1}{2}$ hours by boat.

Distance: 26 miles

Check It Out

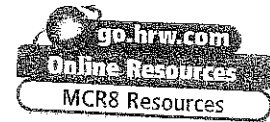
5. Write and solve an equation to find the speed of a plane making the trip.

Math Reasoning IDENTIFYING RELATIONSHIPS

How can $\frac{x}{3} = 12$ help you solve $\frac{1}{3} \cdot x = 12$?

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Interactive Practice

Write the operation you would use to solve each equation. Do not solve.

A. $x - 2\frac{1}{5} = 4\frac{1}{3}$ _____

B. $\frac{p}{3} = \frac{1}{2}$ _____

C. $c + \frac{1}{7} = \frac{4}{7}$ _____

D. $5p = \frac{4}{5}$ _____

Write the next step in each solution.

E. $a - \frac{1}{5} = \frac{4}{5}$

F. $\frac{g}{4} = \frac{4}{7}$

$a - \frac{1}{5} + \underline{\hspace{1cm}} = \frac{4}{5} + \underline{\hspace{1cm}}$

$\frac{g}{4} \times \underline{\hspace{1cm}} = \frac{4}{7} \times \underline{\hspace{1cm}}$

Independent Practice

Solve. See Example 1.

1. $n + \frac{4}{5} = 1$

2. $c - \frac{1}{7} = \frac{4}{7}$

3. $b - \frac{1}{4} = \frac{3}{5}$

4. $w + \frac{8}{9} = 2\frac{2}{9}$

5. $s + 1\frac{4}{11} = 2$

6. $w - \frac{3}{7} = 1\frac{1}{7}$

Solve. See Example 2.

7. $\frac{m}{3} = \frac{5}{6}$

8. $7x = 2\frac{1}{2}$

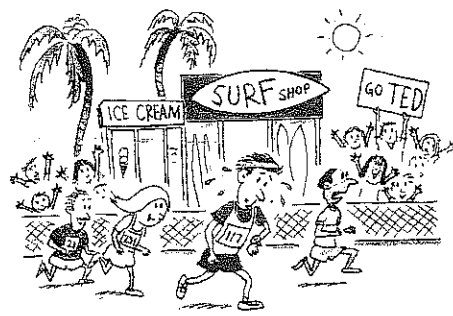
9. $\frac{2}{3}n = \frac{1}{3}$

10. $\frac{3p}{4} = \frac{12}{16}$

Independent Practice *continued*

Solve.

11. Ted is running in the Wharf to Wharf marathon. He has already run $4\frac{1}{2}$ kilometers. Write and solve an equation to find how many more kilometers he has left to run.



The Santa Cruz to Capitola, Wharf to Wharf marathon is 10 K.



Error Search

Describe each error. Then correct it.

12. To solve $x + 2\frac{1}{2} = 12$, add $2\frac{1}{2}$ to each side of the equation.

13. If $\frac{6}{7} \times a = \frac{7}{8}$, then $a = \frac{7}{8} \times \frac{7}{6}$. This means that $a = \frac{3}{4}$.



Write About It

14. How does subtraction of fractions help you solve $x + \frac{3}{7} = \frac{8}{9}$?



Ready To Go On?



California Standards NS 1.2, AF 1.0, AF 1.1

Lesson Summary

Review what you learned about solving equations with fractions.

- After recognizing what operation is in the equation, perform the inverse operation on each side of the equation.
- Add, subtract, multiply, or divide fractions and mixed numbers as needed.

Lesson Quiz

Solve.

1. $x + \frac{3}{11} = \frac{9}{22}$ _____

2. $a - \frac{3}{4} = \frac{1}{8}$ _____

3. $\frac{n}{5} = \frac{5}{8}$ _____

4. If three quarters of a number is 18, what is the number? _____