

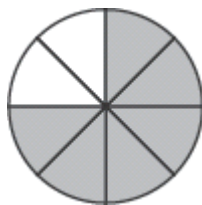
# Math Topic 12 Study Guide

## Modeling Addition of Fractions (12 – 1)

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Eight friends want to see a movie. Four of them want to see a comedy. Two want to see an action movie and two want to see a science-fiction movie. What fraction of the group wants to see either a comedy or a science-fiction movie?

You can use a model to add fractions.



Look at the circle. It is divided into eighths, because there are eight people in the group. Each person represents  $\frac{1}{8}$  of the group.

Four people want to see a comedy. Shade in four of the sections to represent  $\frac{4}{8}$ . Two people want to see a science-fiction movie.

Shade in two more sections to represent  $\frac{2}{8}$ . Count the number of shaded sections. There are six. So,  $\frac{6}{8}$  of the group wants to see

$$\frac{4}{8} + \frac{2}{8} = \frac{6}{8} \quad \text{Write the sum in simplest form.} \quad \frac{6 \div 2}{8 \div 2} = \frac{3}{4}$$

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Find each sum. Simplify, if possible.

- |   |   |  |
|---|---|--|
| 1. $\frac{2}{5} + \frac{1}{5}$ _____    | 2. $\frac{4}{6} + \frac{1}{6}$ _____                | 3. $\frac{3}{8} + \frac{3}{8}$ _____                   |
| 4. $\frac{1}{6} + \frac{1}{6}$ _____    | 5. $\frac{2}{5} + \frac{3}{5}$ _____                | 6. $\frac{2}{10} + \frac{3}{10}$ _____                 |
| 7. $\frac{5}{8} + \frac{3}{8}$ _____    | 8. $\frac{3}{10} + \frac{1}{10}$ _____              | 9. $\frac{3}{4} + \frac{1}{4}$ _____                   |
| 10. $\frac{5}{10} + \frac{4}{10}$ _____ | 11. $\frac{1}{6} + \frac{1}{6} + \frac{1}{6}$ _____ | 12. $\frac{1}{12} + \frac{5}{12} + \frac{2}{12}$ _____ |

13. **Number Sense** We can express time as a fraction of an hour. For example, 15 minutes is  $\frac{1}{4}$  hour. 30 minutes is  $\frac{1}{2}$  hour. What fraction of an hour is 45 minutes?

# Adding Fractions with Like Denominators (12 – 2)

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When you add fractions with like denominators, add the numerators and keep the denominator the same.

Find the sum of  $\frac{3}{8} + \frac{1}{8}$

Add the numerators.  $3 + 1 = 4$

Keep the denominator the same.  $\frac{3}{8} + \frac{1}{8} = \frac{4}{8}$

Is this fraction expressed in simplest form?

**Remember:** a fraction is in simplest form when the greatest common factor (GCF) of the numerator and denominator is 1.

$\frac{4 \div 4}{8 \div 4} = \frac{1}{2}$  is in simplest form, because the GCF of 1 and 2 is 1.

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Find each sum. Simplify if possible.

1.  $\frac{1}{3} + \frac{1}{3}$  \_\_\_\_\_

2.  $\frac{3}{10} + \frac{6}{10}$  \_\_\_\_\_

3.  $\frac{5}{12} + \frac{2}{12}$  \_\_\_\_\_

4.  $\frac{3}{12} + \frac{7}{12}$  \_\_\_\_\_

5.  $\frac{5}{10} + \frac{3}{10}$  \_\_\_\_\_

6.  $\frac{2}{8} + \frac{4}{8}$  \_\_\_\_\_

7.  $\frac{7}{10} + \frac{3}{10}$  \_\_\_\_\_

8.  $\frac{1}{8} + \frac{6}{8}$  \_\_\_\_\_

9.  $\frac{1}{10} + \frac{5}{10}$  \_\_\_\_\_

10.  $\frac{1}{5} + \frac{2}{5} + \frac{2}{5}$  \_\_\_\_\_

11.  $\frac{2}{8} + \frac{1}{8} + \frac{4}{8}$  \_\_\_\_\_

12.  $\frac{2}{6} + \frac{1}{6}$  \_\_\_\_\_

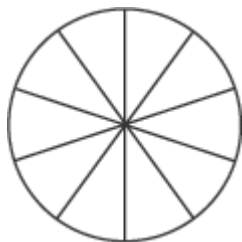
13. **Reasoning** There were 10 bowling pins standing before Jared took his first turn. On his first turn, he knocked down 5 pins. On his second turn, he knocked down 3 pins. What fraction of the pins did Jared knock down in his two turns? \_\_\_\_\_

# Modeling Subtraction of Fractions (12 – 3)

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Karla made a pizza and cut it into 10 slices. She ate two slices.  
What fraction of the pizza is left?

You can use a model to subtract fractions.



Karla's pizza is divided into 10 slices. One way to show this is  $\frac{10}{10} = 1$  whole pizza. Karla ate two slices of the pizza.

Cross out two of the slices. Count the number of slices left.

There are 8 slices or  $\frac{8}{10}$  of the pizza left.

$$\frac{10}{10} - \frac{2}{10} = \frac{8}{10}$$

Write the answer in simplest form, if possible.

$$\frac{8 \div 2}{10 \div 2} = \frac{4}{5}$$

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Use fraction strips or models to subtract. Simplify if possible.

1.  $\frac{5}{5} - \frac{2}{5} =$  \_\_\_\_\_

2.  $\frac{7}{10} - \frac{3}{10} =$  \_\_\_\_\_

3.  $\frac{3}{4} - \frac{2}{4} =$  \_\_\_\_\_

4.  $\frac{8}{10} - \frac{5}{10} =$  \_\_\_\_\_

5.  $\frac{6}{6} - \frac{3}{6} =$  \_\_\_\_\_

6.  $\frac{11}{12} - \frac{7}{12} =$  \_\_\_\_\_

7.  $\frac{5}{6} - \frac{2}{6} =$  \_\_\_\_\_

8.  $\frac{4}{8} - \frac{2}{8} =$  \_\_\_\_\_

9.  $\frac{11}{12} - \frac{8}{12} =$  \_\_\_\_\_

10.  $\frac{7}{12} - \frac{5}{12} =$  \_\_\_\_\_

11.  $\frac{6}{10} - \frac{4}{10} =$  \_\_\_\_\_

12.  $\frac{9}{12} - \frac{6}{12} =$  \_\_\_\_\_

13. **Algebra** Find  $x$ .

$$x - \frac{1}{6} = \frac{1}{6}$$

# Subtracting Fractions with Like Denominators (12 – 4)

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When subtracting with two fractions having the same denominator, the difference also has the same denominator.

Find  $\frac{7}{8} - \frac{5}{8}$ .

**Step 1:**

Subtract the numerators.

$$7 - 5 = 2$$

**Step 2:**

Write the difference over the same denominator.

$$\frac{7}{8} - \frac{5}{8} = \frac{2}{8}$$

**Step 3:**

Simplify the answer if possible.

$$\frac{2}{8} = \frac{1}{4}$$

So,  $\frac{7}{8} - \frac{5}{8} = \frac{1}{4}$ .

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Subtract the fractions. Simplify if possible.

1.  $\frac{4}{5} - \frac{3}{5}$  \_\_\_\_\_

2.  $\frac{8}{12} - \frac{3}{12}$  \_\_\_\_\_

3.  $\frac{3}{6} - \frac{1}{6}$  \_\_\_\_\_

4.  $\frac{9}{10} - \frac{3}{10}$  \_\_\_\_\_

5.  $\frac{11}{12} - \frac{5}{12}$  \_\_\_\_\_

6.  $\frac{5}{6} - \frac{1}{6}$  \_\_\_\_\_

7.  $\frac{97}{100} - \frac{40}{100}$  \_\_\_\_\_

8.  $\frac{5}{8} - \frac{1}{8}$  \_\_\_\_\_

9.  $\frac{7}{10} - \frac{2}{10} - \frac{1}{10}$  \_\_\_\_\_

10.  $\frac{7}{12} - \frac{4}{12}$  \_\_\_\_\_

11.  $\frac{3}{4} - \frac{1}{4} - \frac{2}{4}$  \_\_\_\_\_

12.  $\frac{8}{8} - \frac{1}{8}$  \_\_\_\_\_

13. **Reasoning** During archery practice, Manny hit the target 7 times out of 10 tries. What fraction of his arrows did NOT hit the target?

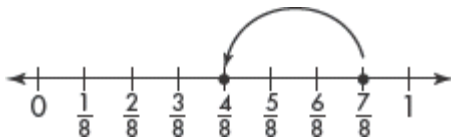
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# Adding and Subtracting on the Number Line (12 – 5)

Bernadette has  $\frac{7}{8}$  yard of ribbon. She cuts off  $\frac{3}{8}$  yard to make a collar for her dog. How much ribbon does Bernadette have left?

You can use a number line to help you subtract fractions.

Draw a number line to represent the ribbon. Divide the number line into eighths. Place a point at  $\frac{7}{8}$  to show the length of the ribbon before it is cut. Draw an arrow  $\frac{3}{8}$  of a unit to the left to show how much of the ribbon Bernadette cut off.

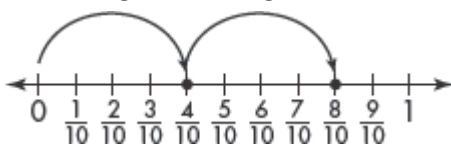


$$\frac{7}{8} - \frac{3}{8} = \frac{4}{8} \quad \text{Simplify: } \frac{4}{8} = \frac{1}{2} \quad \text{There is } \frac{1}{2} \text{ yard of ribbon left.}$$

You can also use a number line to help you add fractions.

Kevin and Duane are recycling aluminum cans. Each boy has collected  $\frac{4}{10}$  pound. How many pounds have they collected in all?

Divide this number line into tenths. Start at zero and draw an arrow to and place a point at  $\frac{4}{10}$  to show the amount of aluminum Kevin collected. Now draw another arrow  $\frac{4}{10}$  of a unit long to the right to show Duane's amount.



$$\frac{4}{10} + \frac{4}{10} = \frac{8}{10} \quad \text{Simplify: } \frac{8}{10} = \frac{4}{5} \quad \text{The boys collected } \frac{4}{5} \text{ pound of aluminum.}$$

Add or subtract the fractions. You may use a number line. Simplify your answer, if possible.

1.  $\frac{2}{5} + \frac{1}{5} =$  \_\_\_\_\_

2.  $\frac{8}{12} - \frac{3}{12} =$  \_\_\_\_\_

3.  $\frac{5}{10} - \frac{3}{10} =$  \_\_\_\_\_

4.  $\frac{2}{6} + \frac{1}{6} =$  \_\_\_\_\_

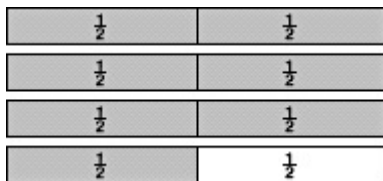
5.  $\frac{29}{100} - \frac{4}{100} =$  \_\_\_\_\_

6.  $\frac{1}{8} + \frac{2}{8} + \frac{3}{8} =$  \_\_\_\_\_

# Improper Fractions and Mixed Numbers (12 – 6)

You can use fraction strips to write a mixed number as an improper fraction.

$3\frac{1}{2}$  of the model below is shaded.



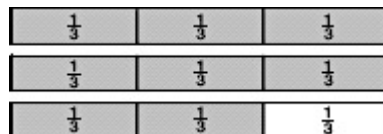
Into how many parts is each strip divided? 2. This is your denominator.

Count the shaded halves. There are 7. This is your numerator.

$3\frac{1}{2}$  is the same as the improper fraction  $\frac{7}{2}$ .

You can also use fraction strips to write an improper fraction as a mixed number.

$\frac{8}{3}$  of the model below is shaded.



How many strips are completely shaded? 2. This is your whole number.

What fraction of the third strip is shaded?  $\frac{2}{3}$ . This is your fraction.

$\frac{8}{3}$  is the same as the mixed number  $2\frac{2}{3}$ .

Write each mixed number as an improper fraction.

1.  $2\frac{1}{3}$  \_\_\_\_\_      2.  $4\frac{1}{5}$  \_\_\_\_\_      3.  $2\frac{3}{4}$  \_\_\_\_\_      4.  $5\frac{2}{6}$  \_\_\_\_\_

Write each improper fraction as a mixed number or a whole number.

5.  $\frac{13}{12}$  \_\_\_\_\_      6.  $\frac{50}{10}$  \_\_\_\_\_      7.  $\frac{23}{10}$  \_\_\_\_\_      8.  $\frac{17}{8}$  \_\_\_\_\_

9. **Writing to Explain** Is  $\frac{45}{5}$  equal to a whole number or a mixed number?

Explain how you know.

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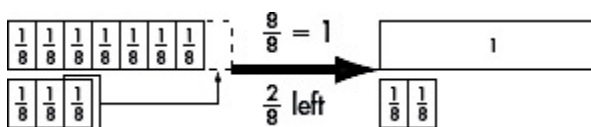
# Modeling Addition and Subtraction of Mixed Numbers (12 – 7)

Example 1: Draw a model to add  $1\frac{7}{8} + 2\frac{3}{8}$ .

**Step 1** Model each mixed number using fraction strips.

**Step 2** Add the fractions. Regroup if you can.

$$\begin{array}{r} 1\frac{7}{8} \\ + 2\frac{3}{8} \\ \hline 3\frac{10}{8} \\ \hline 4\frac{1}{4} \end{array}$$



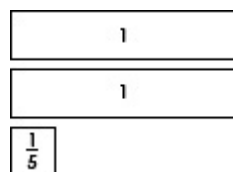
**Step 3** Add the whole numbers to the regrouped fractions. Write the sum. Simplify, if possible.

So,  $1\frac{7}{8} + 2\frac{3}{8} = 4\frac{1}{4}$ .

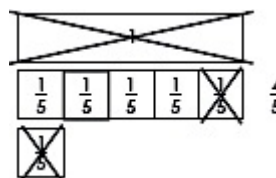


Example 2: Draw a model to subtract  $2\frac{1}{5} - 1\frac{2}{5}$ .

**Step 1** Model the number you are subtracting from,  $2\frac{1}{5}$ .



**Step 2** Rename  $2\frac{1}{5}$  as  $1\frac{6}{5}$ . Cross out one whole and  $\frac{2}{5}$  to show subtracting  $1\frac{2}{5}$ .



Express the part of the model that is not crossed out as a fraction or mixed number. So,  $2\frac{1}{5} - 1\frac{2}{5} = \frac{4}{5}$ .

Use fraction strips to find each sum or difference. Simplify, if possible.

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

2.  $2\frac{5}{8} + 4\frac{3}{8}$

3.  $5\frac{2}{6} + 3\frac{5}{6}$

4.  $2\frac{2}{4} + 6\frac{3}{4}$

5.  $6\frac{1}{8} - 3\frac{5}{8}$

6.  $8\frac{3}{12} - 2\frac{5}{12}$

7.  $12\frac{1}{3} - 5\frac{2}{3}$

8.  $9\frac{7}{10} - 6\frac{9}{10}$

# Adding Mixed Numbers (12 – 8)

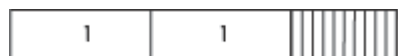
Randy talks on the telephone for  $2\frac{5}{6}$  hours, and then surfs the Internet for  $3\frac{3}{4}$  hours. How many hours does he spend on the two activities?

**Step 1.** Write equivalent fractions with the least common denominator. You can use fraction strips to show the equivalent fractions.

$$3\frac{3}{4} = 3\frac{9}{12}$$



$$2\frac{5}{6} = 2\frac{10}{12}$$



**Step 2.** Add the fraction part of the mixed number first. Then add the whole numbers.

$$\frac{9}{12} + \frac{10}{12} = \frac{19}{12}$$

$$\frac{19}{12} + 5 = \frac{19}{12}$$

**Step 3.** Simplify the sum if possible.

$$5\frac{19}{12} = 6\frac{7}{12} \text{ hours}$$

$$\text{So, } 2\frac{5}{6} + 3\frac{3}{4} = 6\frac{7}{12}.$$

In 1 through 6, find each sum. Simplify if possible.

1.

$$\begin{array}{r} 2\frac{10}{12} \\ + 3\frac{3}{12} \\ \hline \end{array}$$

2.

$$\begin{array}{r} 1\frac{3}{8} \\ + 6\frac{6}{8} \\ \hline \end{array}$$

3.

$$\begin{array}{r} 5\frac{4}{10} \\ + 4\frac{2}{10} \\ \hline \end{array}$$

4.  $10\frac{2}{6} + \frac{3}{6} = \underline{\hspace{2cm}}$

5.  $3\frac{3}{12} + 6\frac{8}{12} = \underline{\hspace{2cm}}$

6.  $1\frac{2}{5} + 3\frac{1}{5} = \underline{\hspace{2cm}}$

7. **Geometry** Tirzah wants to put a fence around her garden. She has 22 yards of fence material. Does she have enough to go all the way around the garden?

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Tirzah's garden

$4\frac{8}{12}$  yards

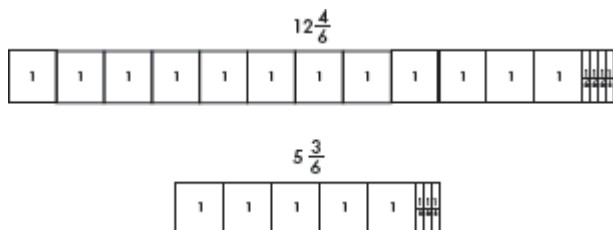
$6\frac{9}{12}$  yards



# Subtracting Mixed Numbers (12 – 9)

The Plainville Zoo has had elephants for  $12\frac{4}{6}$  years. The zoo has had zebras for  $5\frac{3}{6}$  years. How many years longer has the zoo had elephants?

**Step 1:** Write equivalent fractions with the least common denominator. You can use fraction strips.



**Step 2:** Find the difference of  $12\frac{4}{6} - 5\frac{3}{6}$ . Subtract the fractions. Then subtract the whole numbers. Simplify the difference if possible.

$$\frac{4}{6} - \frac{3}{6} = \frac{1}{6} \qquad 12 - 5 = 7$$

So,  $12\frac{4}{6} - 5\frac{3}{6} = 7\frac{1}{6}$  years.

**Example 2:** Sometimes you may have to rename a fraction so you can subtract.

Find the difference of  $6 - 2\frac{3}{8}$ .

$$\begin{array}{r} 6 \longrightarrow \text{rename} \longrightarrow 5\frac{8}{8} \\ - 2\frac{3}{8} \\ \hline \end{array} \qquad \begin{array}{r} 5\frac{8}{8} \\ - 2\frac{3}{8} \\ \hline 3\frac{5}{8} \end{array}$$

For 1 through 4, find each difference. Simplify, if possible.  
Remember: You may have to rename a fraction in order to subtract.

1. 
$$\begin{array}{r} 4\frac{5}{8} \\ - 2\frac{2}{8} \\ \hline \end{array}$$

2. 
$$\begin{array}{r} 5\frac{7}{12} \\ - 1\frac{2}{12} \\ \hline \end{array}$$

3. 
$$\begin{array}{r} 3 \\ - 1\frac{3}{4} \\ \hline \end{array}$$

4. 
$$\begin{array}{r} 6\frac{5}{6} \\ - 5\frac{4}{6} \\ \hline \end{array}$$

5. **Number Sense** To find the difference of  $7 - 3\frac{5}{12}$  how do you rename the 7?

6. Robyn ran  $5\frac{3}{4}$  miles last week. She ran  $4\frac{1}{4}$  miles this week. How many more miles did she run last week?

# Decomposing and Composing Fractions (12 – 10)

## Example 1

$$\begin{array}{r} \frac{1}{9} \\ + \frac{2}{9} \\ \hline \end{array}$$

$\frac{3}{9} = \frac{1}{3}$  Rewrite  $\frac{3}{9}$  as  $\frac{1}{3}$

## Example 2

$$\frac{1}{8} + \frac{3}{8} + \frac{5}{8} = \frac{9}{8} \text{ or } 1\frac{1}{8}$$

Show another way to make this sum.

$$\frac{6}{8} + \frac{3}{8} = \frac{9}{8} = 1\frac{1}{8}$$

Add or subtract fractions and write answers in simplest form.  
For the addition problems, write another addition problem that has the same sum and uses two or more fractions.

1.  $\frac{1}{4} + \frac{1}{4}$

2.  $\frac{2}{3} - \frac{1}{3}$

3.  $\frac{2}{8} + \frac{5}{8}$

4.  $\frac{5}{6} - \frac{1}{6}$

5.  $\frac{4}{12} + \frac{2}{12}$

6.  $\begin{array}{r} \frac{5}{6} \\ - \frac{2}{6} \\ \hline \end{array}$

7.  $\begin{array}{r} \frac{3}{10} \\ + \frac{3}{10} \\ \hline \end{array}$

8.  $\begin{array}{r} \frac{9}{10} \\ - \frac{3}{10} \\ \hline \end{array}$

9.  $\begin{array}{r} \frac{3}{12} \\ + \frac{6}{12} \\ \hline \end{array}$

10.  $\begin{array}{r} \frac{44}{100} \\ - \frac{24}{100} \\ \hline \end{array}$

11. At lunch, Alice ate  $\frac{3}{8}$  of her sandwich. Later, for a snack, she ate another  $\frac{3}{8}$  of the sandwich. Write an addition sentence that shows how much of the sandwich Alice ate. Suppose Alice ate the same total amount of her sandwich at 3 different times instead of 2. Write an addition problem that shows the amount she ate as a sum of 3 fractions.

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# Problem Solving: Draw a Picture and Write an Equation (12 – 11)

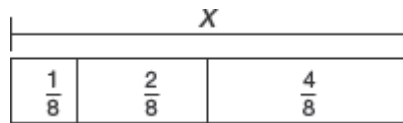
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**Read and Understand** Pippa filled  $\frac{1}{8}$  of a jar with blue stones,  $\frac{2}{8}$  of the jar with yellow stones, and  $\frac{4}{8}$  of the jar with purple stones. How much of the jar is filled in all?

What do I know? Pippa filled  $\frac{1}{8}$ ,  $\frac{2}{8}$ , and  $\frac{4}{8}$  of a jar.

What am I asked to find? How much of the jar is filled with stones?

**Plan** Draw a picture and write an equation.



$$\frac{1}{8} + \frac{2}{8} + \frac{4}{8} = X$$

**Solve** Find equal fractions and add. Simplify if you need to.

$$\frac{1}{8} + \frac{2}{8} + \frac{4}{8} = \frac{7}{8}$$

$$X = \frac{7}{8}$$

Pippa filled the jar  $\frac{7}{8}$  full of stones.

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Draw a picture and write an equation to solve.

1. Joel walked  $\frac{4}{12}$  of a mile to the store,  $\frac{3}{12}$  of a mile to the library, and  $\frac{2}{12}$  of a mile to the post office. Let  $x$  = the total distance Joel walked. How far did he walk?

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2. Midge walked  $\frac{3}{4}$  mile Monday and  $\frac{1}{4}$  mile Tuesday. Let  $x$  = how much farther she walked on Monday. How much farther did Midge walk on Monday?

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3. **Number Sense** Glenda wrote  $\frac{2}{10}$  of her paper on Monday,  $\frac{1}{10}$  of her paper on Tuesday, and  $\frac{1}{10}$  of her paper on Wednesday. She said she wrote more than half of her paper. Is she correct? Why or why not?

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