Adding and Subtracting Fractions

Warm Up

Find the LCM for each set of numbers.

1. 8 and 12 — 24
2. 12 and 18 — 36
3. 10 and 12 — 60
4. 12 and 24 — 24

Problem of the Day

Let A through I represent digits of a number. Replace the letters A through I with the digits 1 through 9, respectively, and verify that the statement is true.

$$\left(\frac{E}{CD}\right) + \left(\frac{I}{AB}\right) + \left(\frac{G}{FH}\right) = 1$$

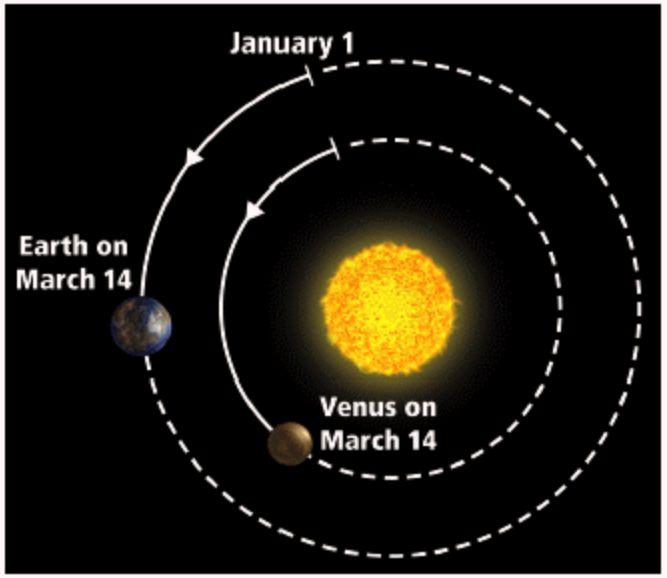
$$\frac{5}{34} + \frac{9}{12} + \frac{7}{68} = \frac{60 + 306 + 42}{408} = 1$$

Adding and Subtracting Fractions

***Learn** to add and subtract fractions.*

Adding and Subtracting Fractions

From January 1 to March 14 of any given year, Earth completes approximately $\frac{1}{5}$ of its orbit around the Sun, while Venus completes approximately $\frac{1}{3}$ its orbit.



The illustration shows what the positions of the planets would be on March 14 if they started at the same place on January 1 and their orbits were circular. To find out how much more of its orbit Venus completes than Earth, you need to subtract fractions.

Additional Example 1A: Adding or Subtracting Fractions with Like Denominators

Add. Write the answer in simplest form.

$$\frac{5}{8} + \frac{1}{8}$$

$$\frac{5}{8} + \frac{1}{8} = \frac{5 + 1}{8}$$

Add the numerators and keep the denominator.

$$= \frac{6}{8} = \frac{3}{4}$$

Simplify.

Additional Example 1B: Adding or Subtracting Fractions with Like Denominators

Subtract. Write the answer in simplest form.

$$\frac{9}{11} - \frac{4}{11}$$

$$\frac{9}{11} - \frac{4}{11} = \frac{9 - 4}{11}$$

Subtract the numerators and keep the denominator.

$$= \frac{5}{11}$$

The answer is in the simplest form.

Check It Out: Example 1A

Add. Write the answer in simplest form.

$$\frac{5}{6} + \frac{1}{6}$$

$$\frac{5}{6} + \frac{1}{6} = \frac{5 + 1}{6}$$

Add the numerators and keep the denominator.

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

Simplify.

Check It Out: Example 1B

Subtract. Write the answer in simplest form.

$$\frac{7}{10} - \frac{4}{10}$$

$$\frac{7}{10} - \frac{4}{10} = \frac{7 - 4}{10}$$

Subtract the numerators and keep the denominator.

$$= \frac{3}{10}$$

The answer is in the simplest form.

Adding and Subtracting Fractions

To add or subtract fractions with different denominators, you must rewrite the fractions with a common denominator.

Two Ways to Find a Common Denominator
• Find the LCM (least common multiple) of the denominators. • Multiply the denominators.

Helpful Hint

The LCM of two denominators is the lowest common denominator (LCD) of the fractions.

Additional Example 2A: Adding and Subtracting Fractions with Unlike Denominators

Add. Write the answer in simplest form.

$$\frac{5}{6} + \frac{7}{8}$$

$$\frac{5}{6} + \frac{7}{8} = \frac{5 \cdot 4}{6 \cdot 4} + \frac{7 \cdot 3}{8 \cdot 3}$$

The LCM of the denominator is 24.

$$= \frac{20}{24} + \frac{21}{24} = \frac{41}{24} = 1\frac{17}{24}$$

Write equivalent fractions. Add

Estimate $1 + 1 = 2$

$1\frac{17}{24}$ is a reasonable answer.

Additional Example 2B: Adding and Subtracting Fractions with Unlike Denominators

Subtract. Write the answer in simplest form.

$$\frac{2}{3} - \frac{3}{4}$$

$$\frac{2}{3} - \frac{3}{4} = \frac{2 \cdot 4}{3 \cdot 4} - \frac{3 \cdot 3}{4 \cdot 3}$$ Multiply the denominators.

$$= \frac{8}{12} - \frac{9}{12} = -\frac{1}{12}$$ Write equivalent fractions. Subtract.

Estimate $1 - 1 = 0$ $-\frac{1}{12}$ is a reasonable answer.

Additional Example 2C: Adding and Subtracting Fractions with Unlike Denominators

Add. Write the answer in simplest form.

$$-\frac{2}{7} + \frac{1}{3}$$

$$-\frac{2}{7} + \frac{1}{3} = -\frac{2 \cdot 3}{7 \cdot 3} + \frac{1 \cdot 7}{3 \cdot 7}$$ Multiply the denominators.

$$= -\frac{6}{21} + \frac{7}{21} = \frac{1}{21}$$ Write equivalent fractions. Add

Estimate - $-\frac{1}{2} = -\frac{1}{2}$

$\frac{1}{21}$ is a reasonable answer.

Check It Out: Example 2A

Add. Write the answer in simplest form.

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

$$\frac{2}{5} + \frac{5}{6} = \frac{2 \cdot 6}{5 \cdot 6} + \frac{5 \cdot 5}{6 \cdot 5}$$

Multiply the denominators.

$$= \frac{12}{30} + \frac{25}{30} = \frac{37}{30} = 1\frac{7}{30}$$

Write equivalent fractions.
Divide.

Estimate 1/2 + 1 = 2

$1\frac{7}{30}$ is a reasonable answer.

Check It Out: Example 2B

Subtract. Write the answer in simplest form.

$$\frac{2}{5} - \frac{1}{2}$$

$$\frac{2}{5} - \frac{1}{2} = \frac{2 \cdot 2}{5 \cdot 2} - \frac{1 \cdot 5}{2 \cdot 5}$$ Multiply the denominators.

$$= \frac{4}{10} - \frac{5}{10} = -\frac{1}{10}$$ Write equivalent fractions. Subtract.

Estimate $\frac{1}{2} - \frac{1}{2} = 0$ $-\frac{1}{10}$ is a reasonable answer.

Check It Out: Example 2C

Add. Write the answer in simplest form.

$$-\frac{3}{5} + \frac{1}{2}$$

$$-\frac{3}{5} + \frac{1}{2} = -\frac{3 \cdot 2}{5 \cdot 2} + \frac{1 \cdot 5}{2 \cdot 5}$$ Multiply the denominators.

$$= -\frac{6}{10} + \frac{5}{10} = -\frac{1}{10}$$ Write equivalent fractions. Add

Estimate $-\frac{1}{2} = -\frac{1}{2}$ $-\frac{1}{10}$ Is a reasonable answer.

Adding and Subtracting Fractions

Additional Example 3: Astronomy Application

In one Earth year, Jupiter completes about $\frac{1}{12}$ of its orbit around the Sun, while Mars completes about $\frac{1}{2}$ of its orbit. How much more of its orbit does Mars complete than Jupiter?

$$\frac{1}{2} - \frac{1}{12} = \frac{1 \cdot 6}{2 \cdot 6} - \frac{1 \cdot 1}{12 \cdot 1}$$

The LCM of the denominators is 12.

$$= \frac{6}{12} - \frac{1}{12}$$

Write equivalent fractions using the common denominator.

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

Subtract.

Mars completes $\frac{5}{12}$ more of its orbit than Jupiter does.

Adding and Subtracting Fractions

Check It Out: Example 3

It takes Michelle $\frac{5}{12}$ hour to drive to work. It takes Luke $\frac{1}{2}$ hour to drive to work. How much longer does it take Luke to drive to work?

$$\frac{1}{2} - \frac{5}{12} = \frac{1 \cdot 6}{2 \cdot 6} - \frac{5 \cdot 1}{12 \cdot 1}$$

The LCM of the denominators is 12.

$$= \frac{6}{12} - \frac{5}{12}$$

Write equivalent fractions using the common denominator.

$$= \frac{1}{12}$$

Subtract.

It takes Luke $\frac{1}{12}$ hour longer to drive to work.

Lesson Quizzes

Standard Lesson Quiz

Lesson Quiz for Student Response Systems

Adding and Subtracting Fractions

Lesson Quiz

Add or subtract. Write each answer in simplest form.

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

2. $\frac{3}{8} + \frac{5}{8}$ 1

3. $\frac{5}{12} + \frac{1}{2}$ $\frac{11}{12}$

4. $\frac{1}{3} - \frac{1}{12}$ $\frac{1}{4}$

5. You need a nail to go through a $\frac{7}{8}$-inch door and extend an extra $\frac{1}{4}$ inch. How long should the nail be?

$1\frac{1}{8}$ in.

Adding and Subtracting Fractions

Lesson Quiz for Student Response Systems

1. Add. Write your answer in simplest form.

$\frac{4}{9} + \frac{5}{9}$

A. 0

B. $\frac{1}{2}$

C. $\frac{1}{9}$

D. 1

Lesson Quiz for Student Response Systems

2. Subtract. Write your answer in simplest form.

$$-\frac{9}{11} \quad \frac{5}{11}$$

A. $\frac{4}{11}$

B. $\frac{14}{11}$

C. $\frac{3}{11}$

D. $1\frac{3}{11}$

Adding and Subtracting Fractions

Lesson Quiz for Student Response Systems

3. Add. Write your answer in simplest form.

$$\frac{3}{8} + \frac{1}{3}$$

A. C. $\frac{4}{11}$

$\frac{17}{24}$

B. D. $\frac{3}{11}$ or 1

$\frac{24}{17}$

$\frac{7}{17}$

Adding and Subtracting Fractions

Lesson Quiz for Student Response Systems

4. Subtract. Write your answer in simplest form.

$$-\frac{5}{12} \quad \frac{1}{\_} \quad 5$$

A. $\frac{4}{7}$

B. $\frac{6}{7}$ *or* 4

C. $\frac{13}{60}$

$\frac{60}{13}$

$\frac{8}{13}$

Adding and Subtracting Fractions

Lesson Quiz for Student Response Systems

5. You need $\frac{8}{9}$ pounds of fruits to make a pudding. Sam has $\frac{5}{12}$ pounds of fruits. How much more does he need to make the pudding?

A. $\frac{17}{24}$ lb

C. $\frac{17}{36}$ lb

B. $\frac{19}{24}$ lb

D. $\frac{19}{36}$ lb