Maintaining Mathematical Proficiency

Adding and Subtracting Rational Numbers (7.NS.A.1d)

Example 1 Find the sum $-\dfrac{3}{4} + \dfrac{1}{3}$.

$$-\dfrac{3}{4} + \dfrac{1}{3} = -\dfrac{9}{12} + \dfrac{4}{12}$$ Rewrite using the LCD (least common denominator).

$$= \dfrac{-9 + 4}{12}$$ Write the sum of the numerators over the common denominator.

$$= -\dfrac{5}{12}$$ Add.

Example 2 Find the difference $\dfrac{7}{8} - \left(-\dfrac{5}{8}\right)$.

$$\dfrac{7}{8} - \left(-\dfrac{5}{8}\right) = \dfrac{7}{8} + \dfrac{5}{8}$$ Add the opposite of $-\dfrac{5}{8}$.

$$= \dfrac{7 + 5}{8}$$ Write the sum of the numerators over the common denominator.

$$= \dfrac{12}{8}$$ Add.

$$= \dfrac{3}{2}, \text{ or } 1\dfrac{1}{2}$$ Simplify.

Evaluate.

1. $\dfrac{3}{5} + \dfrac{2}{3}$

2. $-\dfrac{4}{7} + \dfrac{1}{6}$

3. $\dfrac{7}{9} - \dfrac{4}{9}$

4. $\dfrac{5}{12} - \left(-\dfrac{1}{2}\right)$

5. $\dfrac{2}{7} + \dfrac{1}{7} - \dfrac{6}{7}$

6. $\dfrac{3}{10} - \dfrac{3}{4} + \dfrac{2}{5}$

Simplifying Complex Fractions (7.NS.A.3)

Example 3 Simplify $\dfrac{\frac{1}{2}}{\frac{4}{5}}$.

$$\dfrac{\frac{1}{2}}{\frac{4}{5}} = \dfrac{1}{2} \div \dfrac{4}{5}$$ Rewrite the quotient.

$$= \dfrac{1}{2} \cdot \dfrac{5}{4}$$ Multiply by the reciprocal of $\dfrac{4}{5}$.

$$= \dfrac{1 \cdot 5}{2 \cdot 4}$$ Multiply the numerators and denominators.

$$= \dfrac{5}{8}$$ Simplify.

Simplify.

7. $\dfrac{\frac{3}{8}}{\frac{5}{6}}$

8. $\dfrac{\frac{1}{4}}{-\frac{5}{7}}$

9. $\dfrac{\frac{2}{3}}{\frac{2}{3} + \frac{1}{4}}$

10. **ABSTRACT REASONING** For what value of x is the expression $\dfrac{1}{x}$ undefined? Explain your reasoning.

Mathematical Practices

*Mathematically proficient students are careful about **specifying units of measure**, labeling axes, and clarifying the relationship between quantities in a problem.* **(MP6)**

Specifying Units of Measure

🌀 Core Concept

Converting Units of Measure

To convert from one unit of measure to another unit of measure, you can begin by writing the new units. Then multiply the old units by the appropriate conversion factors. For example, you can convert 60 miles per hour to feet per second as follows.

$$\boxed{\text{old units}} \longrightarrow \frac{60 \text{ mi}}{1 \text{ h}} = \frac{? \text{ ft}}{1 \text{ sec}} \longleftarrow \boxed{\text{new units}}$$

$$\frac{60 \text{ mi}}{1 \text{ h}} \cdot \frac{1 \text{ h}}{60 \text{ min}} \cdot \frac{1 \text{ min}}{60 \text{ sec}} \cdot \frac{5280 \text{ ft}}{1 \text{ mi}} = \frac{5280 \text{ ft}}{60 \text{ sec}}$$

$$= \frac{88 \text{ ft}}{1 \text{ sec}}$$

EXAMPLE 1 Converting Units of Measure

You are given two job offers. Which has the greater annual income?
- $45,000 per year
- $22 per hour

SOLUTION

One way to answer this question is to convert $22 per hour to dollars per year and then compare the two annual salaries. Assume there are 40 hours in a work week.

$$\frac{22 \text{ dollars}}{1 \text{ h}} = \frac{? \text{ dollars}}{1 \text{ yr}}$$ **Write new units.**

$$\frac{22 \text{ dollars}}{1 \text{ h}} \cdot \frac{40 \text{ h}}{1 \text{ week}} \cdot \frac{52 \text{ weeks}}{1 \text{ yr}} = \frac{45,760 \text{ dollars}}{1 \text{ yr}}$$ **Multiply by conversion factors.**

▶ The second offer has the greater annual salary.

Monitoring Progress

1. You drive a car at a speed of 60 miles per hour. What is the speed in meters per second?

2. A hose carries a pressure of 200 pounds per square inch. What is the pressure in kilograms per square centimeter?

3. A heater raises the temperature of a room by 3 degrees Celsius per hour. What is the rate in degrees Fahrenheit per minute?

4. A concrete truck pours concrete at the rate of 1 cubic yard per minute. What is the rate in cubic feet per hour?

5. Water in a pipe flows at a rate of 10 gallons per minute. What is the rate in liters per second?