

## 2.2.4: Fractions

5 out of 4 people  
have trouble  
with fractions.

A fraction describes equal parts of a whole:  $\frac{\text{part}}{\text{whole}}$

Using official math vocabulary:  $\frac{\text{numerator}}{\text{denominator}}$

### ? Exercises 2.2.4.1

The month of April had 11 rainy days and 19 days that were not rainy.

1. What fraction of the days were rainy?
2. What fraction of the days were not rainy?

**Answer**

1.  $\frac{11}{30}$
2.  $\frac{19}{30}$

## Simplifying Fractions

Two fractions are equivalent if they represent the same number. (The same portion of a whole.) To build an equivalent fraction, multiply the numerator and denominator by the same number.

### ? Exercises 2.2.4.1

3. Write  $\frac{4}{5}$  as an equivalent fraction with a denominator of 15.
4. Write  $\frac{2}{3}$  as an equivalent fraction with a denominator of 12.

**Answer**

3.  $\frac{12}{15}$
4.  $\frac{8}{12}$

Many fractions can be **simplified**, or reduced. Here are four special cases.

### ? Exercises 2.2.4.1

Simplify each fraction, if possible.

5.  $\frac{7}{1}$
6.  $\frac{7}{7}$
7.  $\frac{0}{7}$

8.  $\frac{7}{0}$

**Answer**

5. 7

6. 1

7. 0

8. undefined

A fraction is completely reduced, or in simplest form, or in lowest terms, when the numerator and denominator have no common factors other than 1. To reduce a fraction, divide the numerator and denominator by the same number.

#### ? Exercises 2.2.4.1

Reduce each fraction to simplest form.

9.  $\frac{9}{12}$

10.  $\frac{10}{6}$

**Answer**

9.  $\frac{3}{4}$

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

## Multiplying Fractions

To multiply fractions, multiply the numerators and multiply the denominators straight across. If possible, simplify your answer.

#### ? Exercises 2.2.4.1

Multiply each pair of numbers. Be sure that each answer is in simplest form.

11.  $8 \cdot \frac{1}{4}$

12.  $\frac{6}{7} \cdot \frac{7}{12}$

13.  $\frac{5}{8} \cdot \frac{2}{3}$

14.  $\frac{6}{5} \cdot \frac{10}{12}$

**Answer**

11. 2

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

13.  $\frac{5}{12}$

14. 1

To find a fraction **of** a number, multiply.

### ? Exercise 2.2.4.1

15. To pass his workplace training, Nathan must correctly answer at least  $\frac{9}{10}$  of 50 questions. How many questions must he answer correctly to pass the training?

#### Answer

15. at least 45 questions

## Dividing Fractions

To divide by a fraction, multiply by the reciprocal of the second number. (Flip the second fraction upside-down.)

### ? Exercises 2.2.4.1

Divide. Be sure that each answer is in simplest form.

16.  $12 \div \frac{3}{4}$

17.  $\frac{3}{10} \div \frac{1}{2}$

18. Suppose you need to measure 2 cups of flour, but the only scoop you can find is  $\frac{1}{3}$  cup. How many scoops of flour will you need?

#### Answer

16. 16

17.  $\frac{3}{5}$

18. 6 scoops

## Comparing Fractions

If two fractions have the same denominator, we can simply compare their numerators.

If two fractions have different denominators, we can rewrite them with a common denominator and then compare their numerators.

### ? Exercise 2.2.4.1

19. Cookie recipe A requires  $\frac{3}{4}$  cup of sugar, whereas cookie recipe B requires  $\frac{2}{3}$  cup of sugar. Which recipe requires more sugar?



#### Answer

19. A requires  $\frac{1}{12}$  cup more than B

## Adding & Subtracting Fractions

To add or subtract two fractions with the same denominator, add or subtract the numerators and keep the common denominator.

### ? Exercises 2.2.4.1

20. Jack ate  $\frac{3}{8}$  of a pizza. Mack ate  $\frac{1}{8}$  of the pizza. What fraction of the pizza did they eat together?

21. Tracy ate  $\frac{5}{6}$  of a pizza. Stacy ate  $\frac{1}{6}$  of the pizza. How much more of the pizza did Tracy eat?

#### Answer

20.  $\frac{1}{2}$  of the pizza

21.  $\frac{2}{3}$  more

To add or subtract two fractions with different denominators, first write them with a common denominator. Then add or subtract them.

### ? Exercises 2.2.4.1

A  $\frac{3}{8}$ -inch thick sheet of plywood is going to be laid onto a  $\frac{1}{4}$ -inch thick sheet of plywood.

22. What is the combined thickness of the two sheets?

23. What is the difference in thickness of the two sheets of plywood?

Jacqueline budgets  $\frac{1}{4}$  of her monthly income for food and  $\frac{1}{3}$  of her monthly income for rent.

24. What fraction of her monthly income does she budget for these two expenses combined?

25. What fraction more of her monthly income does she budget for her rent than for her food?

#### Answer

22.  $\frac{5}{8}$  inches combined

23.  $\frac{1}{8}$  inches difference

24.  $\frac{7}{12}$  combined

25.  $\frac{1}{12}$  more

## Fractions and Decimals

To write a fraction as a decimal, divide the numerator by the denominator.

A decimal that ends (eventually has a remainder of 0) is called a terminating decimal. Fun fact: If the denominator of a fraction has no prime factors other than 2's and 5's, the decimal will terminate. Also, the fraction can be built up to have a denominator of 10, or 100, or 1,000...

### ? Exercises 2.2.4.1

Write each fraction as a decimal.

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

27.  $\frac{7}{20}$

**Answer**

26. 2.75

27. 0.35

A decimal that continues a pattern of digits is called a repeating decimal. We can represent the repeating digits by using either an overbar or ellipsis (three dots)...

### ? Exercises 2.2.4.1

Write each fraction as a decimal.

28.  $\frac{5}{9}$

29.  $\frac{18}{11}$

**Answer**

28.  $0.\overline{5}$  or 0.555...

29.  $1.\overline{63}$  or 1.636363...

## Mixed Numbers

A mixed number represents a **sum**. For example,  $6\frac{2}{3}$  means  $6 + \frac{2}{3}$ .

To write a mixed number as an improper fraction:

1. Multiply the whole number part by the denominator.
2. Add this result to the original numerator to get the new numerator.
3. Keep the same denominator.

### ? Exercises 2.2.4.1

Rewrite each mixed number as an improper fraction.

30.  $2\frac{1}{5}$

31.  $6\frac{2}{3}$

**Answer**

30.  $\frac{11}{5}$

31.  $\frac{20}{3}$

To write an improper fraction as a mixed number:

1. Divide the numerator by the denominator to get the whole number part.
2. The remainder after dividing is the new numerator.
3. Keep the same denominator.

### ? Exercises 2.2.4.1

Rewrite each improper fraction as a mixed number.

32.  $\frac{23}{2}$

33.  $\frac{14}{3}$

**Answer**

32.  $11\frac{1}{2}$

33.  $4\frac{2}{3}$

Adding or subtracting mixed numbers can be fairly simple or more complicated, depending on the numbers. If adding two mixed numbers would give you an improper fraction as part of your result, you'll need to carry; if subtracting two mixed numbers would give you a negative fraction as part of your result, you'll need to borrow.

### ? Exercises 2.2.4.1

34. Add:  $7\frac{1}{3} + 2\frac{3}{4}$

35. Subtract:  $7\frac{1}{3} - 2\frac{3}{4}$

**Answer**

34.  $10\frac{1}{12}$

35.  $4\frac{7}{12}$

Multiplying or dividing mixed numbers is tricky. Change any mixed numbers into improper fractions before doing the calculation, then change the answer back to a mixed number if possible.

### ? Exercises 2.2.4.1

36. Multiply:  $3\frac{1}{2} \cdot 2\frac{1}{3}$

37.  $5\frac{1}{2}$  cups of water will be divided equally into 3 jars. How much water will go into each jar?

**Answer**

36.  $8\frac{1}{6}$

37.  $1\frac{5}{6}$  cup

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