LEARNING THROUGH SPORTS™

Mathematics:
Fractions

The following section of this customized textbook includes material from these skill areas:

Skill Description

2033: compare fractions

4.NF.2: Compare two fractions with different numerators and different denominators, e.g., by creating common denominators or numerators, or by comparing to a benchmark fraction such as 1/2. Recognize that comparisons are valid only when the two fractions refer to the same whole. Record the results of comparisons with symbols >, =, or <, and justify the conclusions, e.g., by using a visual fraction model.

2035: divide regions into equal parts and recognize equal and unequal regions

4.NF.1: Explain why a fraction a/b is equivalent to a fraction (n x a)/(n x b) by using visual fraction models, with attention to how the number and size of the parts differ even though the two fractions themselves are the same size. Use this principle to recognize and generate equivalentfractions.

2036: explore fractions using a variety of representations

4.NF.5: Express a fraction with denominator 10 as an equivalent fraction with denominator 100, and use this technique to add two fractions with respective denominators 10 and 100.

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2037: identify and represent equivalent fractions

4.NF.1: Explain why a fraction a/b is equivalent to a fraction (n x a)/(n x b) by using visual fraction models, with attention to how the number and size of the parts differ even though the two fractions themselves are the same size. Use this principle to recognize and generate equivalentfractions.

2038: identify fractions

4.NF.5: Express a fraction with denominator 10 as an equivalent fraction with denominator 100, and use this technique to add two fractions with respective denominators 10 and 100.

4.NF.1: Explain why a fraction a/b is equivalent to a fraction (n x a)/(n x b) by using visual fraction models, with attention to how the number and size of the parts differ even though the two fractions themselves are the same size. Use this principle to recognize and generate equivalentfractions.

2039: identify mixed numbers

4.NF.3.c: Add and subtract mixed numbers with like denominators, e.g., by replacing each mixed number with an equivalent fraction, and/or by using properties of operations and the relationship between addition and subtraction.

4.NF.2: Compare two fractions with different numerators and different denominators, e.g., by creating common denominators or numerators, or by comparing to a benchmark fraction such as 1/2. Recognize that comparisons are valid only when the two fractions refer to the same whole. Record the results of comparisons with symbols >, =, or <, and justify the conclusions, e.g., by using a visual fraction model.

2044: relate fractions to decimals

4.NF.6: Use decimal notation for fractions with denominators 10 or 100.

4.NF.3.b: Decompose a fraction into a sum of fractions with the same denominator in more than one way, recording each decomposition by an equation. Justify decompositions, e.g., by using a visual fraction model.

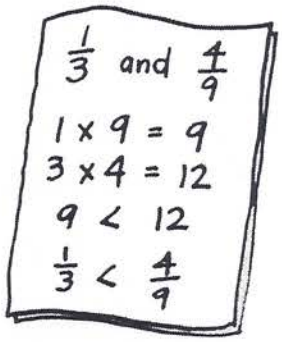
2045: solve problems with fractions

4.NF.2: Compare two fractions with different numerators and different denominators, e.g., by creating common denominators or numerators, or by comparing to a benchmark fraction such as 1/2. Recognize that comparisons are valid only when the two fractions refer to the same whole. Record the results of comparisons with symbols >, =, or <, and justify the conclusions, e.g., by using a visual fraction model.

Comparing & Ordering Fractions

Sometimes you can look at two fractions and know for sure that one is smaller or larger than the other. At other times, you may not be sure.

Here are some ways to find out exactly how two fractions compare.



How to Compare & Order Two Fractions

To compare $\frac{1}{3}$ and $\frac{4}{9}$, cross multiply the two fractions.

Step 1: Multiply the first numerator and the second denominator: $1 \times 9 = 9$

Step 2: Multiply the first denominator and the second numerator: $3 \times 4 = 12$

Step 3: Compare products:
If the first multiplication has the greater product, the first fraction is greater.
If the second multiplication has the greater product, the second fraction is greater.

9 is less than 12, therefore $\frac{1}{3} < \frac{4}{9}$

Get Sharp # 14

To compare mixed fractional numbers, first change them into improper fractions. Then follow either of the methods for comparing.

How to Compare & Order Several Fractions

Change all the fractions to like fractions (common denominators). Then it is easy to put them in order.

$1\frac{2}{3}$ $\frac{2}{5}$ $\frac{5}{6}$ $\frac{7}{15}$

(The least common denominator is 30.)

$1\frac{2}{3} = \frac{5}{3} = \frac{50}{30}$ $\frac{2}{5} = \frac{12}{30}$ $\frac{5}{6} = \frac{25}{30}$

$\frac{7}{15} = \frac{14}{30}$

The right order is:

$\frac{2}{5} \ldots \frac{7}{15} \ldots \frac{5}{6} \ldots 1\frac{2}{3}$

TUGGING PROBLEMS

Take a close look at the team members in this tug-of-war game, so that you can finish the picture accurately. After you have worked each problem, fill in the blank next to it with the number of things you colored or drew.

1. Draw muscles on 10% of the team members. _____
2. Color 0.25 of the girls' hair orange. _____
3. Color 50% of the flowers yellow. _____
4. Color 75% of the hats green. _____
5. Color $\frac{7}{20}$ of the shoes red. _____
6. Color 0.1 of the shoes blue. _____
7. Color $\frac{4}{9}$ of the shirts blue. _____
8. Color $\frac{10}{20}$ of the rope red. _____
9. Draw stars on $\frac{2}{18}$ of the shirts. _____
10. Color 60% of the socks purple. _____
11. Color 0.6 of the shorts orange. _____
12. Draw stripes on $\frac{1}{9}$ of the shirts. _____
13. Color 0.5 of the long pants brown. _____
14. Color bruises on 5% of the elbows. _____
15. Draw bandages on 15% of the knees. _____
16. Put a new hat on 0.1 of the team members. _____
17. Draw mud under $\frac{4}{5}$ of the team members. _____
18. Draw bees stinging 0.2 of the team members. _____
19. Draw untied shoelaces hanging off $\frac{15}{100}$ of the shoes. _____
20. Draw a dog pulling on the shirt of $\frac{10}{100}$ of the team members. _____

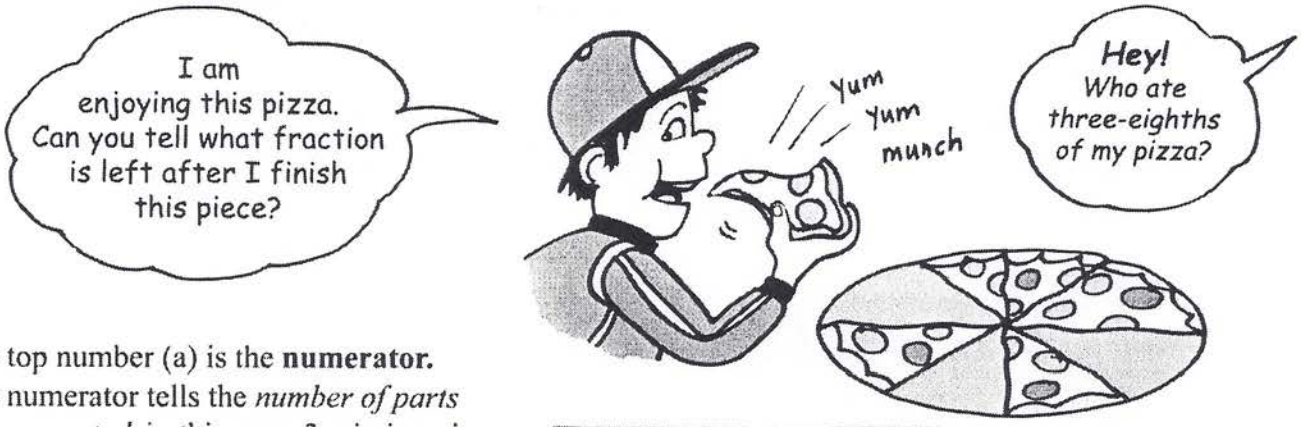
Answer key page 13, unit 254

Fractions

A **fraction** is any number written in the form of $\frac{a}{b}$

FRACTION ACTION

Fraction comes from the Latin word *fractio*, meaning *broken parts*. ***Fraction*** means ***part of a set*** or ***part of a whole***. A fraction is written in a way that compares two numbers or amounts.



The top number (a) is the **numerator.**
The numerator tells the *number of parts being counted,* in this case, 3 missing pieces.

Write the fraction like this: $\frac{3}{8}$ (a) *missing pieces* / (b) *pieces in the whole pizza*

The bottom number (b) is the **denominator.**
The denominator tells *the number of parts in the whole,* or 8 pieces of pizza.

Proper & Improper Fractions

In a **proper fraction**, the numerator is *smaller* than the denominator. $\frac{2}{9}$

In an **improper fraction**, the numerator is *larger* than the denominator. The value of the fraction is always *equal to* or *greater than* one. $\frac{12}{7}$

Reading and Writing Fractions

$\frac{7}{8}$ reads ***seven-eighths***

$\frac{11}{12}$ reads ***eleven-twelfths***

$\frac{2}{3}$ reads ***two-thirds***

$\frac{14}{20}$ reads ***fourteen-twentieths***

$\frac{3}{100}$ reads ***three-hundredths***

$\frac{6}{9}$ reads ***six-ninths***

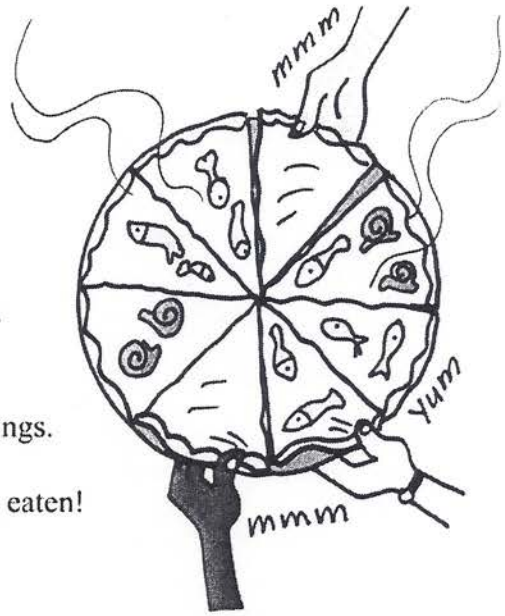
A fraction is also a way of writing a division problem.

$\frac{3}{24}$ means $3 \div 24$

(three divided by twenty-four)

Fractions as Part of a Whole

Some fractions represent parts of a whole. Each pizza is a whole item, cut into parts.



$\frac{5}{8}$ of the pizza is topped with anchovies.

$\frac{2}{8}$ of the pizza is topped with snails.

$\frac{1}{8}$ of the pizza has both toppings.

$\frac{3}{8}$ of this pizza is about to be eaten!

Get Sharp Tip #12
The denominator in a fraction cannot be zero.

Fractions as Part of a Set

Sometimes, a fraction represents part of a set. This picture includes a set of football fans. It also includes a set of blankets, feet, banners, other sets. The fractions answer questions about the sets.

How many fans are wearing **hats**?..... $\frac{4}{5}$ .....(the set: fans)

How many blankets have **stripes**? ..... $\frac{1}{3}$ .....(the set: blankets)

How many feet are wearing **athletic shoes**? ..... $\frac{7}{10}$ .....(the set: feet)

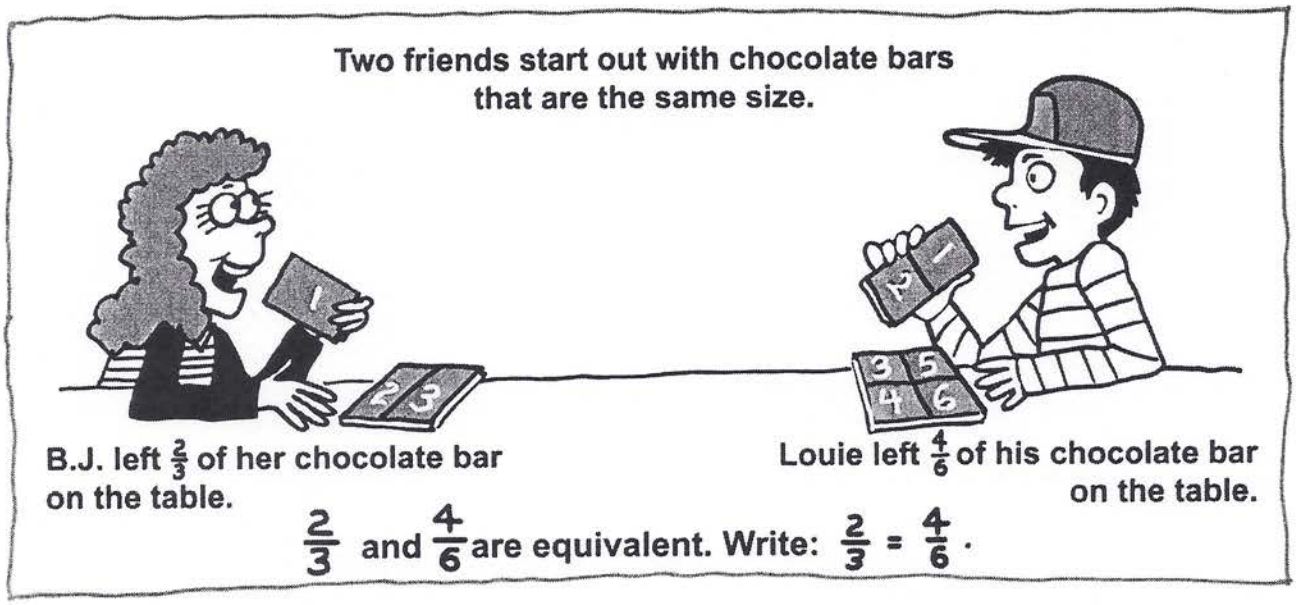
How many fans are carrying **thermoses**?..... $\frac{2}{5}$ .....(the set: fans)

How many banners are for the **Grizzlies**?..... $\frac{2}{3}$ .....(the set: banners)

How many of the hands **are bare**?..... $\frac{4}{10}$ .....(the set: hands)

Equivalent Fractions

Equivalent fractions are two or more fractions that represent the same amount.



How to Form Equivalent Fractions

Step 1: Multiply or divide both the numerator and the denominator by the same nonzero number.

Step 2: Write the new fraction.

$$\frac{3}{4} = \frac{3 \times 2}{4 \times 2} = \frac{6}{8}$$

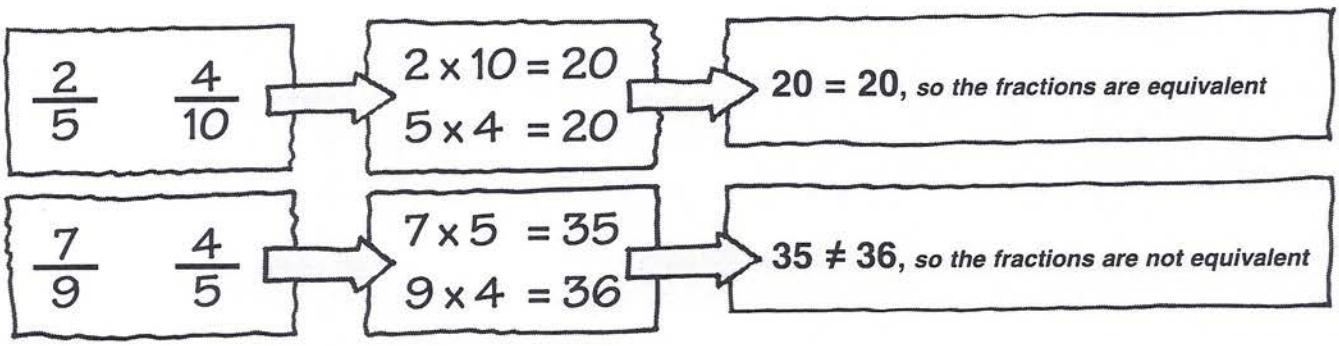
$$\frac{56}{72} = \frac{56 \div 8}{72 \div 8} = \frac{7}{9}$$

How to Tell Equivalent Fractions

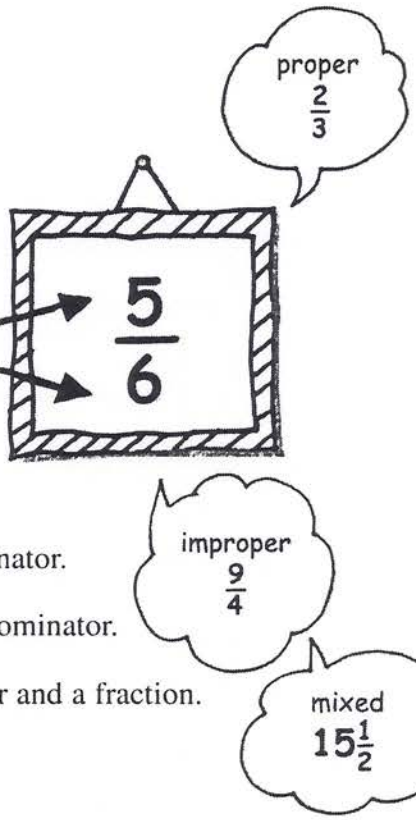
Step 1: Cross multiply.

Step 2: Compare the two products.

Step 3: If the products are equal, the fractions are equivalent. Otherwise they are not.



Fractions



Fraction means **part of a whole or part of a set.**

The set of **fractions** includes any number in the form of $\frac{a}{b}$ that compares part of an object or part of a set to the whole.
(The bottom number (b) cannot be 0.)

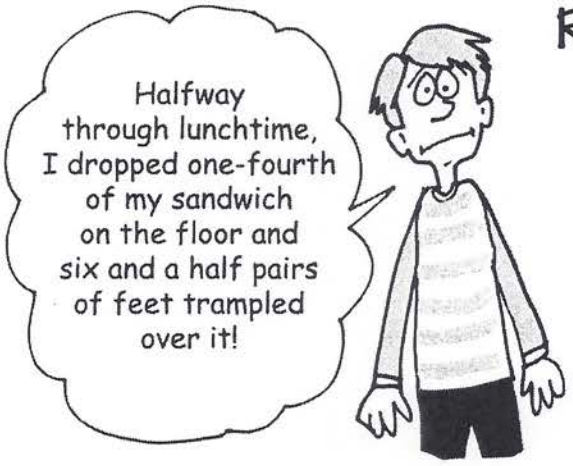
A fractional number has two parts: a **numerator** (top number) and a **denominator** (bottom number).

The **numerator** tells the number of parts that are being counted.
The **denominator** tells the number of parts in the whole.

In a **proper fraction,** the numerator is smaller than the denominator.

In an **improper fraction,** the numerator is greater than the denominator.

A **mixed fractional numeral** contains a whole number and a fraction.



Reading and Writing Fractions

$\frac{2}{3}$ reads ***two-thirds***

$\frac{4}{6}$ reads ***four-sixths***

$\frac{7}{8}$ reads ***seven-eighths***

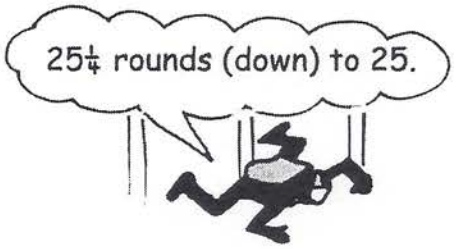
$\frac{13}{9}$ reads ***thirteen-ninths***

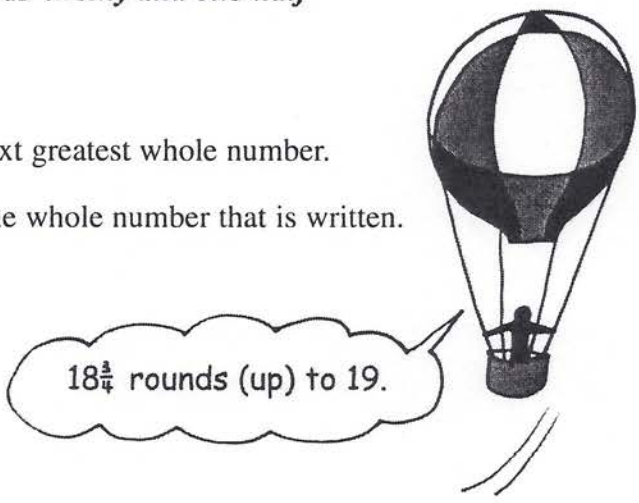
$20\frac{1}{2}$ reads ***twenty and one-half***

Rounding Mixed Numbers

If the fraction **is worth $\frac{1}{2}$ or more**, round up to the next greatest whole number.

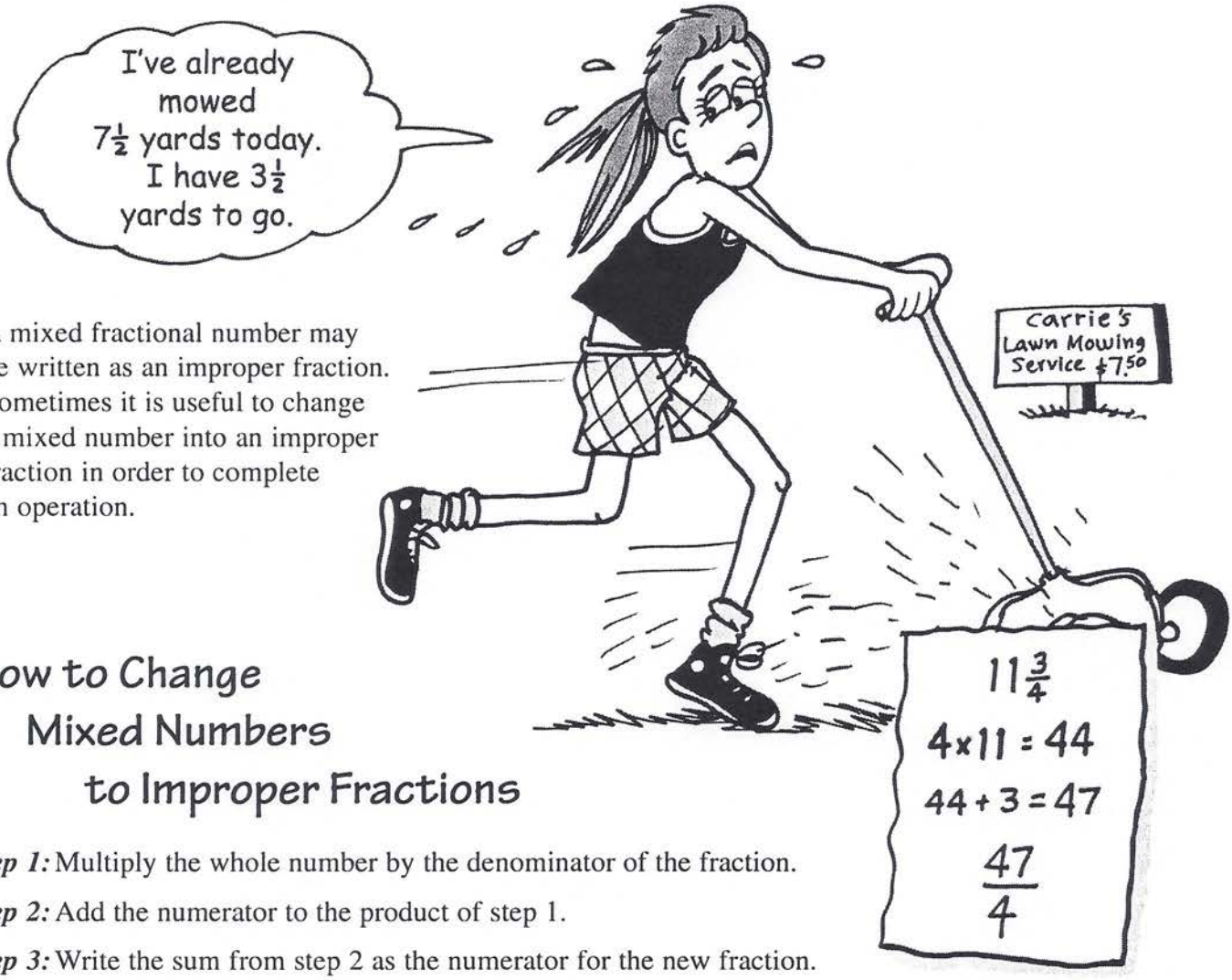
If the fraction **is worth less than $\frac{1}{2}$,** round down to the whole number that is written.





Mixed Fractional Numbers

A **mixed fractional number** combines a whole number and a fraction. The value of a mixed fractional number is always greater than one (unless it is a negative number).



A mixed fractional number may be written as an improper fraction. Sometimes it is useful to change a mixed number into an improper fraction in order to complete an operation.

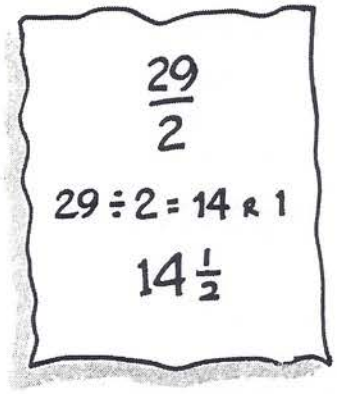
How to Change Mixed Numbers to Improper Fractions

Step 1: Multiply the whole number by the denominator of the fraction.

Step 2: Add the numerator to the product of step 1.

Step 3: Write the sum from step 2 as the numerator for the new fraction.

Step 4: Write the original denominator as the denominator for the new fraction.



How to Change Improper Fractions to Mixed Numbers

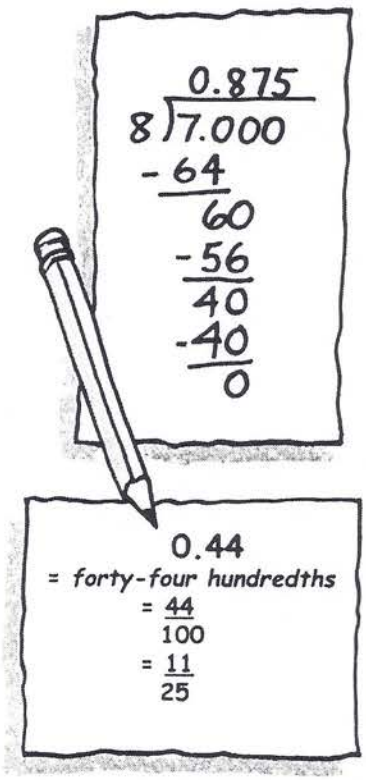
Step 1: Divide the numerator by the denominator.

Step 2: Write the quotient as a whole number.

Step 3: Write the remainder as the numerator in a fraction.

Step 4: Write the original denominator in the fraction.

Fractions & Decimals



How to Write a Fraction as a Decimal

Step 1: Divide the numerator by the denominator.

Step 2: Write a zero to hold the ones place (if there is no number in that place).

$$\frac{7}{8} = 0.875$$

How to Write a Decimal as a Fraction

Step 1: Remove the decimal point and write the number as the numerator. The denominator is 10 or a multiple of 10, depending what place the last digit of the decimal occupied. For instance, in 0.044, the last digit is a thousandth.

Step 2: Reduce the fraction to lowest terms.

$\frac{44}{1000}$ reduced to lowest terms is $\frac{11}{250}$.

WHO WON?

Ari skied the run in 7.38 minutes.

Ramon's time was $7\frac{3}{4}$ minutes.

Danny's time was 0.15 hours.

To solve a problem that has some terms in decimals and others in fractions, change everything to decimals. Then compare the amounts.

7.38 min. = 7.38 min.
$7\frac{3}{4}$ min. = 7.75 min.
0.15 hours = 0.15 x 60 = 9 min.

Ari is the fastest.

Multiplying Fractions

How to Multiply Fractions

The top running speed of a human is less than $\frac{1}{2}$ the speed of an ostrich.

Step 1: Multiply the numerators; this product is the new numerator.

Step 2: Multiply the denominators; this product is the new denominator.

Step 3: Reduce the product fraction to lowest terms.

$$\frac{5}{9} \times \frac{3}{11} = \frac{15}{99} \quad \text{(in lowest terms)} \longrightarrow \quad \frac{5}{33}$$

No matter how big an iceberg is, $\frac{8}{9}$ of it will hide below the surface of the water.

How to Multiply a Fraction by a Whole Number

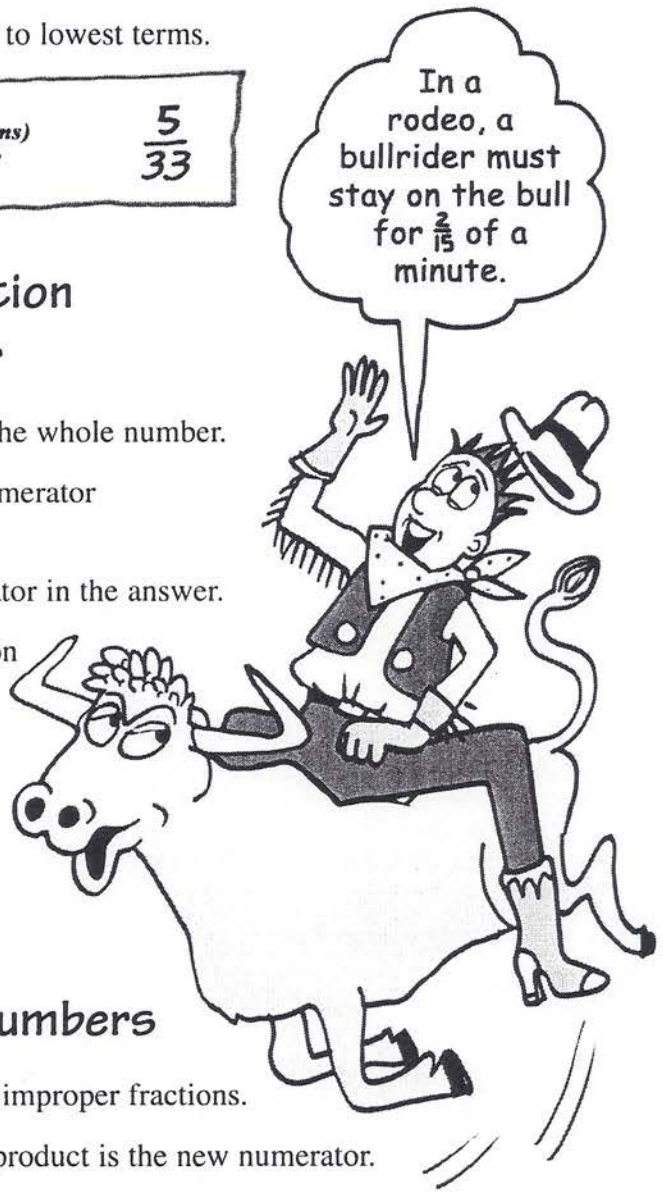
Step 1: Multiply the numerator by the whole number.

Step 2: Write this product as the numerator in the answer.

Step 3: Write the original denominator in the answer.

Step 4: Change the improper fraction into a mixed numeral, and reduce to lowest terms.

$$4 \times \frac{2}{3} = \frac{8}{3} = 2\frac{2}{3}$$



The *Titanic* was $882\frac{3}{4}$ feet long.

How to Multiply Mixed Numbers

Only $\frac{1}{3}$ of all humans can flare their nostrils.

Step 1: Change all mixed numerals to improper fractions.

Step 2: Multiply the numerators; this product is the new numerator.

Step 3: Multiply the denominators; this product is the new denominator.

Step 4: Change the improper fraction into a mixed numeral, and reduce to lowest terms.

$$7\frac{1}{2} \times 5\frac{2}{5} = \frac{15}{2} \times \frac{27}{5} = \frac{405}{10} = 40\frac{5}{10} = 40\frac{1}{2}$$

Dividing Fractions

How to Divide Fractions

Step 1: Invert (flip over) the second fraction (the divisor fraction).

Step 2: Change the problem into a multiplication problem.

Step 3: Multiply the fractions.

Step 4: Reduce the quotient fraction to lowest terms.

$$\frac{1}{4} \div \frac{2}{3} = \frac{1}{4} \times \frac{3}{2} = \frac{3}{8}$$

How to Divide a Whole Number by a Fraction
(or a Fraction by a Whole Number)

Step 1: Change the whole number into an improper fraction with the whole number as the numerator and 1 as the denominator.

Step 2: Proceed with the instructions for dividing fractions.

Step 3: Change any improper fractions in the quotient to mixed numerals, and reduce to lowest terms.

$$5 \div \frac{2}{5} = \frac{5}{1} \div \frac{2}{5} = \frac{5}{1} \times \frac{5}{2} = \frac{25}{2} = 12\frac{1}{2}$$

How to Divide Mixed Numbers

Step 1: Change any mixed numbers into improper fractions.

Step 2: Proceed with the instructions for dividing fractions.

Step 3: Change any improper fractions in the quotient to mixed numerals, and reduce to lowest terms.

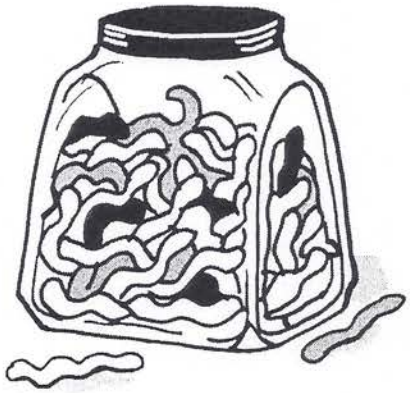
$$2\frac{1}{2} \div 4\frac{1}{5} = \frac{5}{2} \div \frac{21}{5} = \frac{5}{2} \times \frac{5}{21} = \frac{25}{42}$$

Problem-Solving Strategies

A problem-solving strategy is a method for approaching and solving a problem. There are many different ways to solve problems. Different strategies fit well with different kinds of problems.

One of the skills involved in sharp problem solving is being able to choose a good strategy. Here are some strategies to have among your list of tools for attacking problems. (See pages 196–206).

Guess & Check



Sometimes the best strategy for solving a problem is to make a smart guess. After you make a careful guess, if it is possible, you can count or calculate to see if your guess was right.

The **Guess & Check** strategy is a good one for a problem where you can see a quantity, but it is too large, complex, or far away to count accurately and easily. Use it for this problem.

The Problem:

How many candy worms are in this jar?

Trial & Error

For some problems, the best strategy is to try different solutions until you find one that works.

Trial & Error is a good strategy for those tricky age problems.

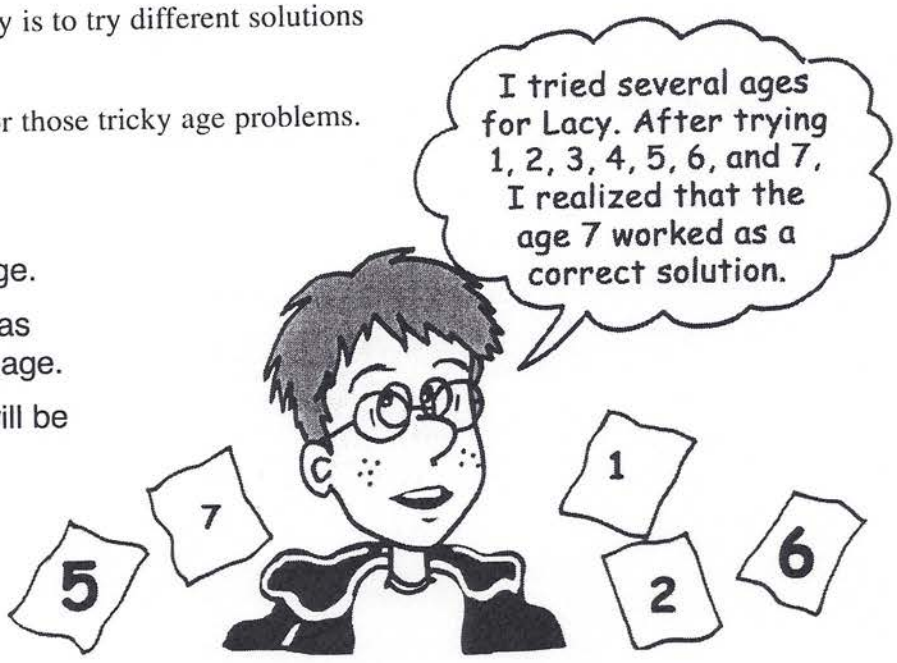
The Problem:

Tracy is twice Lacy's age.

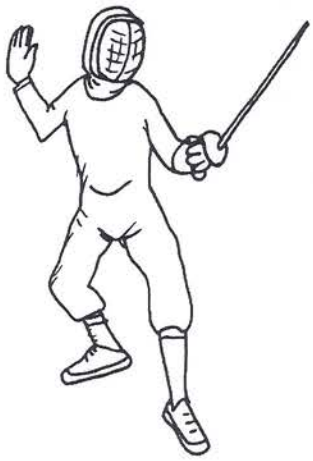
Six years ago, Tracy was eight times Lacy's age.

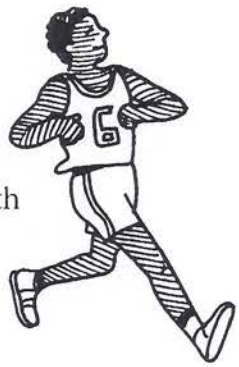
In seven years, Lacy will be $\frac{2}{3}$ of Tracy's age.

How old is Lacy?



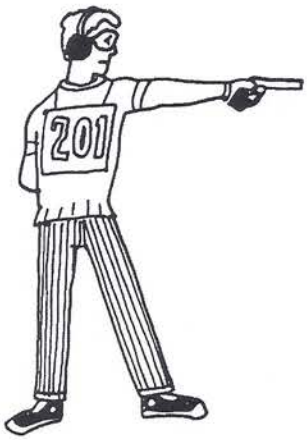
PENTATHLON CALCULATIONS

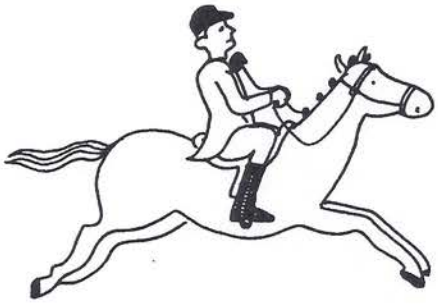




Penta means five, so athletes who compete in the pentathlon have to be good at five different sports. The modern pentathlon is based on the duties of a warrior who must deliver a message across enemy lines. He has to ride a horse around many obstacles, defend himself with a sword and gun, run great distances, and swim across rivers and streams. Olympic competitors must complete contests in equestrian riding, fencing, pistol shooting, running, and swimming.

Each of these calculations has five parts, also. You need to be good at each step in order to get the right answer!





1. $\frac{9}{10} - \frac{1}{10} + \frac{7}{10} + \frac{5}{10} - \frac{1}{10} =$ _____
2. $\frac{7}{9} - \frac{3}{9} - \frac{2}{9} + \frac{6}{9} - \frac{2}{9} =$ _____
3. $\frac{2}{13} + \frac{5}{13} - \frac{4}{13} + \frac{10}{13} - \frac{6}{13} =$ _____
4. $\frac{5}{6} - \frac{2}{6} + \frac{6}{6} - \frac{2}{6} - \frac{3}{6} =$ _____
5. $\frac{3}{20} - \frac{1}{20} + \frac{15}{20} - \frac{4}{20} + \frac{2}{20} =$ _____
6. $\frac{1}{11} + \frac{5}{11} + \frac{8}{11} - \frac{9}{11} + \frac{1}{11} =$ _____
7. $\frac{1}{5} - \frac{1}{5} + \frac{2}{5} + \frac{9}{5} - \frac{6}{5} =$ _____
8. $\frac{4}{16} - \frac{2}{16} + \frac{7}{16} + \frac{5}{16} + \frac{1}{16} =$ _____
9. $\frac{5}{25} - \frac{3}{25} + \frac{9}{25} - \frac{2}{25} + \frac{1}{25} =$ _____
10. $\frac{6}{12} - \frac{5}{12} + \frac{7}{12} - \frac{7}{12} + \frac{1}{12} =$ _____
11. $\frac{9}{6} - \frac{2}{6} + \frac{10}{6} - \frac{3}{6} + \frac{15}{6} =$ _____
12. $\frac{11}{100} + \frac{15}{100} - \frac{4}{100} + \frac{50}{100} - \frac{1}{100} =$ _____
13. $\frac{3}{30} + \frac{8}{30} + \frac{14}{30} - \frac{7}{30} - \frac{2}{30} =$ _____
14. $999\frac{8}{10} - 999 + \frac{14}{10} - \frac{2}{10} + \frac{5}{10} =$ _____

Answer key page 12, unit 246