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Fractions Packet

Contents

Note to the Student: This packet is a supplement to your textbook

Intro to Fractions

Reading Fractions

Fractions are parts. We use them to write and work with amounts that are less than a whole number (one) but more than zero. The form of a fraction is one number over another, separated by a fraction (divide) line.

i.e. $\frac{1}{2}$, $\frac{3}{4}$, and $\frac{5}{9}$

These are fractions. Each of the two numbers tells certain information about the fraction (partial number). The bottom number (denominator) tells how many parts the whole (one) was divided into. The top number (numerator) tells how many of the parts to count.

$\frac{1}{2}$ says, "Count one of two equal ports."

$\frac{3}{4}$ says, "Count three of four equal parts."

$\frac{5}{9}$ says, "Count five of nine equal parts."

Fractions can be used to stand for information about wholes and their parts:

EX. A class of 20 students had 6 people absent one day. 6 absentees are part of a whole class of 20 people. $\frac{6}{20}$ represents the fraction of people absent.

EX. A "Goodbar" candy breaks up into 16 small sections. If someone ate 5 of those sections, that person ate $\frac{5}{16}$ of the "Goodbar".

Exercise 1 Write fractions that tell the following information:
(answers on page 39)

1. Count two of five equal parts

2. Count one of four equal parts

3. Count eleven of twelve equal parts

4. Count three of five equal parts

5. Count twenty of fifty equal parts

6. It's 25 miles to Gramma's. We have already driven 11 miles. What fraction of the way have we driven?

7. A pizza was cut into twelve slices. Seven were eaten. What fraction of the pizza was eaten?

8. There are 24 students in a class. 8 have passed the fractions test. What fraction of the students have passed fractions?

The Fraction Form of One

Because fractions show how many parts the whole has been divided into and how many of the parts to count, the form also hints at the number of parts needed to make up the whole thing. If the bottom number (denominator) is five, we need 5 parts to make a whole: $\frac{5}{5} = 1$. If the denominator is 18, we need 18 parts to make a whole of 18 parts: $\frac{18}{18} = 1$. Any fraction whose top and bottom numbers are the same is equal to 1.

Example: $\frac{2}{2} = 1$, $\frac{4}{4} = 1$, $\frac{100}{100} = 1$, $\frac{11}{11} = 1$, $\frac{6}{6} = 1$

Complementary Fractions

Fractions tell us how many parts are in a whole and how many parts to count. The form also tells us how many parts have not been counted (the complement). The complement completes the whole and gives opposite information that can be very useful.

$\frac{3}{4}$ says, "Count 3 of 4 equal parts." That means 1 of the 4 was not counted and is somehow different from the original 3.

$\frac{3}{4}$ implies another $\frac{1}{4}$ (its complement). Together, $\frac{3}{4}$ and $\frac{1}{4}$ make $\frac{4}{4}$, the whole thing.

$\frac{5}{8}$ says, "Count 5 of 8 equal parts." That means 3 of the 8 parts have not been counted, which implies another $\frac{3}{8}$, the complement. Together, $\frac{5}{8}$ and $\frac{3}{8}$ make $\frac{8}{8}$, which is equal to one.

Complementary Situations

It's 8 miles to town, We have driven 5 miles. That's $\frac{5}{8}$ of the way, but we still have 3 miles to go to get there or $\frac{3}{8}$ of the way.

$\frac{5}{8} + \frac{3}{8} = \frac{8}{8} = 1$ (1 is all the way to town).

A pizza was cut into 12 pieces. 7 were eaten $\frac{7}{12}$. That means there are 5 slices left or $\frac{5}{12}$ of the pizza. $\frac{7}{12} + \frac{5}{12} = \frac{12}{12} = 1$ (the whole pizza).

Mary had 10 dollars. She spent 5 dollars on gas, 1 dollar on parking, and 3 dollars on lunch. In fraction form, how much money does she have left?

Gas = $\frac{5}{10}$, parking = $\frac{1}{10}$, lunch = $\frac{3}{10}$

$\frac{5}{10} + \frac{1}{10} + \frac{3}{10} = \frac{9}{10}$; $\frac{1}{10}$ is the complement (the leftover money)

Altogether it totals $\frac{10}{10}$ or all of the money.

Exercise 2 (answers on page 39)

Write the complements to answer the following questions:

1. A cake had 16 slices. 5 were eaten. What fraction of the cake was left?

2. There are 20 people in our class. 11 are women. What part of the class are men?

3. It is 25 miles to grandma's house. We have driven 11 miles already. What fraction of the way do we have left to go?

4. There are 36 cookies in the jar. 10 are Oreos. What fraction of the cookies are not Oreos?

Reducing Fractions

If I had 20 dollars and spent 10 dollars on a CD, it's easy to see I've spent half of my money. It must be that $\frac{10}{20}=\frac{1}{2}$. Whenever the number of the part (top) and the number of the whole (bottom) have the same relationship between them that a pair of smaller numbers have, you should always give the smaller pair answer. 2 is half of 4. 5 is half of 10. $\frac{1}{2}$ is the reduced form of $\frac{5}{10}$ and $\frac{2}{4}$ and $\frac{10}{20}$ and many other fractions.

A fraction should be reduced any time both the top and bottom number can be divided by the same smaller number. This way you can be sure the fraction is as simple as it can be.

$\frac{5}{10}$ both 5 and 10 can be divided by 5

$$\frac{5}{10}=\frac{5\div 5}{10\div 5}=\frac{1}{2}$$

$\frac{1}{2}$ describes the same number relationship that $\frac{5}{10}$ did, but with smaller numbers. $\frac{1}{2}$ is the reduced form of $\frac{5}{10}$.

$\frac{6}{8}$ both 6 and 8 can be divided by 2. $\frac{6}{8}=\frac{6\div 2}{8\div 2}=\frac{3}{4}$

$\frac{3}{4}$ is the reduced form of $\frac{6}{8}$.

When you divide both the top and bottom numbers of a fraction by the same number, you are dividing by a form of one so the value of the fraction doesn't change, only the size of the numbers used to express it.

$\frac{12}{16}=\frac{12\div 2}{16\div 2}=\frac{6}{8}$ These numbers are smaller but they can go lower because both 6 and 8 can be divided by 2 again. $\frac{6}{8}=\frac{6\div 2}{8\div 2}=\frac{3}{4}$

$\frac{18}{24}=\frac{18\div 2}{24\div 2}=\frac{9}{12}=\frac{9\div 3}{12\div 3}=\frac{3}{4}$

$\frac{27}{63}=\frac{27\div 3}{63\div 3}=\frac{9}{21}=\frac{9\div 3}{21\div 3}=\frac{3}{7}$ or $\frac{27}{63}=\frac{27\div 9}{63\div 9}=\frac{3}{7}$

Exercise 3 (answers on page 39)

Try these. Keep dividing until you can't divide anymore.

1. $\frac{6}{8}$ =
2. $\frac{12}{15}$ =
3. $\frac{14}{18}$ =
4. $\frac{8}{10}$ =
5. $\frac{6}{12}$ =
6. $\frac{16}{24}$ =

Good knowledge of times tables will help you see the dividers you need to reduce fractions.

Here are some hints you can use that will help, too.

Hint 1

If the top and bottom numbers are both even, use $\frac{2}{2}$.

Hint 2

If the sum of the digits is divisible by 3 then use $\frac{3}{3}$.

$\frac{111}{231}$ looks impossible but note that 111 (1+1+1) adds up to three and 231 (2+3+1) adds up to 6. Both 3 and 6 divide by 3 and so will both these numbers:

$\frac{111}{231}=\frac{111\div 3}{231\div 3}=\frac{37}{77}$

The new fraction doesn't look too simple, but it is smaller than when we first started.

Hint 3

If the 2 numbers of the fraction end in 0 and/or 5, you can divide by $\frac{5}{5}$.

$$\frac{45}{70}=\frac{45\div 5}{70\div 5}=\frac{9}{14}$$

Hint 4

If both numbers end in zeros, you can cancel the zeros in pairs, one from the top and one from the bottom. This is the same as dividing them by $\frac{10}{10}$ for each cancelled pair.

$$\frac{4000}{50000}=\frac{4\cancel{000}}{50\cancel{000}}=\frac{4}{50}=\frac{4\div 2}{50\div 2}=\frac{2}{25}$$

Hint 5

If you have tried to cut the fraction by $\frac{2}{2}, \frac{3}{3}, \frac{5}{5}$ and gotten nowhere, you should try to see if the top number divides into the bottom one evenly. For $\frac{23}{69}$, none of the other hints help here, but 69 ÷ 23 = 3. This means you can reduce by $\frac{23}{23}$. $\frac{23}{69}=\frac{23\div 23}{69\div 23}=\frac{1}{3}$

For more help on reducing fractions, see page 13

Exercise 4 (answers on page 39)

Directions: Reduce these fractions to lowest terms

1. $\frac{14}{18}=$ 2. $\frac{80}{100}=$ 3. $\frac{18}{36}=$ 4. $\frac{400}{5000}=$

5. $\frac{20}{25}=$ 6. $\frac{27}{36}=$ 7. $\frac{40}{45}=$ 8. $\frac{63}{81}=$

9. $\frac{9}{12}=$ 10. $\frac{60}{85}=$ 11. $\frac{17}{51}=$ 12. $\frac{50}{75}=$

Higher Equivalents

There are good reasons for knowing how to build fractions up to a larger form. It is exactly the opposite of what we do in reducing. If reducing is done by division, it makes sense that building up should be done by multiplication.

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

$$\frac{3}{5}=\frac{3\times 3}{5\times 3}=\frac{9}{15}$$

$$\frac{8}{9}=\frac{8\times 6}{9\times 6}=\frac{48}{54}$$

A fraction can be built up to an equivalent form by multiplying by any form of one, any number over itself.

$\frac{2}{3}=\frac{2\times 6}{3\times 6}=\frac{12}{18}$ $\qquad$ $\frac{2}{3}=\frac{2\times 4}{3\times 4}=\frac{8}{12}$

$\frac{2}{3}=\frac{2\times 11}{3\times 11}=\frac{22}{33}$ $\qquad$ $\frac{2}{3}=\frac{2\times 5}{3\times 5}=\frac{10}{15}$

$\frac{2}{3}=\frac{12}{18}=\frac{8}{12}=\frac{22}{33}=\frac{6}{9}$ All are forms of $\frac{2}{3}$; all will reduce to $\frac{2}{3}$

Comparing Fractions

Sometimes it is necessary to compare the size of fractions to see which is larger or smaller, or if the two are equal. Sometimes several fractions must be placed in order of size. Unless fractions have the same bottom number (denominator) and thus parts of the same size, you can't know for certain which is larger or if they are equal.

Which is larger $\frac{2}{3}$ or $\frac{5}{6}$? Who knows? A ruler might help, but rulers aren't usually graduated in thirds or sixths. Did you notice that if 3 were doubled, it would be 6?

So build up $\frac{2}{3}$ by $\frac{2}{2}$; $\frac{2}{3}=\frac{2\times 2}{3\times 2}=\frac{4}{6}$

Then it's easy to see that $\frac{5}{6}$ is larger because it counts more sixth parts than $\frac{4}{6}$, so $\frac{4}{6}<\frac{5}{6}$ means $\frac{2}{3}<\frac{5}{6}$

Which is larger $\frac{15}{16}$ or $\frac{3}{4}$?

Build up $\frac{3}{4}$ by $\frac{4}{4}$. $\frac{3}{4}=\frac{3\times 4}{4\times 4}=\frac{12}{16}$. $\frac{15}{16}>\frac{12}{16}$ so $\frac{15}{16}>\frac{3}{4}$

Exercise 5 (answers on page 39)

Use <, >, or = to compare these fractions

1. $\frac{3}{4}$ $\frac{9}{16}$

2. $\frac{2}{5}$ $\frac{3}{10}$

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

4. $\frac{10}{16}$ $\frac{5}{8}$

5. $\frac{7}{8}$ $\frac{15}{16}$

Mixed Numbers

A "mixed" number is one that is part whole number and part fraction. $3\frac{1}{2}$, $4\frac{5}{8}$, $11\frac{2}{3}$ are samples of mixed numbers. Mixed numbers have to be written as fractions only if you're going to multiply or divide them or use them as multipliers or divisors in fraction problems. This change of form is easy to do. Think about $3\frac{1}{2}$. That's 3 whole things and half another. Each of the 3 wholes has 2 halves ($\frac{2}{2} = 1$). The number 3 is 1+1+1 or $\frac{2}{2}+\frac{2}{2}+\frac{2}{2}$. That's $\frac{6}{2}$ and, with the original $\frac{1}{2}$, there's a total of $\frac{7}{2}$. You don't have to think of every one this way; just figure the whole number times the denominator (bottom) and add the numerator (top) $3\frac{1}{2}=\frac{3\times 2+1}{2}=\frac{7}{2}$.

$3\frac{1}{2}=\frac{3\times 2+1}{2}=\frac{7}{2}$ $\qquad$ $4\frac{5}{8}=\frac{4\times 8+5}{8}=\frac{32+5}{8}=\frac{37}{8}$

$2\frac{2}{3}=\frac{2\times 3+2}{3}=\frac{6+2}{3}=\frac{8}{3}$ $\qquad$ $11\frac{5}{9}=\frac{11\times 9+5}{9}=\frac{99+5}{9}=\frac{104}{9}$

Exercise 6 (answers on page 39)

Change these mixed numbers to "top heavy" fractions:

1. $5\frac{7}{8}$ $\qquad$ 2. $9\frac{2}{3}$ $\qquad$ 3. $2\frac{1}{2}$ $\qquad$ 4. $1\frac{1}{8}$

5. $13\frac{1}{2}$ $\qquad$ 6. $7\frac{3}{4}$ $\qquad$ 7. $12\frac{2}{5}$ $\qquad$ 8. $9\frac{5}{9}$

These "top heavy" forms are "work" forms, but they are not usually acceptable answers. If the answer to a calculation comes out a top heavy fraction, it will have to be changed to a mixed number. This can be done by reversing the times and plus to divide and minus. $3\frac{1}{2}$ became $\frac{7}{2}$ by $\frac{2\times 3+1}{2}$. $\frac{7}{2}$ can go back to $3\frac{1}{2}$ by dividing 7 and 2.

$3\frac{1}{2}$

$2\overline{)7}$ The answer is the whole number 3. The remainder 1 is the top number of

$\underline{6}$

1

the fraction and the divider 2 is the denominator (bottom fraction number).

$\frac{37}{8} = 8\overline{)37} = 4\frac{5}{8}$ $\frac{17}{4} = 4\overline{)17} = 4\frac{1}{4}$ $\frac{35}{3} = 3\overline{)35} = 11\frac{2}{3}$

$\underline{32}$ $\underline{16}$ $\underline{33}$

5 1 2

Exercise 7 (answers on page 39)

Reduce these top heavy fractions to mixed numbers.

1. $\frac{27}{8}$ 2. $\frac{13}{5}$ 3. $\frac{93}{8}$ 4. $\frac{66}{7}$ 5. $\frac{25}{2}$

Top heavy fractions may contain common factors as well. They will need to be divided out either before or after the top heavy fraction is changed to a mixed number.

$\frac{26}{8} = 8\overline{)26} = 3\frac{2}{8}$ but $\frac{2}{8}$ can be divided by $\frac{2}{2}$. Then $3\frac{2}{8} \div \frac{2}{2} = 3\frac{1}{4}$

$\underline{24}$

2

If you had noticed that both 26 and 8 are even, you could divide out $\frac{2}{2}$ right away and then go for the mixed number. Either way, the mixed number is the same.

$\frac{26}{8} = \frac{26 \div 2}{8 \div 2} = \frac{13}{4} = 4\overline{)13} = 3\frac{1}{4}$

$\underline{12}$

1

Exercise 8 (answers on page 39)

1. $\frac{65}{10} =$ 2. $\frac{40}{6} =$ 3. $\frac{22}{4} =$ 4. $\frac{22}{8} =$ 5. $\frac{30}{9} =$

Estimating Fractions

"One of the most important uses of estimation in mathematics is in the calculation of problems involving fractions. People find it easier to detect significant errors when working with whole numbers. However, the extra steps involved in the calculation with fractions and mixed numbers often distract our attention from an error that we should have detected." [1]

Students should ask the following questions as motivation for estimating:

1) Would estimates "help" in the calculation?
2) Is the answer I get reasonable?
3) Does the answer seem realistic?

Try to make every fraction you work with into a whole number. 0 and 1 should be your targets with fractions. Mixed numbers should be estimated to the nearest whole number (except Ex.8).
Here are some **examples** of problems using estimation:

Ex. 1 $\frac{2}{3}+\frac{1}{2}\approx 1+1=2$ **note: ⅔ is closer to 1 (than 0) and ½ should be considered 1**

This symbol means "approximately equal to"

Ex. 2 $\frac{1}{3}+\frac{1}{2}\approx 0+1=1$ **note: ⅓ is closer to 0 (than 1)**

Ex. 3 $5\frac{1}{3}-2\frac{1}{2}\approx 5-3=2$ **note: 5⅓ is closer to 5 (than 6) and 2½ should be considered closer to 3 (than 2)**

Ex. 4 $5\frac{2}{3}-2\frac{1}{2}\approx 6-3=3$ **note: 5⅔ is closer to 6 (than 5)**

Ex. 5 $\frac{2}{3}\times\frac{1}{2}\approx 1\times 1=1$ **see Ex. 1 above**

Ex. 6 $\frac{2}{3}\div\frac{1}{2}\approx 1\div 1=1$ **see Ex. 1 above**

Ex. 7 $5\frac{1}{3}\times 2\frac{1}{2}\approx 5\times 3=15$ **see Ex. 3 above**

Ex. 8 $5\frac{1}{3}\div 2\frac{1}{2}\approx 6\div 3=2$ **note: 5⅓ is made into a 6 because it is easier to divide by 3**

Exercise 9 Estimate the answers to the following fractions operations **(answers on page 39)**

1) $\frac{6}{7}+\frac{2}{3}$ **2)** $\frac{6}{7}-\frac{1}{3}$ **3)** $\frac{6}{7}\div\frac{2}{3}$ **4)** $\frac{6}{7}\times\frac{2}{3}$ **5)** $3\frac{6}{7}-2\frac{2}{3}$ **6)** $8\frac{3}{7}\div 3\frac{2}{3}$

[1] Basic College Mathematics ,4th Ed., Tobey & Slater, p. 176

Reducing Fractions

Divide by 2 if…

The top AND bottom numbers are EVEN numbers

Like: $\frac{2}{4}, \frac{14}{26}, \frac{32}{44}$

Divide by 3 if …

The sum of the top numbers can be divided by 3 AND the sum of the bottom numbers can be divided by 3

Like: $\frac{561}{762}$ $\frac{5+6+1=12}{7+6+2=15}$ $\frac{\text{12 can be divided evenly by 3}}{\text{15 can be divided evenly by 3}}$

Divide by 5 if…

The top AND bottom numbers end in 0 or 5

Like: $\frac{5}{15}, \frac{60}{75}, \frac{255}{460}$

Divide by 10 if…

The top AND bottom numbers end in 0.

Like: $\frac{20}{40}, \frac{140}{260}, \frac{320}{440}$

Divide by 25 if…

The top AND bottom numbers end in 25 or 50 or 75 or 100

Like: $\frac{225}{400}, \frac{150}{275}, \frac{3275}{4500}$

Divisibility RULES!

- Dividing by 3

  Add up the digits: if the sum is divisible by three, then the number divides by three.

  Ex. $\frac{207}{603} \Rightarrow \frac{2+0+7}{6+0+3} = \frac{9 \div 3}{9 \div 3} = \frac{3}{3}$ therefore $\frac{207}{603}$ divides by $\frac{3}{3}$

- Dividing by 4

  Look at the last two digits. If they are divisible by four, then the number divides by four.

  Ex. $\frac{124}{136} \Rightarrow \frac{24}{36} = \frac{24 \div 4}{36 \div 4} = \frac{6}{9}$ therefore $\frac{124}{136}$ divides by $\frac{4}{4}$

- Dividing by 6

  If the digits can be divided by two and three, then the number divides by six

  Ex. $\left.\begin{array}{l} \frac{612}{1806} \Rightarrow \frac{612 \div 2}{1806 \div 2} = \frac{306}{903} \\ \textit{And} \\ \frac{612}{1806} \Rightarrow \frac{612 \div 3}{1806 \div 3} = \frac{204}{602} \end{array}\right\}$ therefore $\frac{612}{1806}$ divides by $\frac{6}{6}$

- Dividing by 7

  Take the last digit, double it, and then subtract it from the other numbers. If the answer is divisible by seven, then the number divides by seven.

  Ex. $\frac{287}{315} \Rightarrow \frac{28-14}{31-10} = \frac{14 \div 7}{21 \div 7} = \frac{2}{3}$ therefore $\frac{287}{315}$ divides by $\frac{7}{7}$

- Dividing by 8

  If the last three digits are divisible by eight then the number divides by eight.

  Ex. $\frac{2104}{3160} \Rightarrow \frac{104 \div 8}{160 \div 8} = \frac{13}{20}$ therefore $\frac{2104}{3160}$ divides by $\frac{8}{8}$

- Dividing by 12

  If the number divides by both 3 and 4, then the number will divide by 12

  Ex. $\frac{1224}{3612} \Rightarrow \frac{1224 \div 3}{3612 \div 3} = \frac{408}{1204}$

  And

  $\frac{1224}{3612} \Rightarrow \frac{1224 \div 4}{3612 \div 4} = \frac{306}{903}$

  } therefore $\frac{1224}{3612}$ divides by $\frac{12}{12}$

- Dividing by 13

  Delete the last digit. Subtract nine times the deleted digit from the remaining number. If what is left is divisible by thirteen, then the number divides by thirteen.

  Ex.

Forget it! This is too much work!

Remember to try to reduce with any number that makes the reduction simple and easy for you.

Good Luck!

ORDERING
Fractions

Being able to place numbers in order (smallest to largest or largest to smallest) is fundamental to the understanding of mathematics. In these exercises we will learn how to order fractions.

Ordering Fractions

There are several ways to order fractions. One way is to use common sense. This method can be simple but requires some general knowledge. If nothing else, it can be used as a starting point to finding the necessary order.

Take a look at the following examples:

Ex. Place the following fractions from smallest to largest order

$$\frac{1}{3},\ \frac{1}{5},\ \frac{1}{2}$$

The larger the number on the bottom of a fraction (assuming the numerator is the same for all the fractions), the smaller the fraction is. In the above example, $\frac{1}{5}$ is the smallest fraction because the 5 is the largest denominator. Next in order would be the $\frac{1}{3}$ because the 3 is the next largest denominator. This leaves the $\frac{1}{2}$, which has the smallest denominator. Therefore, the order for these fractions is:

$$\frac{1}{5},\ \frac{1}{3},\ \frac{1}{2}$$

Ex. Place the following fractions from smallest to largest

$$\frac{3}{5},\ \frac{2}{3},\ \frac{5}{6}$$

The larger bottom number here is the 6 in $\frac{5}{6}$. But the student should ask, "Is this the smallest fraction?" By inspection, it does not seem to be. But with fractions of this sort (different numerators), students run into the most problems when ordering.

Another way to order fractions is to find common denominators for all the fractions; build up the fractions; then compare the top numbers (numerators) of all the fractions.

Look at the following example:

Ex. Order the following fractions from smallest to largest

$$\frac{5}{6},\ \frac{3}{5},\ \frac{2}{3}$$

The fractions will be rewritten with common denominators. This process is called building. Once the denominators change, then the numerators will change by the same amount.

$$\frac{3}{5}=\frac{3\times 6}{5\times 6}=\frac{18}{30},\quad \frac{2}{3}=\frac{2\times 10}{3\times 10}=\frac{20}{30},\quad \frac{5}{6}=\frac{5\times 5}{6\times 5}=\frac{25}{30}$$

By looking at the top numbers, the order of these fractions is:

$$\frac{3}{5},\ \frac{2}{3},\ \frac{5}{6}$$

Exercise A (answers on page 42)

Order these fractions from SMALLEST to largest.

1. $\frac{3}{4},\ \frac{3}{7},\ \frac{2}{3}$

2. $\frac{1}{7},\ \frac{3}{14},\ \frac{3}{28}$

Exercise B (answers on page 42)

Order these fractions from LARGEST to smallest.

1. $\frac{8}{11},\ \frac{3}{4},\ \frac{13}{22}$

2. $\frac{7}{8},\ \frac{35}{64},\ \frac{5}{16}$

Multiplication and Division of Fractions Worksheets

When multiplying fractions, simply multiply the numerators (top number of the fractions) together and multiply the denominators (bottom number of the fractions) together. It is good practice to check to see if any of the numbers can cancel. Canceling is done when the numerator and denominator can be divided *evenly* by the same number.

Note: canceling can happen top-to-bottom and/or diagonally but never across.

Ex. 1: $\frac{1}{2}\times\frac{2}{3}=\frac{2}{6}$ this product can be canceled. Divide the numbers in the fraction by 2 to get the canceled answer $\frac{2\div 2}{6\div 2}=\frac{1}{3}$.

The fractions in Ex. 1 can cancel before they are multiplied.

Ex. 1: $\frac{1}{\cancel{2}_{1}}\times\frac{\cancel{2}^{1}}{3}=\frac{1}{3}$

The 2's cancel by dividing by 2. Cross them out and place 1's close by. Now multiply the top numbers together, then the bottom numbers. The product is the final answer.

Ex. 2: $\frac{35}{40}\times\frac{100}{1000}$ can be rewritten as $\frac{\cancel{35}^{7}}{\cancel{40}_{8}}\times\frac{\cancel{100}^{1}}{\cancel{1000}_{10}}=\frac{7}{8}\times\frac{1}{10}=\frac{7}{80}$

Cancel by dividing by 5. Then cancel by dividing by 100. Multiply and get the product.

Ex. 3: $3\times\frac{1}{3}$ can be written like. $\frac{\cancel{3}^{1}}{1}\times\frac{1}{\cancel{3}_{1}}=\frac{1}{1}=1$ Cancel by dividing by 3. Finally, multiply to find the product.

Exercise 1 (answers on page 40)

Multiply these fractions. Cancel and simplify if possible.

1. $\frac{1}{8} \times \frac{2}{3} =$

2. $\frac{1}{2} \times \frac{4}{5} =$

3. $\frac{3}{5} \times \frac{10}{11} =$

4. $\frac{8}{9} \times \frac{3}{4} =$

5. $\frac{7}{10} \times \frac{2}{21} =$

6. $\frac{3}{4} \times \frac{5}{7} =$

7. $\frac{5}{9} \times \frac{7}{8} =$

8. $6 \times \frac{1}{3} =$

9. $\frac{5}{9} \times 9 =$

10. $10 \times \frac{1}{2} =$

11. $\frac{1}{3} \times 12 =$

12. $\frac{15}{16} \times \frac{8}{10} =$

13. $\frac{7}{8} \times \frac{12}{13} =$

14. $\frac{6}{9} \times \frac{1}{3} =$

15. $\frac{5}{10} \times \frac{3}{4} =$

16. $\frac{16}{17} \times \frac{23}{24} =$

17. $\frac{5}{16} \times \frac{20}{30} =$

18. $\frac{9}{10} \times \frac{50}{100} =$

Multiplying Mixed Numbers

Change mixed numbers into improper fractions then multiply as before.

Ex. 1: $2\frac{1}{2}\times 3\frac{1}{3}=\frac{5}{\cancel{2}_{1}}\times\frac{\cancel{10}^{5}}{3}=\frac{25}{3}=8\frac{1}{3}$

Change the mixed numbers to improper fractions by:

$2\frac{1}{2}=\frac{2\times 2+1}{2}=\frac{4+1}{2}=\frac{5}{2}$

1) multiplying the bottom number by the whole number
2) add the top number
3) keep the bottom number.

Cancel top and bottom. Multiply. Improper fractions simplify by dividing.

Ex.2: $4\frac{1}{4}\times 6=\frac{17}{\cancel{4}_{2}}\times\frac{\cancel{6}^{3}}{1}=\frac{51}{2}=25\frac{1}{2}$ Change the mixed number into an improper fraction. Change the whole number into an improper fraction. Cancel. Multiply. Simplify to get the quotient.

<u>Exercise 2</u> (answers on page 40)

Multiply these fractions. Cancel and simplify if necessary.

1. $1\frac{1}{2}\times 1\frac{3}{4}=$
2. $2\frac{1}{3}\times 5\frac{2}{5}=$
3. $4\frac{1}{3}\times 1\frac{7}{8}=$
4. $\frac{1}{2}\times 2\frac{1}{8}=$
5. $3\frac{1}{4}\times\frac{7}{8}=$
6. $5\frac{5}{7}\times\frac{14}{15}=$
7. $7\times 1\frac{3}{8}=$
8. $2\frac{4}{5}\times 5=$
9. $6\frac{2}{3}\times 9=$
10. $1\frac{8}{9}\times 1\frac{5}{6}=$
11. $7\frac{1}{7}\times 8\frac{2}{5}=$
12. $1\frac{1}{7}\times 9\frac{1}{3}=$

Dividing Fractions

When dividing fractions, invert (turn over) the fraction to the right of the ÷ ("divide by") symbol. Cancel (if possible) then multiply.

Ex. 1: $\frac{1}{2} \div \frac{3}{4} = \frac{1}{\cancel{2}_{1}} \times \frac{\cancel{4}^{2}}{3} = \frac{2}{3}$

Ex. 2: $\frac{3}{5} \div 5 = \frac{3}{5} \div \frac{5}{1} = \frac{3}{5} \times \frac{1}{5} = \frac{3}{25}$

Exercise 3 (answers on page 40)

Divide these fractions. Cancel if necessary and simplify

1. $\frac{2}{3} \div \frac{5}{6} =$
2. $\frac{9}{10} \div \frac{1}{2} =$
3. $\frac{3}{4} \div \frac{1}{4} =$
4. $\frac{9}{11} \div \frac{7}{22} =$
5. $\frac{2}{5} \div \frac{1}{6} =$
6. $\frac{1}{2} \div \frac{3}{4} =$
7. $\frac{7}{8} \div \frac{1}{4} =$
8. $\frac{1}{5} \div \frac{1}{6} =$
9. $\frac{5}{8} \div \frac{15}{16} =$
10. $\frac{15}{16} \div \frac{5}{8} =$
11. $\frac{7}{12} \div \frac{3}{4} =$
12. $\frac{8}{9} \div \frac{9}{8} =$
13. $2 \div \frac{3}{8} =$
14. $6 \div \frac{1}{2} =$
15. $\frac{3}{4} \div 4 =$

Dividing Mixed Number Fractions

When dividing mixed numbers, change the mixed numbers to improper fractions, invert the fraction on the right of the ÷ symbol, cancel if possible, multiply then simplify.

Ex. 1: $2\frac{1}{2} \div 1\frac{1}{3} = \frac{5}{2} \div \frac{4}{3} = \frac{5}{2} \times \frac{3}{4} = \frac{15}{8} = 1\frac{7}{8}$

Ex. 2: $4\frac{1}{2} \div 6 = \frac{9}{2} \div \frac{6}{1} = \frac{\cancel{9}^{3}}{2} \times \frac{1}{\cancel{6}_{2}} = \frac{3}{4}$

Exercise 4 (answers on page 40)

Divide the following mixed numbers. Cancel and simplify when possible.

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

2. $3\frac{1}{2} \div 1\frac{1}{8} =$

3. $5\frac{2}{5} \div 1\frac{9}{10} =$

4. $\frac{3}{4} \div 2\frac{1}{3} =$

5. $6\frac{4}{5} \div \frac{1}{2} =$

6. $8\frac{1}{3} \div \frac{5}{6} =$

7. $8 \div 1\frac{5}{6} =$

8. $3\frac{6}{7} \div 2 =$

9. $5\frac{7}{8} \div 4 =$

10. $3\frac{3}{7} \div 3\frac{3}{7} =$

11. $2\frac{1}{2} \div 1\frac{1}{2} =$

12. $16\frac{2}{3} \div 13\frac{1}{6} =$

Fraction Word Problems (Multiplication/Division)

When solving word problems, make sure to UNDERSTAND THE QUESTION. Look for bits of information that will help get to the answer. Keep in mind that some sentences may not have key words or key words might even be misleading. USE COMMON SENSE when thinking about how to solve word problems. The first thing you think of might be the best way to solve the problem.

Here are some KEY WORDS to look for in word problems:

Product, times: mean to multiply

Quotient, per, for each, average: mean to divide

Ex. 1: If 3 boxes of candy weigh $6\frac{1}{2}$ pounds, find the weight per box.

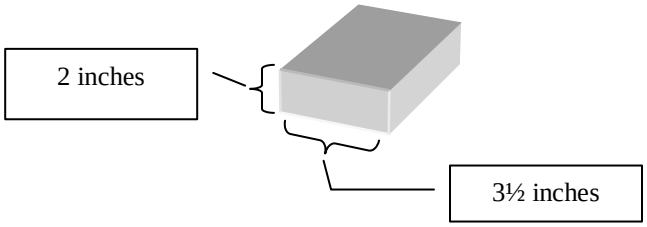
"per" means to divide

$$6\frac{1}{2} \div 3 = \frac{13}{2} \div \frac{3}{1} = \frac{13}{2} \times \frac{1}{3} = \frac{13}{6} = 2\frac{1}{6} \text{ pounds}$$

Ex. 2: If one "2 by 4" is actually $3\frac{1}{2}$ inches wide, find the width of twelve "2 by 4"s.

twelve 2" by 4"'s here means 12 times as wide as one 2" by 4"

$$3\frac{1}{2} \times 12 = \frac{7}{2} \times \frac{\cancel{12}^{6}}{1} = 42 \text{ inches}$$



Exercise 5 (answers on page 40)

Solve the following fraction word problems. Cancel and simplify your answers.

1. A stack of boards is 21 inches high. Each board is $1\frac{3}{4}$ inches thick. How many boards are there?

2. A satellite makes 4 revolutions of the earth in one day. How many revolutions would it make in $6\frac{1}{2}$ days?

3. A bolt has $16\frac{1}{2}$ turns per inch. How many turns would be in $2\frac{1}{2}$ inches of threads?

4. If a bookshelf is $28\frac{1}{8}$ inches long, how many $1\frac{7}{8}$ inch thick books will it hold?

5. Deborah needs to make 16 costumes for the school play. Each costume requires $2\frac{1}{4}$ yards of material. How many yards of material will she need?

6. The Coffee Pub has cans of coffee that weigh $3\frac{1}{4}$ pounds each. The Pub has $8\frac{1}{2}$ cans of coffee left. What is the total weight of $8\frac{1}{2}$ cans?

7. Belinda baked 9 pies that weigh $20\frac{1}{4}$ pounds total. How much does each pie weigh?

8. A piece of paper is $\frac{4}{1000}$ inches thick. How many sheets of paper will it take to make a stack 1 inch high?

9. Tanya has read $\frac{3}{4}$ of a book, which is 390 pages. How many pages are in the entire book?

10. DJ Gabe is going to serve ⅓ of a whole pizza to each guest at his party. If he expects 24 guests, how many pizza's will he need?

To the student:

The fractions chapter is split into two parts. The first part introduces what fractions are and shows how to multiply and divide them. The second part shows how to add and subtract. The methods for accomplishing these operations can be confusing if studied all at once. Before proceeding with this packet, please talk to your instructor about what you should do next. The Editors.

Addition and Subtraction of Fractions

Finding the LEAST COMMON DENOMINATOR (LCD)

When adding and subtracting fractions, there must be a common denominator so that the fractions can be added or subtracted. Common denominators are the same number on the bottom of fractions.

There are several methods for finding the common denominator. The following is one in which we will find the least common denominator or LCD. Each set of fractions has many common denominators; we will find the smallest number that one or both fractions will change to.

Ex. Suppose we are going to add these fractions: $\frac{1}{2}+\frac{2}{3}$

Step 1: Start with the largest of the denominators

Ex: **3 is the largest**

Step 2: See if the other denominator can divide into the largest without getting a remainder. If there is no remainder, then you have found the LCD!

Ex. **3 divided by 2 has a remainder of 1**

Step 3: If there is a remainder, multiply the largest denominator by the number 2 and repeat step 2 above. If there is no remainder, then you have found the LCD! If there is a remainder, keep multiplying the denominator by successive numbers (3, 4, 5, etc.) until there is no remainder. This process may take several steps but it will eventually get to the LCD.

Ex. **3 x 2 = 6; 2 divides evenly into 6; therefore, 6 is the LCD**.

Ex. 1: $\frac{1}{2}+\frac{1}{4}$

Step 1: 4 is the largest denominator

Step 2: 4 divided by 2 has no remainder, therefore 4 is the LCD!

Ex. 2: $\frac{1}{5}+\frac{1}{6}$

Step 1: 6 is the largest denominator

Step 2: 6 divided by 5 has a remainder.

Multiply 6 x 2 = 12.

12 divided by 5 has a remainder

6 x 3 = 18.

18 divided by 5 has a remainder

6 x 4 = 24

24 divided by 5 has a remainder

6 x 5 = 30

30 divided by 5 has NO remainder, therefore 30 is the LCD!

Note: You may have noticed that multiplying the denominators together also gets the LCD. This method will always get a common denominator but it may not get a lowest common denominator.

Exercise 1 (answers on page 41)

Using the previously shown method, write just the **LCD** for the following sets of fractions **(Do Not Solve)**

1) $\frac{1}{2},\frac{1}{3}$

2) $\frac{2}{5},\frac{2}{3}$

3) $\frac{5}{8},\frac{1}{2}$

4) $\frac{1}{4},\frac{1}{3}$

5) $\frac{1}{7},\frac{2}{5}$

6) $\frac{4}{9},\frac{1}{3}$

7) $\frac{3}{4},\frac{1}{2}$

8) $\frac{7}{8},\frac{3}{5}$

9) $\frac{3}{10},\frac{2}{3}$

10) $\frac{13}{15},\frac{4}{5}$

11) $\frac{1}{2},\frac{2}{3},\frac{5}{6}$

12) $\frac{3}{4},\frac{5}{8},\frac{7}{16}$

13) $\frac{3}{8},\frac{1}{6},\frac{1}{3}$

14) $\frac{1}{7},\frac{1}{2},\frac{1}{3}$

15) $\frac{3}{8},\frac{1}{5},\frac{1}{3}$

Getting equivalent Fractions and Reducing Fractions

Once we have found the LCD for a set of fractions, the next step is to change each fraction to one of its equivalents so that we may add or subtract it.

An equivalent fraction has the same value as the original fraction…it looks a little different!

Here are some examples of equivalent fractions:

$\frac{1}{2}=\frac{2}{4}$ $\frac{1}{2}=\frac{3}{6}$ $\frac{1}{2}=\frac{4}{8}$ $\frac{1}{2}=\frac{5}{10}$ …etc.

$\frac{2}{3}=\frac{4}{6}$ $\frac{2}{3}=\frac{6}{9}$ $\frac{2}{3}=\frac{8}{12}$ $\frac{2}{3}=\frac{10}{15}$ …etc.

An equivalent fraction is obtained by multiplying both the numerator and denominator of the fraction by the same number. This is called **BUILDING**.

Here are some examples:

$\frac{5x3}{8x3}=\frac{15}{24}$ 5 and 8 were both multiplied by 3

$\frac{7x2}{12x2}=\frac{14}{24}$ 7 and 12 were both multiplied by 2

$\frac{1x17}{3x17}=\frac{17}{51}$ 1 and 3 were both multiplied by 17

Note: the numbers used to multiply look like fraction versions of 1.

An equivalent fraction can also obtained by dividing both the numerator and denominator of the fraction by the same number. This is called **REDUCING**.

Here are some more examples:

$\frac{10\div 2}{12\div 2}=\frac{5}{6}$ 10 and 12 were both divided by 2

$\frac{8\div 4}{12\div 4}=\frac{2}{3}$ 8 and 12 were both divided by 4

$\frac{200\div 25}{225\div 25}=\frac{8}{9}$ 200 and 225 were both divided by 25

Exercise 2 **(answers on page 41)**

Find the number that belongs in the space by **building** or **reducing** equivalent fractions.

1) $\frac{1}{2} = \frac{\quad}{10}$

2) $\frac{2}{3} = \frac{\quad}{15}$

3) $\frac{5}{6} = \frac{\quad}{12}$

4) $\frac{3}{4} = \frac{\quad}{12}$

5) $\frac{2}{5} = \frac{\quad}{20}$

6) $\frac{5}{7} = \frac{\quad}{21}$

7) $\frac{3}{6} = \frac{\quad}{2}$

8) $\frac{6}{8} = \frac{\quad}{4}$

9) $\frac{8}{10} = \frac{\quad}{5}$

10) $\frac{12}{24} = \frac{\quad}{2}$

11) $\frac{5}{30} = \frac{\quad}{6}$

12) $\frac{7}{14} = \frac{\quad}{2}$

13) $\frac{2}{7} = \frac{\quad}{35}$

14) $\frac{7}{42} = \frac{\quad}{6}$

15) $\frac{10}{15} = \frac{\quad}{3}$

16) $\frac{1}{8} = \frac{\quad}{24}$

17) $\frac{1}{3} = \frac{\quad}{24}$

18) $\frac{20}{22} = \frac{\quad}{11}$

19) $\frac{21}{42} = \frac{\quad}{2}$

20) $\frac{17}{51} = \frac{\quad}{3}$

21) $\frac{10}{30} = \frac{\quad}{3}$

Simplifying Improper Fractions

An improper fraction is one in which the numerator is larger than the denominator. If the answer to an addition, subtraction, multiplication, or division fraction is improper, simplify it and reduce if possible.

Ex. 1: $\frac{4}{3}$ is an improper fraction. Divide the denominator into numerator.

$$3\overline{)\begin{array}{r}1\\4\\-3\\\hline 1\end{array}} = 1\frac{1}{3}$$

Ex. 2: $\frac{10}{8}$ is an improper fraction. Divide to simplify. Reduce.

$$\frac{10}{8} = 8\overline{)\begin{array}{r}1\\10\\-8\\\hline 2\end{array}} = 1\frac{2}{8} = 1\frac{1}{4}$$

Ex. 3: $\frac{136}{20}$ is an improper fraction. Divide to simplify. Reduce.

$$\frac{136}{20} = 20\overline{)\begin{array}{r}6\\136\\-120\\\hline 16\end{array}} = 6\frac{16}{20} = 6\frac{4}{5}$$

Exercise 3 (answers on page 41)

Simplify the following fractions. Reduce if possible.

1) $\frac{6}{5}=$ 2) $\frac{5}{4}=$ 3) $\frac{7}{3}=$

4) $\frac{10}{6}=$ 5) $\frac{4}{2}=$ 6) $\frac{6}{4}=$

7) $\frac{15}{3}=$ 8) $\frac{20}{12}=$ 9) $\frac{19}{4}=$

10) $\frac{23}{5}=$ 11) $\frac{18}{3}=$ 12) $\frac{17}{5}=$

13) $\frac{37}{9}=$ 14) $\frac{28}{8}=$ 15) $\frac{47}{9}=$

16) $\frac{106}{4}=$ 17) $\frac{17}{2}=$ 18) $\frac{140}{20}=$

19) $\frac{162}{10}=$ 20) $\frac{38}{5}=$ 21) $\frac{52}{3}=$

Adding and Subtracting of Fractions

When adding or subtracting, there *must* be a common denominator. If the denominators are different:

(a) Write the problem vertically (top to bottom)
(b) Find the LCD
(c) Change to equivalent fractions (by building)
(d) Add or subtract the numerators (leave the denominators the same)
(e) Simplify and reduce, if possible

Ex. 1: $\frac{3}{5}+\frac{1}{5}=\frac{4}{5}$ The denominators are the same. Add the numerators, keep the denominator. This fraction cannot be simplified or reduced.

Ex. 2: $\frac{1}{2}+\frac{1}{4}=?$

$$\frac{1}{2}=\frac{2}{4}$$
$$+\ \frac{1}{4}=\frac{1}{4}$$
$$\frac{3}{4}$$

The denominators are different numbers. Therefore, change to *equivalent* fractions.

See page 25

Ex. 3: $\frac{5}{8}-\frac{1}{3}=?$

$$\frac{5}{8}=\frac{15}{24}$$
$$-\ \frac{1}{3}=\frac{8}{24}$$
$$\frac{7}{24}$$

Ex. 4: $\frac{2}{3}+\frac{3}{4}=?$

$$\frac{2}{3}=\frac{8}{12}$$
$$+\ \frac{3}{4}=\frac{9}{12}$$
$$\frac{17}{12}=1\frac{5}{12}$$

Ex. 5: $\frac{11}{15}-\frac{1}{3}=?$

$$\frac{11}{15}=\frac{11}{15}$$
$$-\ \frac{1}{3}=\frac{5}{15}$$
$$\frac{6}{15}=\frac{2}{5}$$

Simplifying and reducing completes addition and subtraction problems.

See page 25 & 27

Exercise 4 (answers on page 41)

Add or subtract the following fractions. Simplify and reduce when possible.

1) $\frac{2}{7}+\frac{3}{7}=$

2) $\frac{9}{14}+\frac{1}{14}=$

3) $\frac{1}{6}+\frac{3}{6}=$

4) $\frac{3}{5}+\frac{1}{4}=$

5) $\frac{2}{3}+\frac{1}{2}=$

6) $\frac{4}{5}+\frac{1}{2}=$

7) $\frac{2}{4}+\frac{3}{6}=$

8) $\frac{5}{6}+\frac{3}{8}=$

9) $\frac{7}{9}+\frac{2}{3}=$

10) $\frac{3}{4}-\frac{1}{2}=$

11) $\frac{3}{5}-\frac{1}{3}=$

12) $\frac{7}{8}-\frac{2}{3}=$

13) $\frac{5}{12}-\frac{1}{4}=$

14) $\frac{9}{11}-\frac{1}{2}=$

15) $\frac{11}{12}-\frac{5}{6}=$

16) $\frac{1}{2}-\frac{1}{3}=$

17) $\frac{5}{6}-\frac{1}{4}=$

18) $\frac{9}{10}-\frac{1}{3}=$

19) $\frac{8}{20}+\frac{1}{5}=$

20) $\frac{14}{15}-\frac{1}{6}=$

21) $\frac{4}{7}-\frac{3}{8}=$

22) $\frac{6}{12}+\frac{1}{2}=$

23) $\frac{8}{9}-\frac{2}{3}=$

24) $\frac{12}{16}+\frac{5}{8}=$

25) $\frac{3}{7}-\frac{1}{6}=$

26) $\frac{4}{5}-\frac{6}{10}=$

27) $\frac{2}{13}+\frac{2}{3}=$

Adding and subtracting mixed numbers

A mixed number has a whole number followed by a fraction:

$1\frac{1}{3}$, $2\frac{5}{8}$, $176\frac{1}{2}$, and $8\frac{6}{7}$ are examples of mixed numbers

When adding or subtracting mixed numbers, use the procedure from page 7.

Note: Don't forget to add or subtract the whole numbers.

Ex. 1: $1\frac{1}{2}+2\frac{1}{3}=?$

$$1\frac{1}{2}=1\frac{3}{6}$$
$$+\ 2\frac{1}{3}=2\frac{2}{6}$$
$$3\frac{5}{6}$$

Ex. 2: $6\frac{1}{8}+5=?$

$$6\frac{1}{8}$$
$$+\ 5$$
$$11\frac{1}{8}$$

Ex. 3: $5\frac{1}{3}+\frac{3}{5}=?$

$$5\ \frac{1}{3}=5\ \frac{5}{15}$$
$$+\ \frac{3}{5}=\ \frac{9}{15}$$
$$5\ \frac{14}{15}$$

Ex. 4: $3\frac{6}{9}-1\frac{1}{2}=?$

$$3\ \frac{6}{9}=3\ \frac{12}{18}$$
$$-\ 1\ \frac{1}{2}=1\ \frac{9}{18}$$
$$2\frac{3}{18}=2\frac{1}{6}$$

When mixed numbers cannot be subtracted because the bottom fraction is larger than the top fraction, BORROW so that the fractions can be subtracted from each other.

Ex. 5: $8-2\frac{3}{4}=?$

$$8\ =7\ \frac{4}{4}$$
$$-\ 2\frac{3}{4}=2\frac{3}{4}$$
$$5\frac{1}{4}$$

The $\frac{3}{4}$ cannot be subtracted from nothing. One was borrowed from the 8 and changed to $\frac{4}{4}$. 8 was changed to a 7.Now the mixed numbers can be subtracted from each other.

Ex. 6: $5\frac{1}{6}-2\frac{1}{3}=?$

$$5\frac{1}{6}=\ 5\ \frac{1}{6}=\ 4\frac{7}{6}$$
$$-\ 2\frac{1}{3}=2\frac{2}{6}=\ 2\frac{2}{6}$$
$$2\frac{5}{6}$$

The $\frac{2}{6}$ cannot be subtracted from the $\frac{1}{6}$. One was borrowed from the 5, changed to $\frac{6}{6}$ and then added to the $\frac{1}{6}$ to make $\frac{7}{6}$. The whole number 5 was changed to a 4. Now the mixed numbers can be subtracted.

Exercise 5 (answers on page 41)

Add or subtract the following mixed numbers. Simplify and reduce when possible.

1) $8\frac{4}{5}+8\frac{1}{10}=$

2) $1\frac{2}{3}+\frac{3}{7}=$

3) $16\frac{5}{8}+\frac{11}{12}=$

4) $3\frac{4}{5}+6\frac{2}{3}+5\frac{11}{15}=$

5) $1\frac{11}{12}-\frac{2}{3}=$

6) $4\frac{1}{8}-1=$

7) $5\frac{1}{6}-2\frac{1}{3}=$

8) $14\frac{1}{2}-2\frac{1}{8}=$

9) $7\frac{2}{5}+1\frac{1}{5}=$

10) $2\frac{2}{3}-\frac{1}{4}=$

11) $12\frac{1}{7}-8\frac{2}{3}=$

12) $4\frac{4}{7}-3\frac{6}{7}=$

13) $16\frac{5}{6}-2\frac{1}{3}=$

14) $14-2\frac{1}{9}=$

15) $146+8\frac{1}{5}=$

16) $5\frac{5}{6}+\frac{10}{12}=$

17) $6-4\frac{7}{8}=$

18) $11\frac{3}{5}-5=$

19) $\frac{2}{3}+7=$

20) $2\frac{4}{8}+1\frac{2}{3}=$

21) $100-4\frac{3}{8}=$

Fraction Word Problems (Addition/Subtraction)

When solving word problems, make sure to UNDERSTAND THE QUESTION. Look for bits of information that will help get to the answer. Keep in mind that some sentences may not have key words or key words might even be misleading. USE COMMON SENSE when thinking about how to solve word problems. The first thing you think of might be the best way to solve the problem.

Here are some KEY WORDS to look for in word problems:

Sum, total, more than: mean to add

Difference, less than, how much more than: mean to subtract

Ex. 1: If brand X can of beans weighs $15\frac{1}{2}$ ounces and brand Y weighs $12\frac{3}{4}$ ounces, how much larger is the brand X can?

means to subtract

$$15\frac{1}{2} = 15\frac{2}{4} = 14\frac{6}{4}$$
$$-12\frac{3}{4} = 12\frac{3}{4} = 12\frac{3}{4}$$
$$2\frac{3}{4}$$

Borrow from the whole number and add to the fraction

Ex. 2: Find the total snowfall for this year if it snowed $\frac{1}{10}$ inch in November, $2\frac{1}{3}$ inches in December and $1\frac{3}{4}$ inches in January.

means to add

$$\frac{1}{10} = \frac{6}{60}$$
$$2\frac{1}{3} = 2\frac{20}{60}$$
$$+1\frac{3}{4} = 1\frac{45}{60}$$
$$3\frac{71}{60} = 4\frac{11}{60}$$

Simplify.

Exercise 6 (answers on page 41)

Solve the following add/subtract fraction word problems

1. Find the total width of 3 boards that $1\frac{3}{4}$ inches wide, $\frac{7}{8}$ inch wide, and $1\frac{1}{2}$ inches wide.

2. A 7.15H tire is $6\frac{5}{8}$ inches wide and a 7.15C tire is $4\frac{3}{4}$ inches wide. What is the difference in their widths?

3. A patient is given $1\frac{1}{2}$ teaspoons of medicine in the morning and $2\frac{1}{4}$ teaspoons at night. How many teaspoons total does the patient receive daily?

4. $3\frac{1}{3}$ feet are cut off a board that is $12\frac{1}{4}$ feet long. How long is the remaining part of the board?

5. $\frac{3}{8}$ of the corn in the U.S. is grown in Iowa. $\frac{1}{4}$ of it is grown in Nebraska. How much of the corn supply is grown in the two states?

6. A runner jogs $7\frac{1}{5}$ miles east, $5\frac{1}{4}$ miles south, and $8\frac{2}{3}$ miles west. How far has she jogged?

7. If $3\frac{1}{2}$ ounce of cough syrup is used from a $9\frac{1}{4}$ ounce bottle, how much is left?

8. I set a goal to drink 64 ounces of water a day. If I drink $10\frac{1}{3}$ ounces in the morning, $15\frac{1}{2}$ ounces at noon, and $20\frac{5}{6}$ ounces at dinner, how many more ounces of water do I have to drink to reach my goal for the day?

9. Three sides of parking lot are measured to the following lengths: $108\frac{1}{4}$ feet, $162\frac{3}{8}$ feet, and $143\frac{1}{2}$ feet. If the distance around the lot is $518\frac{15}{16}$ feet, find the fourth side.

10. Gabriel wants to make five banners for the parade. He has 75 feet of material. The size of four of the banners are: $12\frac{1}{3}$ ft., $16\frac{1}{6}$ ft., $11\frac{3}{4}$ ft., and $14\frac{1}{2}$ ft. How much material is left for the fifth banner?

Answer to Intro to Fractions

Exercise 1	Exercise 2	Exercise 3	Exercise 4	Exercise 5
1. $\frac{2}{5}$	1. $\frac{11}{16}$	1. $\frac{3}{4}$	1. $\frac{7}{9}$	1. >
2. $\frac{1}{4}$	2. $\frac{9}{20}$	2. $\frac{4}{5}$	2. $\frac{4}{5}$	2. >
3. $\frac{11}{12}$	3. $\frac{14}{25}$	3. $\frac{7}{9}$	3. $\frac{1}{2}$	3. <
4. $\frac{3}{5}$	4. $\frac{26}{36}$	4. $\frac{4}{5}$	4. $\frac{2}{25}$	4. =
5. $\frac{20}{50}$		5. $\frac{1}{2}$	5. $\frac{4}{5}$	5. <
6. $\frac{11}{25}$		6. $\frac{2}{3}$	6. $\frac{3}{4}$	
7. $\frac{7}{12}$			7. $\frac{8}{9}$	
8. $\frac{8}{24}$			8. $\frac{7}{9}$	
			9. $\frac{3}{4}$	
Exercise 6	**Exercise 7**	**Exercise 8**	10. $\frac{12}{17}$	
1. $\frac{47}{8}$	1. $3\frac{3}{8}$	1. $6\frac{1}{2}$	11. $\frac{1}{3}$	
2. $\frac{29}{3}$	2. $2\frac{3}{5}$	2. $6\frac{2}{3}$	12. $\frac{2}{3}$	
3. $\frac{5}{2}$	3. $11\frac{5}{8}$	3. $5\frac{1}{2}$	**Exercise 9**	
4. $\frac{9}{8}$	4. $9\frac{3}{7}$	4. $2\frac{3}{4}$	1) 2	6) 2
5. $\frac{27}{2}$	5. $12\frac{1}{2}$	5. $3\frac{1}{3}$	2) 1	
6. $\frac{31}{4}$			3) 1	
7. $\frac{62}{5}$			4) 1	
8. $\frac{86}{9}$			5) 1	

Answer to Multiplication and Division of Fractions

Exercise 1	Exercise 2	Exercise 3	Exercise 4	Exercise 5
1. $\frac{1}{12}$	1. $2\frac{5}{8}$	1. $\frac{4}{5}$	1. $2\frac{4}{9}$	1. 12 boards
2. $\frac{2}{5}$	2. $12\frac{3}{5}$	2. $1\frac{4}{5}$	2. $3\frac{1}{9}$	2. 26 revolutions
3. $\frac{6}{11}$	3. $8\frac{1}{8}$	3. 3	3. $2\frac{16}{19}$	3. $41\frac{1}{4}$ turns
4. $\frac{2}{3}$	4. $1\frac{1}{16}$	4. $2\frac{4}{7}$	4. $\frac{9}{28}$	4. 15 books
5. $\frac{1}{15}$	5. $2\frac{27}{32}$	5. $2\frac{2}{5}$	5. $13\frac{3}{5}$	5. 36 yards
6. $\frac{15}{28}$	6. $5\frac{1}{3}$	6. $\frac{2}{3}$	6. 10	6. $27\frac{5}{8}$ pounds
7. $\frac{35}{72}$	7. $9\frac{5}{8}$	7. $3\frac{1}{2}$	7. $4\frac{4}{11}$	7. $2\frac{1}{4}$ pounds
8. 2	8. 14	8. $1\frac{1}{5}$	8. $1\frac{13}{14}$	8. 250 sheets
9. 5	9. 60	9. $\frac{2}{3}$	9. $1\frac{15}{32}$	9. 520 pages
10. 5	10. $3\frac{25}{54}$	10. $1\frac{1}{2}$	10. 1	10. 8 pizzas
11. 4	11. 60	11. $\frac{7}{9}$	11. $1\frac{2}{3}$	
12. $\frac{3}{4}$	12. $10\frac{2}{3}$	12. $\frac{64}{81}$	12. $1\frac{21}{79}$	
13. $\frac{21}{26}$		13. $5\frac{1}{3}$		
14. $\frac{2}{9}$		14. 12		
15. $\frac{3}{8}$		15. $\frac{3}{16}$		
16. $\frac{46}{51}$				
17. $\frac{5}{24}$				
18. $\frac{9}{20}$				

Answers to Addition and Subtraction of Fractions

Exercise 1	Exercise 2	Exercise 3	Exercise 4	Exercise 5	Exercise 6
1) 6	1) 5	1) $1\frac{1}{5}$	1) $\frac{5}{7}$	1) $16\frac{9}{10}$	1) $4\frac{1}{8}$ inches
2) 15	2) 10	2) $1\frac{1}{4}$	2) $\frac{5}{7}$	2) $2\frac{2}{21}$	2) $1\frac{7}{8}$ inches
3) 8	3) 10	3) $2\frac{1}{3}$	3) $\frac{2}{3}$	3) $17\frac{13}{24}$	3) $3\frac{3}{4}$ teaspoons
4) 12	4) 9	4) $1\frac{2}{3}$	4) $\frac{17}{20}$	4) $16\frac{1}{5}$	4) $8\frac{11}{12}$ feet
5) 35	5) 8	5) 2	5) $1\frac{1}{6}$	5) $1\frac{1}{4}$	5) $\frac{5}{8}$
6) 9	6) 15	6) $1\frac{1}{2}$	6) $1\frac{3}{10}$	6) $3\frac{1}{8}$	6) $21\frac{7}{60}$ miles
7) 4	7) 1	7) 5	7) 1	7) $2\frac{5}{6}$	7) $5\frac{3}{4}$ ounces
8) 40	8) 3	8) $1\frac{2}{3}$	8) $1\frac{5}{24}$	8) $12\frac{3}{8}$	8) $17\frac{1}{3}$ ounces
9) 30	9) 4	9) $4\frac{3}{4}$	9) $1\frac{4}{9}$	9) $8\frac{3}{5}$	9) $104\frac{13}{16}$ feet
10) 15	10) 1	10) $4\frac{3}{5}$	10) $\frac{1}{4}$	10) $2\frac{5}{12}$	10) $20\frac{1}{4}$ ft.
11) 6	11) 1	11) 6	11) $\frac{4}{15}$	11) $3\frac{10}{21}$	
12) 16	12) 1	12) $3\frac{2}{5}$	12) $\frac{5}{24}$	12) $\frac{5}{7}$	
13) 24	13) 10	13) $4\frac{1}{9}$	13) $\frac{1}{6}$	13) $14\frac{1}{2}$	
14) 42	14) 1	14) $3\frac{1}{2}$	14) $\frac{7}{22}$	14) $11\frac{8}{9}$	
15) 120	15) 2	15) $5\frac{2}{9}$	15) $\frac{1}{12}$	15) $154\frac{1}{5}$	
	16) 3	16) $26\frac{1}{2}$	16) $\frac{1}{6}$	16) $6\frac{2}{3}$	
	17) 8	17) $8\frac{1}{2}$	17) $\frac{7}{12}$	17) $1\frac{1}{8}$	
	18) 10	18) 7	18) $\frac{17}{30}$	18) $6\frac{3}{5}$	
	19) 1	19) $16\frac{1}{5}$	19) $\frac{3}{5}$	19) $7\frac{2}{3}$	
	20) 1	20) $7\frac{3}{5}$	20) $\frac{23}{30}$	20) $4\frac{1}{6}$	
	21) 1	21) $17\frac{1}{3}$	21) $\frac{11}{56}$	21) $95\frac{5}{8}$	
			22) 1		
			23) $\frac{2}{9}$		
			24) $1\frac{3}{8}$		
			25) $\frac{11}{42}$		
			26) $\frac{1}{5}$		
			27) $\frac{32}{39}$		

Answer to Ordering Fractions

Exercise A

1. $\frac{3}{7}, \frac{2}{3}, \frac{3}{4}$
2. $\frac{3}{28}, \frac{1}{7}, \frac{3}{14}$

Exercise B

1. $\frac{3}{4}, \frac{8}{11}, \frac{13}{22}$
2. $\frac{7}{8}, \frac{35}{64}, \frac{5}{16}$