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Chapter 10: Geometry

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Foreword

Math Mammoth Grade 3 comprises a complete math curriculum for third grade mathematics studies. The curriculum meets and exceeds the Common Core standards.

The main areas of study in Math Mammoth Grade 3 are:

1. Students develop an understanding of multiplication and division of whole numbers through problems involving equal-sized groups, arrays, and area models. They learn the relationship between multiplication and division, and solve many word problems involving multiplication and division (chapters 3, 4, and 8).
2. Students develop an understanding of fractions, beginning with unit fractions. They compare fractions by using visual models and strategies based on noticing equal numerators or denominators (chapter 11).
3. Students learn the concepts of area and perimeter. They relate area to multiplication and to addition, recognize perimeter as a linear measure (in contrast with area), and solve problems involving area and perimeter (chapter 10).
4. Students fluently add and subtract within 1,000, both mentally and in columns. They also learn to add and subtract four-digit numbers, and use addition and subtraction in problem solving in many contexts, such as with money, time, and geometry (chapters 1, 2, and 7).

Additional topics we study are time, money, measuring, and graphs.

This book, 3-B, covers place value (chapter 7), division (chapter 8), measurement (chapter 9), geometry (chapter 10), and fractions (chapter 11). The rest of the topics are in the 3-A worktext.

I heartily recommend that you read the full user guide in the following pages.

I wish you success in teaching math!

Maria Miller, the author

User Guide

Note: You can also find the information that follows online, at **https://www.mathmammoth.com/userguides/** .

The Common Core Standards documentation is available at:
https://www.mathmammoth.com/preview/standards/MathMammoth_CommonCore_Alignment_Grade3_2024ed.pdf

Basic principles in using Math Mammoth Complete Curriculum

Math Mammoth is mastery-based, which means it concentrates on a few major topics at a time, in order to study them in depth. The two books (parts A and B) are like a "framework", but you still have a lot of liberty in planning your child's studies. You can even use it in a *spiral* manner, if you prefer. Simply have your student study in 2-3 chapters simultaneously. In third grade, I suggest studying chapters 1-4 in order, but you can be flexible with the other chapters and schedule them earlier or later.

Math Mammoth is not a scripted curriculum. In other words, it is not spelling out in exact detail what the teacher is to do or say. Instead, Math Mammoth gives you, the teacher, various tools for teaching:

- **The two student worktexts** (parts A and B) contain all the lesson material and exercises. They include the explanations of the concepts (the teaching part) in blue boxes. The worktexts also contain some advice for the teacher in the "Introduction" of each chapter.

  The teacher can read the teaching part of each lesson before the lesson, or read and study it together with the student in the lesson, or let the student read and study on his own. If you are a classroom teacher, you can copy the examples from the "blue teaching boxes" to the board and go through them on the board.

- There are hundreds of **videos** matched to the curriculum available at https://www.mathmammoth.com/videos/ . There isn't a video for every lesson, but there are dozens of videos for each grade level. You can simply have the author teach your child or student!

- Don't automatically assign all the exercises. Use your judgment, trying to assign just enough for your student's needs. You can use the skipped exercises later for review. For most students, I recommend to start out by assigning about half of the available exercises. Adjust as necessary.

- Each chapter introduction contains a **list of links to various free online games** and activities. These games can be used to supplement the math lessons, for learning math facts, or just for some fun.

- The student books contain some **mixed review lessons**, and the curriculum also provides you with additional **cumulative review lessons**.

- There is a **chapter test** for each chapter of the curriculum, and a comprehensive end-of-year test.

- The **worksheet maker** allows you to make additional worksheets for most calculation-type topics in the curriculum. This is a single html file. You will need Internet access to be able to use it.

- You can use the free online exercises at https://www.mathmammoth.com/practice/
  This is an expanding section of the site, so check often to see what new topics we are adding to it!

- Some grade levels have **cut-outs** to make fraction manipulatives or geometric solids.

- And of course there are answer keys to everything.

How to get started

Have ready the first lesson from the student worktext. Go over the first teaching part (within the blue boxes) together with your child. Go through a few of the first exercises together, and then assign some problems for your child to do on their own.

Repeat this if the lesson has other blue teaching boxes. Naturally, you can also use the videos at https://www.mathmammoth.com/videos/

Many students can eventually study the lessons completely on their own — the curriculum becomes self-teaching. However, students definitely vary in how much they need someone to be there to actually teach them.

Pacing the curriculum

Each chapter introduction contains a suggested pacing guide for that chapter. You will see a summary on the right. (This summary does not include time for optional tests.)

Most lessons are 2 or 3 pages long, intended for one day. Some 3-page lessons can take two days. Some lessons are 4-5 pages and can be covered in two days. There are also a few optional lessons (not included in the tables on the right).

It can also be helpful to calculate a general guideline as to how many pages per week the student should cover in order to go through the curriculum in one school year.

Worktext 3-A	
Chapter 1	10 days
Chapter 2	14 days
Chapter 3	13 days
Chapter 4	19 days
Chapter 5	14 days
Chapter 6	10 days
TOTAL	**80 days**

Worktext 3-B	
Chapter 7	11 days
Chapter 8	11 days
Chapter 9	11 days
Chapter 10	22 days
Chapter 11	15 days
TOTAL	**70 days**

The table below lists how many pages there are for the student to finish in this particular grade level, and gives you a guideline for how many pages per day to finish, assuming a 180-day (36-week) school year. The page count in the table below *includes* the optional lessons.

Example:

Grade level	School days	Days for tests and reviews	Lesson pages	Days for the student book	Pages to study per day	Pages to study per week
3-A	93	12	205	81	2.5	12.7
3-B	87	10	193	77	2.5	12.5
Grade 3 total	180	22	398	158	2.5	12.6

The table below is for you to fill in. Allow several days for tests and additional review before tests — I suggest at least twice the number of chapters in the curriculum. Then, to get a count of "pages to study per day", **divide the number of lesson pages by the number of days for the student book**. Lastly, multiply this number by 5 to get the approximate page count to cover in a week.

Grade level	Number of school days	Days for tests and reviews	Lesson pages	Days for the student book	Pages to study per day	Pages to study per week
3-A						
3-B						
Grade 3 total						

Now, something important. Whenever the curriculum has lots of similar practice problems (a large set of problems), feel free to **only assign 1/2 or 2/3 of those problems**. If your student gets it with less amount of exercises, then that is perfect! If not, you can always assign the rest of the problems for some other day. In fact, you could even use these unassigned problems the next week or next month for some additional review.

In general, 1st-2nd graders might spend 25-40 minutes a day on math. Third-fourth graders might spend 30-60 minutes a day. Fifth-sixth graders might spend 45-75 minutes a day. If your student finds math enjoyable, they can of course spend more time with it! However, it is not good to drag out the lessons on a regular basis, because that can then affect the student's attitude towards math.

Working space, the usage of additional paper and mental math

The curriculum generally includes working space directly on the page for students to work out the problems. However, feel free to let your students use extra paper when necessary. They can use it, not only for the "long" algorithms (where you line up numbers to add, subtract, multiply, and divide), but also to draw diagrams and pictures to help organize their thoughts. Some students won't need the additional space (and may resist the thought of extra paper), while some will benefit from it. Use your discretion.

Some exercises don't have any working space, but just an empty line for the answer (e.g. 200 + _____ = 1,000). Typically, I have intended that such exercises to be done using MENTAL MATH.

However, there are some students who struggle with mental math (often this is because of not having studied and used it in the past). As always, the teacher has the final say (not me!) as to how to approach the exercises and how to use the curriculum. We do want to prevent extreme frustration (to the point of tears). The goal is always to provide SOME challenge, but not too much, and to let students experience success enough so that they can continue enjoying learning math.

Students struggling with mental math will probably benefit from studying the basic principles of mental calculations from the earlier levels of Math Mammoth curriculum. To do so, look for lessons that list mental math strategies. They are taught in the chapters about addition, subtraction, place value, multiplication, and division. My article at https://www.mathmammoth.com/lessons/practical_tips_mental_math also gives you a summary of some of those principles.

Using tests

For each chapter, there is a **chapter test**, which can be administered right after studying the chapter. **The tests are optional.** Some families might prefer not to give tests at all. The main reason for the tests is for diagnostic purposes, and for record keeping. These tests are not aligned or matched to any standards.

In the digital version of the curriculum, the tests are provided both as PDF files and as html files. Normally, you would use the PDF files. The html files are included so you can edit them (in a word processor such as Word or LibreOffice), in case you want your student to take the test a second time. Remember to save the edited file under a different file name, or you will lose the original.

The end-of-year test is best administered as a diagnostic or assessment test, which will tell you how well the student remembers and has mastered the mathematics content of the entire grade level.

Using cumulative reviews and the worksheet maker

The student books contain mixed review lessons which review concepts from earlier chapters. The curriculum also comes with additional cumulative review lessons, which are just like the mixed review lessons in the student books, with a mix of problems covering various topics. These are found in their own folder in the digital version, and in the Tests & Cumulative Reviews book in the print version.

The cumulative reviews are optional; use them as needed. They are named indicating which chapters of the main curriculum the problems in the review come from. For example, "Cumulative Review, Chapter 4" includes problems that cover topics from chapters 1-4.

Both the mixed and cumulative reviews allow you to spot areas that the student has not grasped well or has forgotten. When you find such a topic or concept, you have several options:

1. Check if the worksheet maker lets you make worksheets for that topic.
2. Check for any online games and resources in the Introduction part of the particular chapter in which this topic or concept was taught.
3. If you have the digital version, you could simply reprint the lesson from the student worktext, and have the student restudy that.
4. Perhaps you only assigned 1/2 or 2/3 of the exercise sets in the student book at first, and can now use the remaining exercises.
5. Check if our online practice area at https://www.mathmammoth.com/practice/ has something for that topic.
6. Khan Academy has free online exercises, articles, and videos for most any math topic imaginable.

Concerning challenging word problems and puzzles

While this is not absolutely necessary, I heartily recommend supplementing Math Mammoth with challenging word problems and puzzles. You could do that once a month, for example, or more often if the student enjoys it.

The goal of challenging story problems and puzzles is to **develop the student's logical and abstract thinking and mental discipline**. I recommend starting these in fourth grade, at the latest. Then, students are able to read the problems on their own and have developed mathematical knowledge in many different areas. Of course I am not discouraging students from doing such in earlier grades, either.

Math Mammoth curriculum contains lots of word problems, and they are usually multi-step problems. Several of the lessons utilize a bar model for solving problems. Even so, the problems I have created are usually tied to a specific concept or concepts. I feel students can benefit from solving problems and puzzles that require them to think "out of the box" or are just different from the ones I have written.

I recommend you use the free Math Stars problem-solving newsletters as one of the main resources for puzzles and challenging problems:

Math Stars Problem Solving Newsletter (grades 1-8)
https://www.homeschoolmath.net/teaching/math-stars.php

I have also compiled a list of other resources for problem solving practice, which you can access at this link:

https://l.mathmammoth.com/challengingproblems

Another idea: you can find puzzles online by searching for "brain puzzles for kids," "logic puzzles for kids" or "brain teasers for kids."

Frequently asked questions and contacting us

If you have more questions, please first check the FAQ at https://www.mathmammoth.com/faq-lightblue

If the FAQ does not cover your question, you can then contact us using the contact form at the Math

Chapter 7: Four-Digit Numbers
Introduction

This chapter focuses on four-digit numbers. The first lessons cover place value and comparing four-digit numbers. The rest of the chapter deals with addition, subtraction, and word problems.

First, students learn to write and read four-digit numbers. Then they learn about the concept of place value, write numbers in expanded form, and place them on number lines. One lesson is spent comparing numbers.

Then we turn our attention to addition and subtraction, first using mental math. The lessons on mental math stress the similarities between adding and subtracting four-digit numbers and adding and subtracting smaller numbers. This helps build number sense.

Several lessons are spent on adding and subtracting four-digit numbers in columns and practicing regrouping. Students also solve a variety of word problems involving four-digit numbers along the way.

Overall, this chapter is probably fairly easy for most students in the fact it mostly has to do with place value, addition, and subtraction. I advise that you do not assign all the exercises by default. Use your judgment, and strive to vary the number of assigned exercises according to the student's needs.

Good Mathematical Practices

- This chapter has lots of opportunities to focus on accuracy (precision) and checking one's own work. Addition problems can be checked by adding each column in a different order. Subtraction problems can be checked by adding. Sometimes children hurry through their work and thus make mistakes. Don't assign so much work that it creates time-related stress. Less can be more! Emphasize to your student(s) that they can take time to compute carefully, and to check their own work.

Note Concerning the Common Core Standards (CCS)

The CCS specify that in grade 2, students learn numbers up to 1,000, and that in grade 4, students learn numbers up to 1 million. There is no mention of studying numbers and place value in grade 3; however I have decided to include 4-digit numbers here (numbers up to 10,000). I feel a more gradual progression towards large numbers is easier for students.

The topics of this chapter therefore technically belong to fourth grade. This entire chapter can be safely omitted without affecting the subsequent chapters in third grade.

However, keep in mind the following. Chapter 1 of Math Mammoth Grade 4 curriculum (2020 edition) has a few exercises that use four-digit numbers. Also, and the coverage of large numbers in Chapter 2 of Math Mammoth Grade 4 (2020 edition) picks up where this chapter leaves off. If you want or need to delay this topic till fourth grade, you could use some or all of these lessons as part of studying chapter 2 in grade 4.

Pacing Suggestion for Chapter 7

This table does not include the chapter test as it is found in a different book (or file).
Please add one day to the pacing for the test if you use it.

Games and Activities

Making Numbers

You need: Base-ten blocks (manipulatives)

Ask the child to make a particular four-digit number using the manipulatives, such as 2,308. Take turns, so that the child will tell you a number to make. Occasionally, when you make the number with the blocks, make a mistake on purpose so that the child can find it.

9-Card Draw to a Target

You need: Number cards from 0 through 9. (Standard playing cards work if you make, say, the ten to be zero. Or, play with numbers 1-9.) Paper and pencil for each player.

Game play: Choose a target number from 3000, 4000, 5000, 6000, or 7000 (using a target number that is not a multiple of 1000 will make it more challenging). Choose whether to use addition or subtraction.

Each player takes nine cards from the deck, and uses those to form two four-digit numbers to add or subtract (one card is left unused). Each player adds or subtracts the two numbers they formed, using paper & pencil or mental math. (Once you figure out the basic strategy for the game, mental math works much better.) The player closest to the target wins a point for that round.

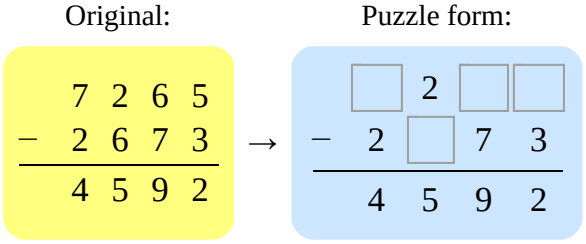
The player with the highest number of points after, say, five rounds, wins.

*This game is adapted from **https://www.earlyfamilymath.org** and published here with permission.*

Missing Number Puzzles

Create puzzles for your student(s) by making an addition or subtraction problem, and leaving out some of the digits. See an example on the right.

For this chapter, use four-digit addition and four-digit subtraction problems that involve regrouping.



You can also reverse the roles, and have your student make these types of puzzles for you to solve. Have your student check your work — and sometimes, make an intentional mistake for them to find!

*This activity is from **https://www.earlyfamilymath.org** and published here with permission.*

Games and Activities at Math Mammoth Practice Zone

Make Number Sentences
You're given numbers (in flowers), and an answer to a math sentence. Drag two flowers to the empty slots so that the math sentence is true. Choose addition and/or subtraction, and number ranges within four-digit numbers.
https://www.mathmammoth.com/practice/number-sentences

Vertical Addition Color-Grid Game
Practice vertical (column) addition with this fun and colorful online game! Choose a maximum of 9000 and 2-4 addends to practice four-digit additions.
https://www.mathmammoth.com/practice/vertical-addition

Vertical Subtraction Color-Grid Game
Practice vertical (column) subtraction with this colorful online game! Choose a maximum of 9999 for the numbers to practice four-digit subtractions.
https://www.mathmammoth.com/practice/vertical-subtraction

Helpful Resources on the Internet

We have compiled a list of Internet resources that match the topics in this chapter, including pages that offer:

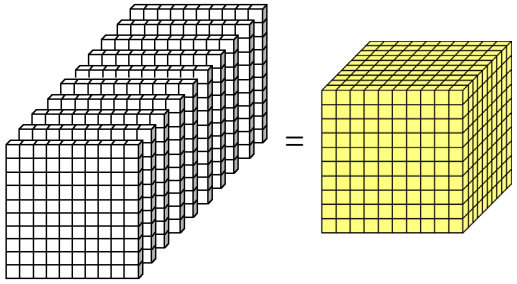
- **online practice** for concepts;
- online **games**, or occasionally, printable games;
- **animations** and interactive **illustrations** of math concepts;
- **articles** that teach a math concept.

We heartily recommend you take a look! Many of our customers love using these resources to supplement the bookwork. You can use these resources as you see fit for extra practice, to illustrate a concept better and even just for some fun. Enjoy!

https://l.mathmammoth.com/2024/gr3ch7

Scan me

Thousands

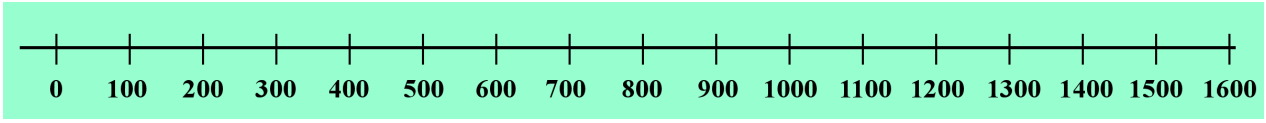


10 hundreds = 1,000

When we stack 10 hundred-flats end-to-end, we get *one thousand.*

Ten hundreds = One thousand.

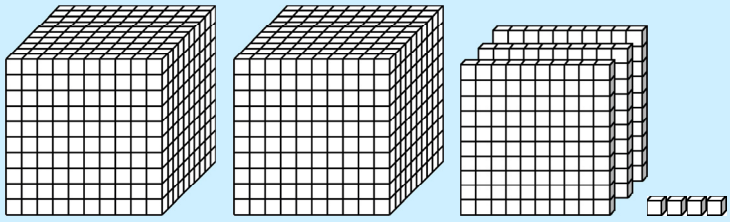
We write one thousand as 1000 or 1,000. The comma is used to separate the "1" of the thousands from the other digits. It just makes it easier to read.



On this number line, you see only whole hundreds (multiples of hundred) marked. In between each two marks are 99 numbers. Imagine 99 little lines between 300 and 400, for example!

When counting by 100, after 900 comes "ten hundreds" or A THOUSAND (1,000).

If we continue skip-counting by 100 from 1,000, we get: *one thousand one hundred*, *one thousand two hundred*, *one thousand three hundred*, and so on. People often read these numbers this way: *eleven hundred*, *twelve hundred*, *thirteen hundred*, and so on.



2,304

two thousand three hundred four

Here you see two thousands, three hundreds, no tens, and four ones (units).

We write it as 2,304.

Six thousand eighteen

thou-sands	hund-reds	tens	ones
6	0	1	8

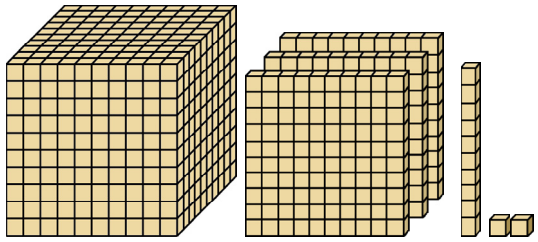
Numbers with four digits are very easy to read. The first digit is in the thousands place. Just read it as "one thousand", "two thousand", "five thousand", and so on.

Read the rest of the digits just like you are used to reading three-digit numbers.

1. (Optional) Do the activity **Making Numbers**. (See the chapter introduction.)

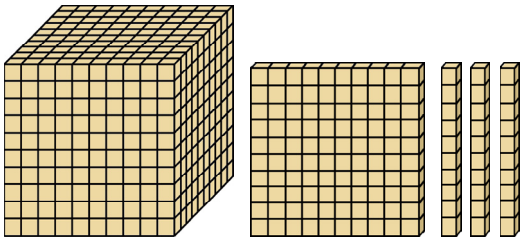
2. Write the numbers shown by the models. Note: sometimes you will need to use a zero.

a.



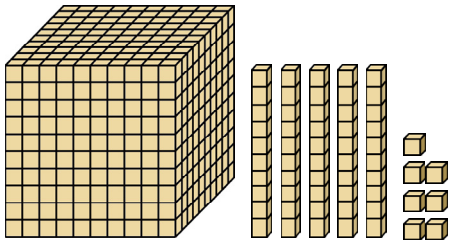
thou-sands	hund-reds	tens	ones

b.



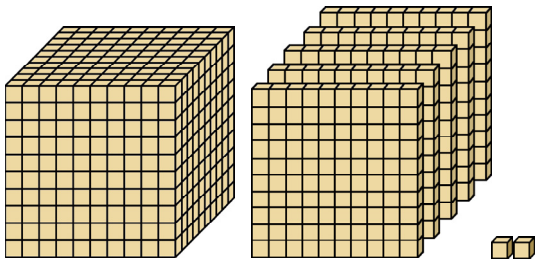
thou-sands	hund-reds	tens	ones

c.



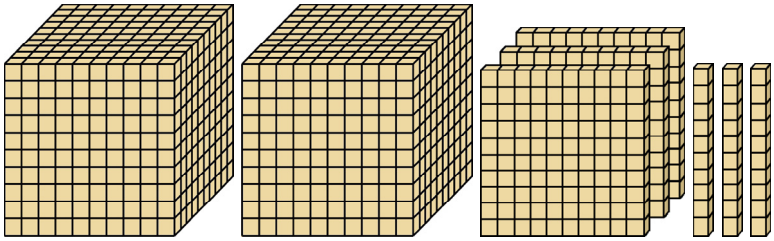
thou-sands	hund-reds	tens	ones

d.



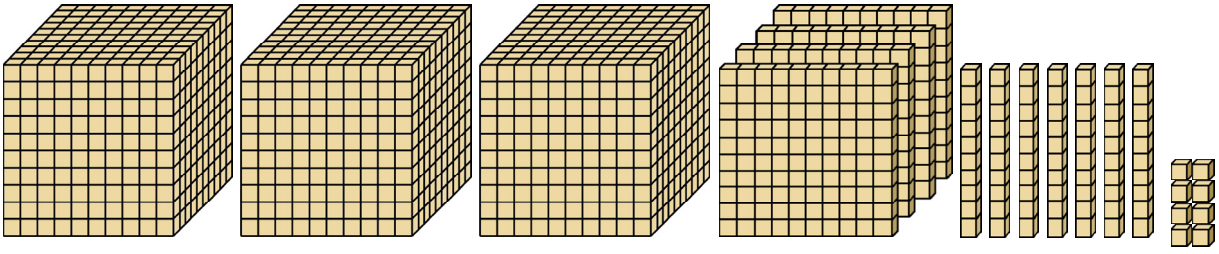
thou-sands	hund-reds	tens	ones

e.



thou-sands	hund-reds	tens	ones

f.



thou-sands	hund-reds	tens	ones

3. Fill in.

a. One thousand two hundred fifty-six

thou-sands	hund-reds	tens	ones
1	2	5	6

b. Three thousand five hundred ninety-four

thou-sands	hund-reds	tens	ones

c. Four thousand six hundred seventeen

thou-sands	hund-reds	tens	ones

d. Nine thousand eight hundred twenty-two

thou-sands	hund-reds	tens	ones

e. Six thousand two hundred eleven

thou-sands	hund-reds	tens	ones

f. Five thousand seven hundred ninety-nine

thou-sands	hund-reds	tens	ones

4. Fill in. Now you will need to use a zero or zeros, so be careful!

a. One thousand one

thou-sands	hund-reds	tens	ones
1	0	0	1

b. Two thousand five

thou-sands	hund-reds	tens	ones

c. Four thousand sixty-one

thou-sands	hund-reds	tens	ones

d. Three thousand twelve

thou-sands	hund-reds	tens	ones

e. Six thousand two hundred

thou-sands	hund-reds	tens	ones

f. Five thousand ninety

thou-sands	hund-reds	tens	ones

g. One thousand one hundred three

thou-sands	hund-reds	tens	ones

h. Seven thousand five hundred six

thou-sands	hund-reds	tens	ones

i. Five thousand eight hundred

thou-sands	hund-reds	tens	ones

j. Two thousand eleven

thou-sands	hund-reds	tens	ones

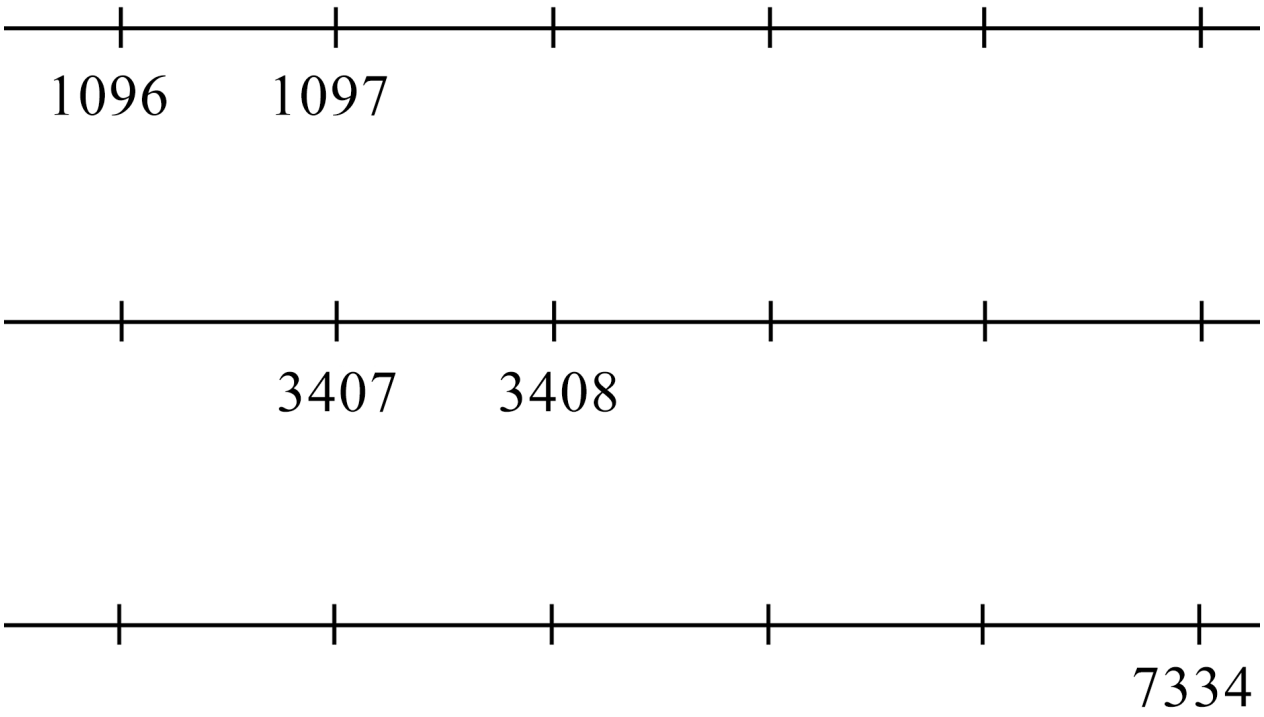
k. Two thousand three hundred twenty

thou-sands	hund-reds	tens	ones

l. Nine thousand thirty-two

thou-sands	hund-reds	tens	ones

5. Fill in the numbers for these number lines.



6. Fill in the number chart, counting by tens.

4010	4020			
4060				

7. Fill in another number chart, counting by tens.

		8680	8690	

Four-Digit Numbers and Place Value

Let's look at the number 2467 in detail.

The 2, 4, 6, and 7 are called the ***digits*** of the number.

Each digit has its own **place** (location) in the number:

- 2 is in the thousands place,
- 4 is in the hundreds place,
- 6 is in the tens place, and
- 7 is in the ones (units) place.

thou-sands	hund-reds	tens	ones
2	4	6	7

2000 + 400 + 60 + 7

Each digit also has a different **value** in the number.

- The value of digit 2 in this number is 2000.
- The value of the digit 4 is 400.
- The value of the digit 6 is 60.
- The value of the digit 7 is just 7.

So, each digit of a number has both a specific place and a specific value. That is why the way we write numbers is called a **place value system**.

The number 2467 is actually the sum (addition) of the values of the digits: it equals 2000 + 400 + 60 + 7.

Examples. Here, each number is written as a sum, according to the places and values of its digits. It is like writing each number out in full, using its parts: the thousands, the hundreds, the tens, and the ones. **Note!** When there are *no* hundreds, tens, or ones, we **write a zero**.

thou-sands	hund-reds	tens	ones
1	0	9	0

1000 + 0 + 90 + 0

thou-sands	hund-reds	tens	ones
5	6	0	2

5000 + 600 + 0 + 2

1. Fill in the blanks.

thou-sands	hund-reds	tens	ones
5	2	5	9

a. 5,000 + _____ + 50 + ____

thou-sands	hund-reds	tens	ones
7	0	8	2

b. 7,000 + 0 + _____ + ____

(This page intentionally left blank.)

Add and Subtract Four-Digit Numbers 2

Example: This is how you can add 5,670 + 20 using mental math. The second number, 20, is two tens. This means we simply add two tens to the 7 tens that 5,670 has. We get 70 + 20 = 90. The sum is 5,670 + 20 = 5,690.

You can also see this idea if we write the 20 under the 5,670, lining up the digits by their places (ones under the ones, tens under the tens, etc.) The 7 tens and the 2 tens get added.

$$\begin{array}{r} 5\,6\,7\,0 \\ +\quad\;\; 2\,0 \\ \hline 5\,6\,9\,0 \end{array}$$

1. Count by tens.

a. 4000, 4010, _____, _____, _____, _____

b. _____, _____, 1740, 1750, _____, _____

c. _____, _____, 3370, 3380, _____, _____

2. Add and subtract using mental math. Compare the problems.

a. 100 + 20 = _____ 5100 + 20 = _____	**b.** 220 + 40 = _____ 4220 + 40 = _____
c. 140 – 90 = _____ 4140 – 90 = _____	**d.** 230 – 30 = _____ 4230 – 30 = _____

3. Solve with mental math. Think of the helping problem without the thousands.

a. 5,540 + 50 = _____ (540 + 50)	**b.** 7,210 + 90 = _____
c. 7,760 – 30 = _____	**d.** 1,490 – 50 = _____
e. 2,080 + 90 = _____	**f.** 4,980 + 20 = _____

4. Solve with mental math.

a. 6,040 + 70 = _____	**b.** 4,530 + 60 = _____	**c.** 8,250 – 20 = _____
d. 4,110 – 50 = _____	**e.** 9,660 + 40 = _____	**f.** 3,530 – 30 = _____

5. These are skip-counting patterns. Find the skip-counting step and fill in the missing numbers.

a.	6,140			6,260				6,420
b.	2,870				3,070			
c.			5,850			6,450		
d.		1,500				1,620		

6. How much was added or subtracted?

a. 5,280 + _____ = 5,300	**b.** 7,760 + _____ = 7,810
c. 3,160 – _____ = 3,110	**d.** 6,140 – _____ = 6,080

Fill in the puzzle.

Puzzle Corner

4,550	–		+		= 4,560
–		+		–	
	+		+		= 50
+		–		+	
	+		+		= 100
= 4,580		= 30		= 60	

Add Four-Digit Numbers in Columns

Adding four-digit numbers in columns happens the same way as adding smaller numbers. Regrouping (carrying) is done the same way as you have learned before. But here, you might have to regroup three times: in the tens, in the hundreds, and in the thousands.

Without help, finish the two examples below. Then ask the teacher to check your answers.

$\begin{array}{r} {\scriptstyle 1\ 1\ 1\ \ } \\ 5879 \\ +\ 2544 \\ \hline 8423 \end{array}$	$\begin{array}{r} 4337 \\ +\ 3918 \\ \hline \end{array}$	$\begin{array}{r} 4768 \\ +\ 2655 \\ \hline \end{array}$

1. Add.

a. $\begin{array}{r} 5091 \\ +\ 510 \\ \hline \end{array}$ **b.** $\begin{array}{r} 2393 \\ +\ 4716 \\ \hline \end{array}$ **c.** $\begin{array}{r} 5862 \\ +\ 1878 \\ \hline \end{array}$

2. Add. Remember: it helps to add those numbers first which make ten (if any)! Lastly, check your work, for example by adding the numbers in any column in a different order.

a. $\begin{array}{r} 6098 \\ 1034 \\ +\ 254 \\ \hline \end{array}$ **b.** $\begin{array}{r} 2255 \\ 345 \\ +\ 2170 \\ \hline \end{array}$ **c.** $\begin{array}{r} 362 \\ 2389 \\ +\ 4067 \\ \hline \end{array}$

d. $\begin{array}{r} 456 \\ 7328 \\ 1134 \\ +\ 554 \\ \hline \end{array}$ **e.** $\begin{array}{r} 1659 \\ 199 \\ 267 \\ +\ 6037 \\ \hline \end{array}$ **f.** $\begin{array}{r} 373 \\ 288 \\ 5217 \\ +\ 3399 \\ \hline \end{array}$

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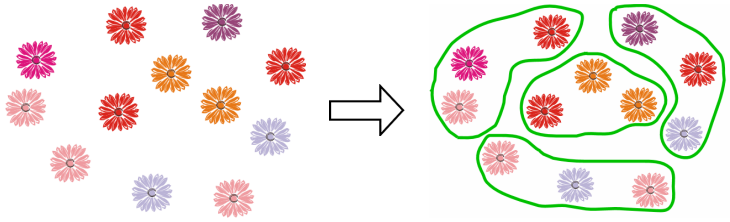
Division as Making Groups

There are 12 daisies. Make groups of 3.

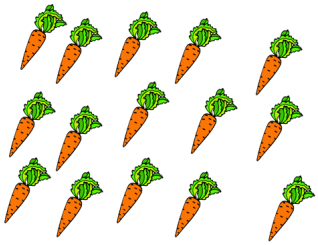


How many groups? *Four groups.*

How many 3's are there in 12? *Four.*

1. Divide into groups.

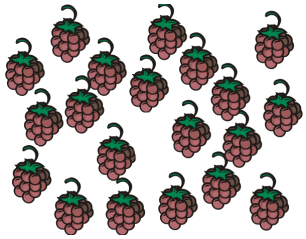
a. There are 15 carrots.
Make groups of 5.



How many groups? _____

How many 5's are there in 15? _____

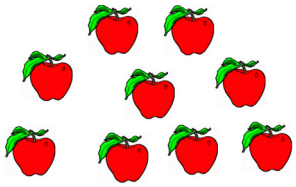
b. There are _____ berries.
Make groups of 4.



How many groups? _____

How many 4's are there in _____? _____

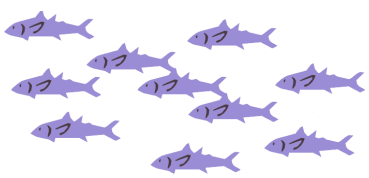
c. There are _____ apples.
Make groups of 3.



How many groups? _____

How many 3's are there in _____? _____

d. There are _____ fish.
Make groups of 2.



How many groups? _____

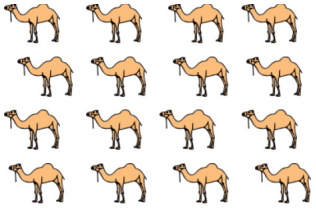
How many 2's are there in _____? _____

e. There are _____ daisies.
Make groups of 6.

How many groups? _____

How many 6's are there in _____? _____

f. There are _____ camels.
Make groups of 4.

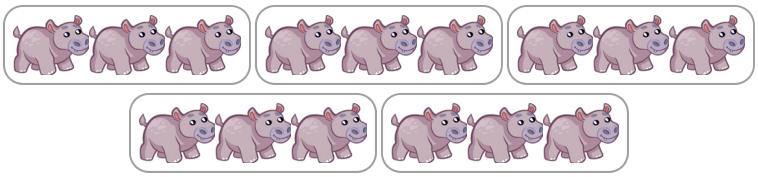


How many groups? _____

How many 4's are there in _____? _____

We **DIVIDE 15** hippos into groups of **three**. We get **five** groups.

How many 3's in 15? Five.



We can write a **division**: $15 \div 3 = 5$ (Read: "Fifteen divided by three is five.")

The number 3 is the **divisor**. It does the dividing, so to speak. Here, it indicates the size of the groups: each group has three hippos. The answer shows how many groups we get.

$18 \div 6 = ?$

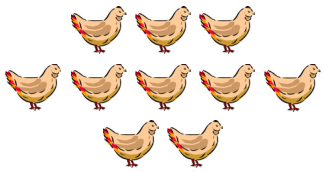
Think: "How many 6's in 18?"

If we DIVIDE 18 into groups of six, how many groups are there?

Since 6 + 6 + 6 = 18, or 3 × 6 = 18, there are THREE groups of six in 18. So, 18 ÷ 6 = **3**.

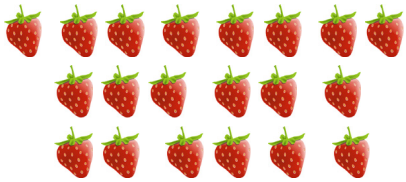
2. Make a division sentence.

a. Divide 10 hens into groups of two. How many groups?



_____ ÷ _____ = _____

b. Divide _____ berries into groups of four. How many groups?

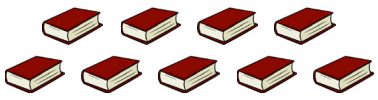


_____ ÷ _____ = _____

c. Divide _____ apples into groups of six. How many groups?

_____ ÷ _____ = _____

d. Divide _____ books into groups of three. How many groups?

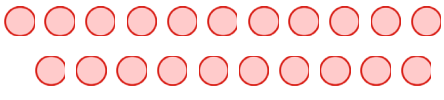


_____ ÷ _____ = _____

e. Divide _____ erasers into groups of five. How many groups?

_____ ÷ _____ = _____

f. Divide _____ circles into groups of three. How many groups?

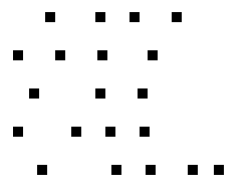
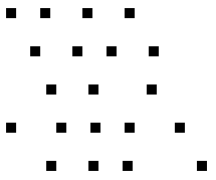
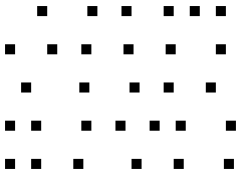
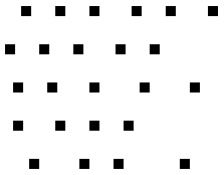
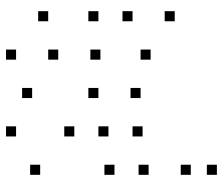
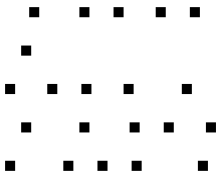
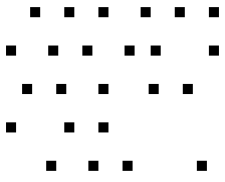
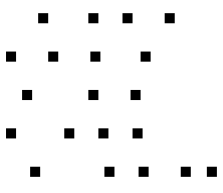


_____ ÷ _____ = _____

3. Draw sticks. Divide them into groups to fit the division sentence.

a. 18 ÷ 3 = _____	**b.** 24 ÷ 2 = _____
c. 21 ÷ 3 = _____	**d.** 25 ÷ 5 = _____
e. 15 ÷ 5 = _____	**f.** 24 ÷ 8 = _____

4. Make groups by circling dots and write a division sentence.

a. Make groups of 4  _____ ÷ 4 = ____	**b.** Make groups of 2  _____ ÷ 2 = ____	**c.** Make groups of 6  _____ ÷ 6 = ____	**d.** Make groups of 3  _____ ÷ 3 = ____
e. Make groups of 5  _____ ÷ 5 = ____	**f.** Make groups of 7  _____ ÷ 7 = ____	**g.** Make groups of 6  _____ ÷ 6 = ____	**h.** Make groups of 10  _____ ÷ 10 = ____

Division and Multiplication

We can write both a **multiplication fact** and a **division fact** from the same picture:	Three ***groups of 4*** makes 12. $3 \times 4 = 12$  12 divided into ***groups of 4*** is three groups. $12 \div 4 = 3$

Both multiplication and division have to do with **same-size groups**, but they are the opposite operations of each other. You could say division is "backwards" multiplication.

1. Fill in the blanks.

a. Two ***groups of 6*** is 12.

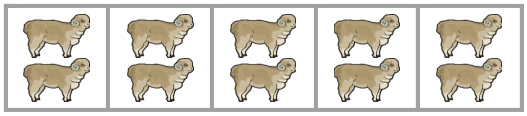
$2 \times 6 = 12$

12 divided into ***groups of 6*** is two groups.

$12 \div 6 = 2$

b. Five ***groups of 2*** is _____.

_____ × 2 = _____

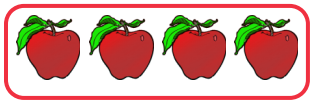


_____ divided into ***groups of 2*** is ___ groups.

_____ ÷ 2 = _____

c. One ***group of 4*** is 4.

_____ × 4 = _____



4 divided into a ***group of 4*** is one group.

_____ ÷ 4 = _____

d. Five ***groups of 1*** is 5.

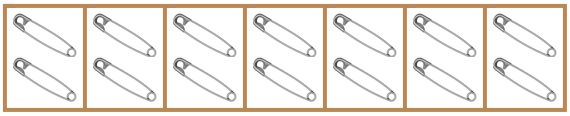
_____ × 1 = _____

5 divided into ***groups of 1*** is ____ groups.

_____ ÷ 1 = _____

e. _____ ***groups of*** _____ is _____.

_____ × _____ = _____

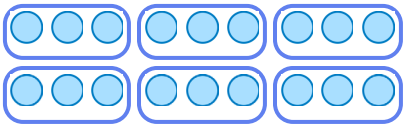


____ divided into ***groups of 2*** is ___ groups.

_____ ÷ _____ = _____

f. _____ ***groups of 3*** is _____.

_____ × _____ = _____



_____ divided into ***groups of 3*** is ___ groups.

_____ ÷ _____ = _____

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Zero in Division

What do you think 6 ÷ 0 would be? 

We could think of sharing 6 apples between zero persons, but that does not make sense. We cannot even talk about how many each one gets, because there is no one around.

We could think of making groups of 0. How many groups would you get? Again, you would not get anywhere; you would never get those 6 apples put into groups of 0.

You might think that maybe 6 ÷ 0 = 0 or that each person gets zero apples. Check it with multiplication! You would get 0 × 0 = 6, which is not true! So, 6 ÷ 0 = 0 does not work either.

Dividing six by zero (6 ÷ 0) is "undefined." Basically, you cannot do it.
The same happens with 1, 2, 3, 4, 5, 7, 8, etc.

What about 0 ÷ 0? Could we say 0 ÷ 0 = 0?

0 ÷ 0 is hard. The answer could be zero, but actually the answer could be *any* number :

Let's say that 0 ÷ 0 = 2. Check by multiplying: 2 × 0 = 0; OK. So 2 would work.
Let's say that 0 ÷ 0 = 0. Check by multiplying: 0 × 0 = 0; OK. So 0 would work.
Let's say that 0 ÷ 0 = 11. Check by multiplying: 11 × 0 = 0; OK. So 11 would work.

So, we cannot find just ONE answer. We say that the answer cannot be determined.

Dividing a number by zero does not work.

What about zero divided by something? That is perfectly fine. For example, 0 ÷ 5 = 0. "If there are zero apples and five people, each person gets zero apples."

1. Solve. CROSS OUT all the problems that are impossible. Think about sharing apples.

a. 4 ÷ 1 = _____ 4 ÷ 0 = _____	**b.** 14 ÷ 14 = _____ 0 ÷ 0 = _____	**c.** 1 ÷ 1 = _____ 7 ÷ 0 = _____	**d.** 0 ÷ 5 = _____ 5 ÷ 5 = _____
e. 0 ÷ 1 = _____ 0 ÷ 4 = _____	**f.** 0 ÷ 14 = _____ 14 ÷ 0 = _____	**g.** 0 ÷ 3 = _____ 0 ÷ 1 = _____	**h.** 10 ÷ 10 = _____ 1 ÷ 1 = _____

In multiplication, zero works just fine!

Multiplication means you have many groups of the same size. You can find the total by adding. Therefore:

$5 \times 0 = 0 + 0 + 0 + 0 + 0 = 0$ (five groups of zero items)	$0 \times 3 = 0$ (zero groups of three items)

2. Multiply. Then for each multiplication, make a matching division sentence if possible.

a. $6 \times 1 =$ _____ _____ ÷ _____ = _____	**b.** $0 \times 8 =$ _____ _____ ÷ _____ = _____	**c.** $5 \times 7 =$ _____ _____ ÷ _____ = _____
d. $10 \times 11 =$ _____ _____ ÷ _____ = _____	**e.** $1 \times 1 =$ _____ _____ ÷ _____ = _____	**f.** $1 \times 8 =$ _____ _____ ÷ _____ = _____
g. $0 \times 0 =$ _____ _____ ÷ _____ = _____	**h.** $5 \times 9 =$ _____ _____ ÷ _____ = _____	**i.** $9 \times 0 =$ _____ _____ ÷ _____ = _____

3. Make a QUESTION for each situation. (Think what you can find out using what the problem tells you.) Then solve your question.

a. Mark, Jack, and Joe decided to share their toy cars evenly in a game. Mark had 18 cars, Jack had 7, and Joe had 11.	**b.** Mrs. Elliott hired six children to do yard work. She paid one of them $15, and the rest of them $10 each.

Puzzle Corner

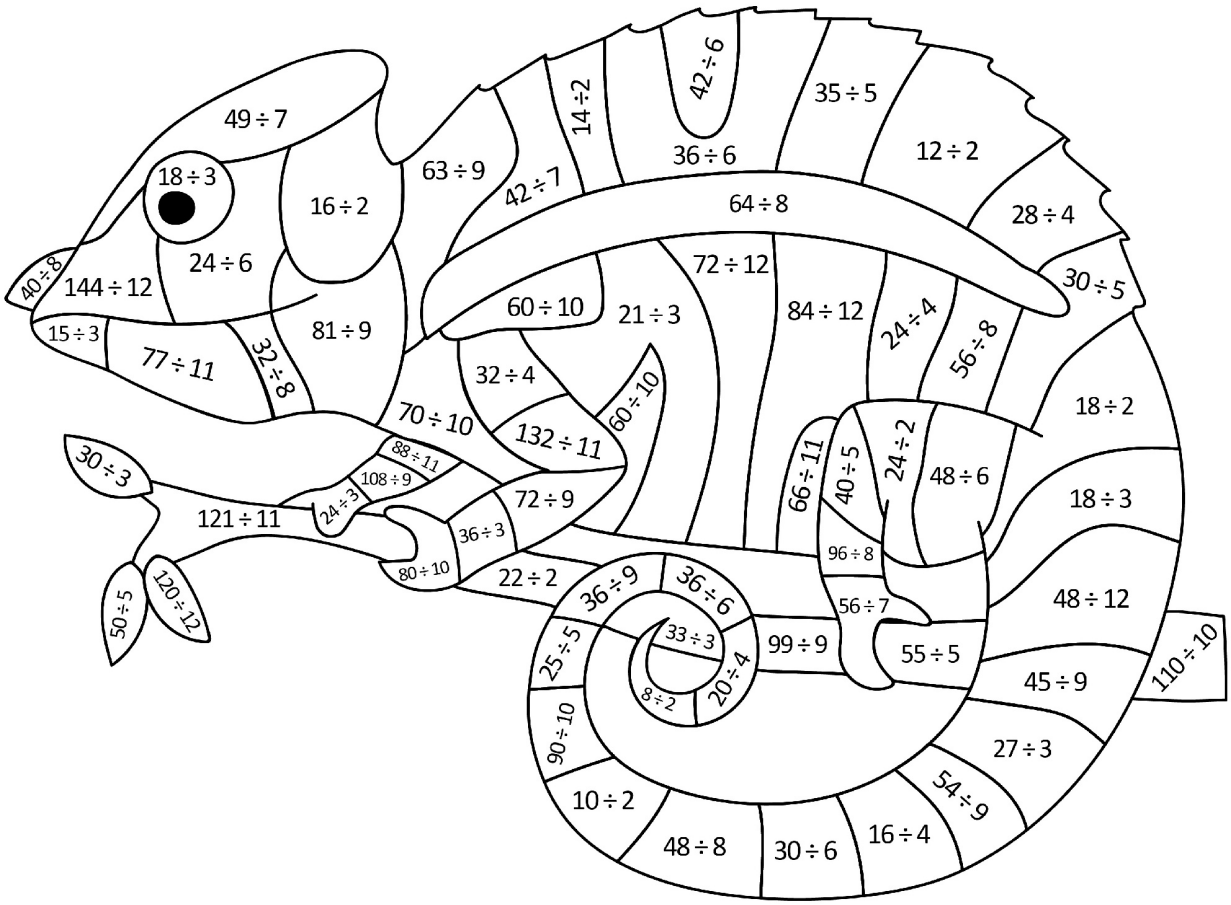
Divisions and multiplications involving zero lead to some interesting situations. Can you solve what ☐ stands for?

a. $0 \div ☐ = 4$ **b.** $0 \times ☐ = 0$ **c.** $☐ \div 0 = 6$ **d.** $0 \times ☐ = 3$

Division Practice

1. Divide, and color by number.

4 = purple	7 = green	10 = dark green
5 = dark pink	8 = blue	11 = brown
6 = red	9 = orange	12 = yellow



2. Play the game Go Fish! Division or Parrot Divisions (see the chapter introduction).

3. Make a QUESTION for each situation. (Think what you can find out using what the problem tells you.) Then solve your question.

a. Jeremy wants to read two books that have 32 and 40 pages. He reads 12 pages a day.	**b.** Kelly had 80 cm of red material and 40 cm of blue material. She cut it all into 20-cm pieces.

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Milliliters and Liters

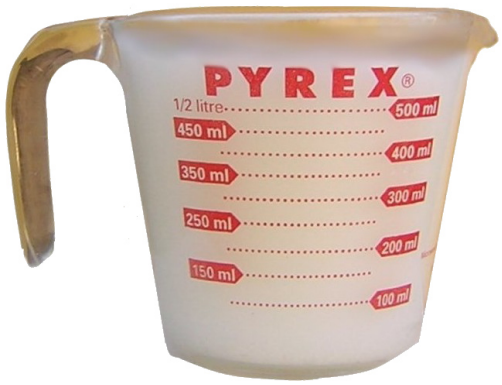
How much water is in a bottle? How much milk is in a glass? To answer these questions, we can measure the **liquid volume** of various liquids.

We can measure liquid volume using **liters (L)** and **milliliters (ml)**.

You may have seen a 1-liter water bottle or soda bottle. Also, one liter is very close to one quart.

One liter is divided into 1,000 milliliters. A fourth of a teaspoon contains about one milliliter. So, milliliters are very tiny units.

Here is a measuring cup that measures volume in milliliters. It goes up to 500 ml, which is exactly half a liter. You can see that printed near the top of the measuring cup.



For this lesson, you will need:

- A measuring cup that measures in milliliters.
- Measuring spoons for 1 teaspoon and for 1/4 teaspoon.
- An eyedropper.
- A few cups, glasses, jars, and other small containers.
- A few items with very small volume: a thimble, spoons, medicine cup, a 1/8 cup measuring cup, and so on.
- Two cooking pans/pots.

1. Use the eyedropper to fill the 1/4-teaspoon measuring spoon with water. It should take one dropperful. So, one dropperful and the 1/4 teaspoon each are about **one milliliter**.

   Now, guess how many milliliters of water will fit into these small items:

   - a measuring spoon measuring 1 tsp
   - a spoon
   - a thimble
   - _____
   - _____

   Then check by filling them with water using the eyedropper.

2. Measure the volume of a few cups, glasses, jars, and other small containers. You will need a measuring cup that measures in milliliters.

Item	Volume in milliliters

3. Measure 1 liter of water into a pan or a pot. Then *guess* how many liters of water would fill it.

   My Guess: the pan will hold _____ liters of water.

   Now, measure another liter of water into the pan, and another, until it is full. In the end, pour in 100 ml of water at a time.

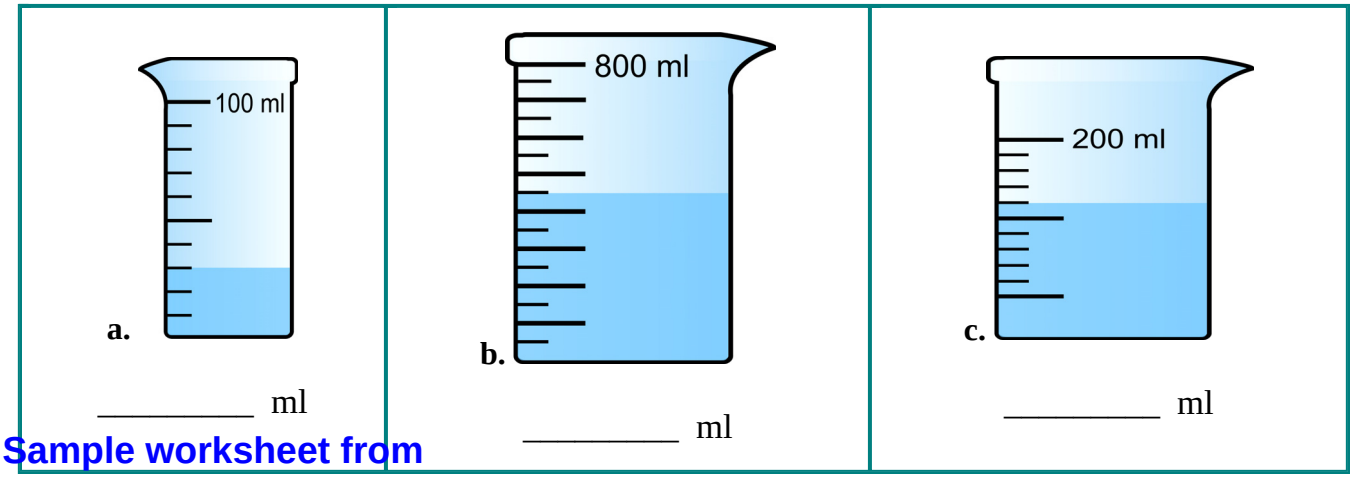
   The pan holds _____ L _____ ml of water.

4. Measure the volume of another pan using the same method. First *guess* how many liters of water will fit into your pan.

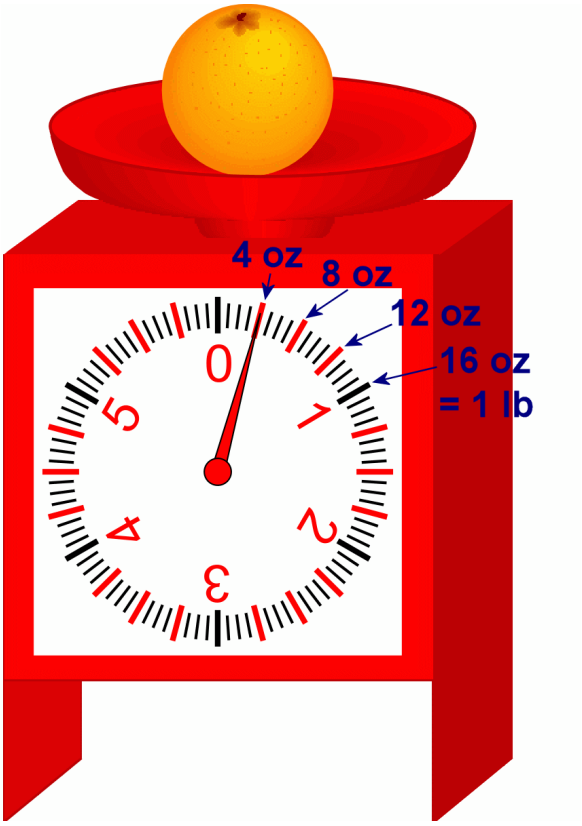
   My Guess: the pan will hold _____ liters of water.

   Measurement: the pan holds _____ L _____ ml of water.

5. How much liquid is in each pitcher?



Pounds and Ounces



We can measure how heavy something is using **pounds** and **ounces**. The picture shows a kitchen scale and an orange on it. The orange weighs 4 ounces (oz). An egg weighs about 2 oz. An ounce is a fairly small unit for weight.

To weigh heavier things (such as people), we can use pounds (abbreviated with "lb"). Sixteen ounces makes one pound: 16 oz = 1 lb.

On this scale, the numbers 0, 1, 2, 3, 4, and 5 refer to whole pounds. Number 6 is not marked, but if the pointer went all the way around one time and was pointing to 0, it would actually mean 6 pounds.

In between the whole pounds are lines to mark the ounces. Some are longer and thicker (red), and some are shorter. The thicker lines mark the 4-ounce, 8-ounce, and 12-ounce points, and the shorter lines mark the individual ounces.

You will need:

- A kitchen scale that measures in pounds and ounces.
- A bathroom scale that measures in pounds.
- Light items to weigh on the kitchen scale.
- Heavier items and people to weigh on the bathroom scale.

1. Weigh light items with a kitchen scale. Write your results here.

Item	Weight
	_____ lb _____ oz

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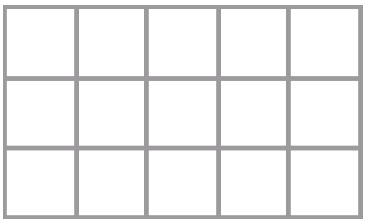
Mixed Review Chapter 9

1. Estimate the total by rounding the prices to the nearest ten. Then find the exact total.
(Rounding Three-Digit Numbers to the Nearest Ten/Ch2)

a. A desk costs $154 and a set of chairs costs $128.

My estimate: about $_____

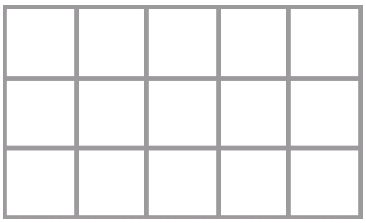
Exact total: $_____



b. Gabriel bought two computers for $698 each.

My estimate: about $_____

Exact total: $_____



2. Write the numbers immediately before and after the given number. (Four-Digit Numbers and Place Value/Ch7)

a. _____, 2,778, _____

b. _____, 6,060, _____

c. _____, 7,150, _____

d. _____, 7,000, _____

3. Divide. (Division and Multiplication/Ch7)

a. 56 ÷ 7 = _____	**b.** 48 ÷ 6 = _____	**c.** 54 ÷ 9 = _____	**d.** 48 ÷ 8 = _____
49 ÷ 7 = _____	72 ÷ 6 = _____	81 ÷ 9 = _____	72 ÷ 8 = _____
28 ÷ 7 = _____	54 ÷ 6 = _____	36 ÷ 9 = _____	32 ÷ 8 = _____

4. Write matching division and multiplication sentences. (Multiplication and Division Fact Families/Ch8)

a. _____ × _____ = _____	**b.** 23 × 1 = _____	**c.** 8 × _____ = 72
42 ÷ 7 = _____	_____ ÷ _____ = _____	_____ ÷ _____ = _____
_____ ÷ _____ = _____	_____ ÷ _____ = _____	_____ ÷ _____ = _____

5. Subtract. Check by adding. (Subtract Four-digit Numbers with Regrouping/Ch7)

a. 7 2 6 2 − 2 3 1 6 + _____	**b.** 6 0 0 3 − 3 2 4 2 + _____

6. Kathy needs to read a 27-page booklet in three days. If she reads the same amount each day, how many pages will she read each day?

7. Make a question for these word problems and solve.

a. Diego arranged his 54 toy cars in rows of six.

b. Lucia earns $9 every time she helps clean the neighbor's yard. She did that three times last month.

8. One TV costs $1,255 and another $787. Brian buys two of the cheaper TVs and two of the costlier TVs for a school. What is the total cost? Solve the problem, and check your calculations.

9. Add mentally. Think of an easier problem to solve first. (Mental Addition/Ch1)

a. 98 + 14 = _____	**b.** 62 + 29 = _____	**c.** 53 + 38 = _____
d. 48 + 19 = _____	**e.** 58 + 39 = _____	**f.** 25 + 26 = _____

10. Multiply. (Various lessons/Ch4)

a. $5 \times 6 =$ _____	**b.** $6 \times 7 =$ _____	**c.** $9 \times 3 \times 3 =$ _____
$3 \times 6 =$ _____	$4 \times 7 =$ _____	$8 \times 2 \times 4 =$ _____
$8 \times 9 =$ _____	$5 \times 12 =$ _____	$6 \times 3 \times 3 =$ _____
$7 \times 7 =$ _____	$8 \times 12 =$ _____	$2 \times 6 \times 2 =$ _____

11. Henry said, "I'll come to your house around 20 after 6." At 6:30, there was no Henry in sight, and Mike said, "Henry is 10 minutes late." Was Mike correct?
(Elapsed Time 2/Ch5)

12. The table shows how many stuffed animals the children have. (Pictographs/Ch8)

Stuffed animals	
Mia	18
Logan	9
Zoe	6
Mason	12

a. How many stuffed animals do the two children with most animals have in total?

b. How many more animals does Mia have than Logan?

c. If Mia and Zoe put together their stuffed animals and shared then equally, how many would each girl have?

d. Draw a pictograph from the information in the space below. Don't forget to include the key (legend).

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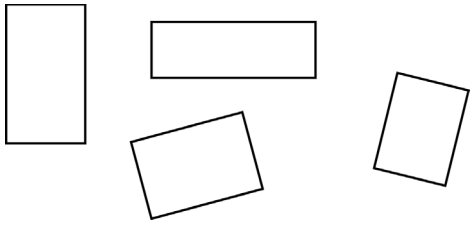
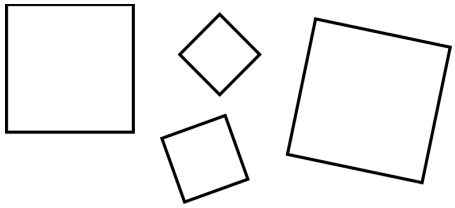
Some Special Quadrilaterals



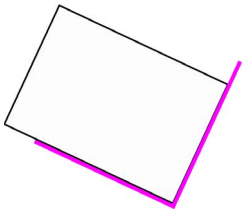
Rectangles are quadrilaterals (they have four sides) with four **right angles**. A right angle is a "straight" corner — like a corner of a book.



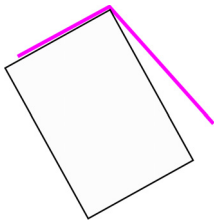
Squares are quadrilaterals with four equal sides (each side has the same length) and four right angles.

You can use the corner of a book to check if an angle is right (if the corner is "straight"). Or, fold a piece of paper twice in half, to get a right-angle checking tool.

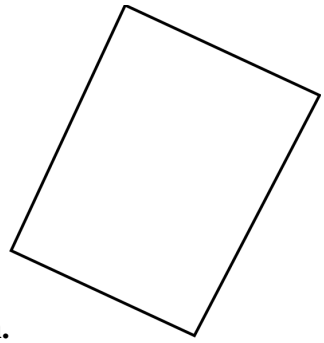
This *is* a right angle!



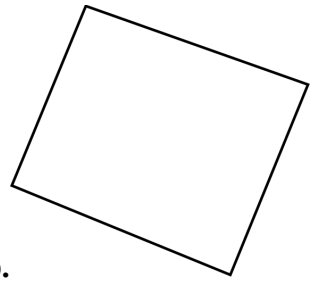
This is *not* a right angle!



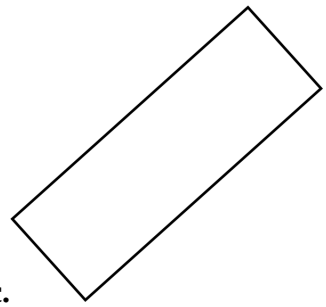
1. Are these shapes rectangles or not? Check if the angles are right angles.



a.

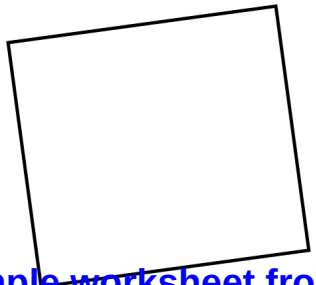


b.

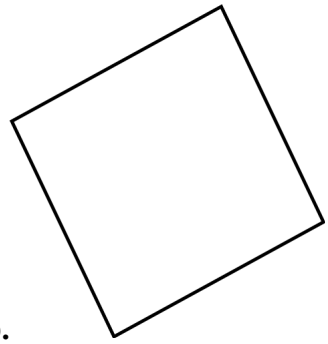


c.

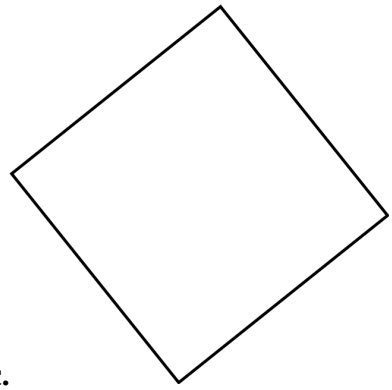
2. Are these shapes squares? Check if the angles are right angles *and* if the sides have the same length (use a ruler).



a.



b.



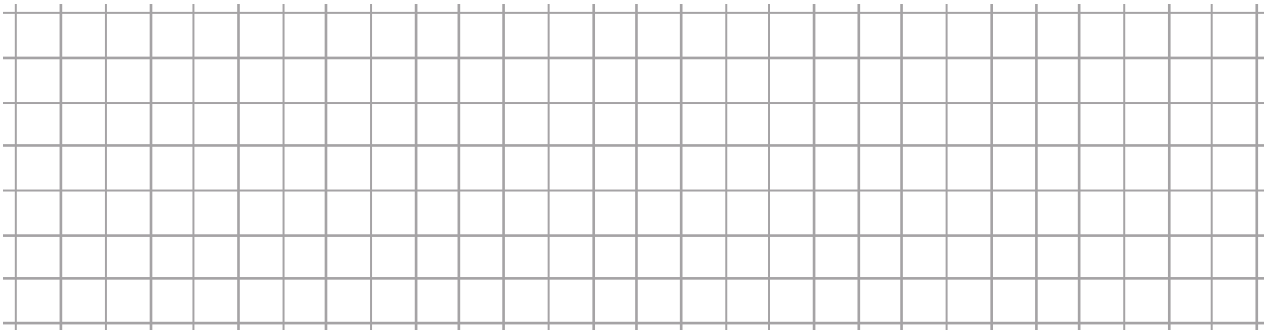
c.

5. Draw in the grid:

   a. a rectangle that is *not a* square;

   b. a rhombus that is *not* a square;

   c. a quadrilateral that is not a rectangle nor a rhombus.

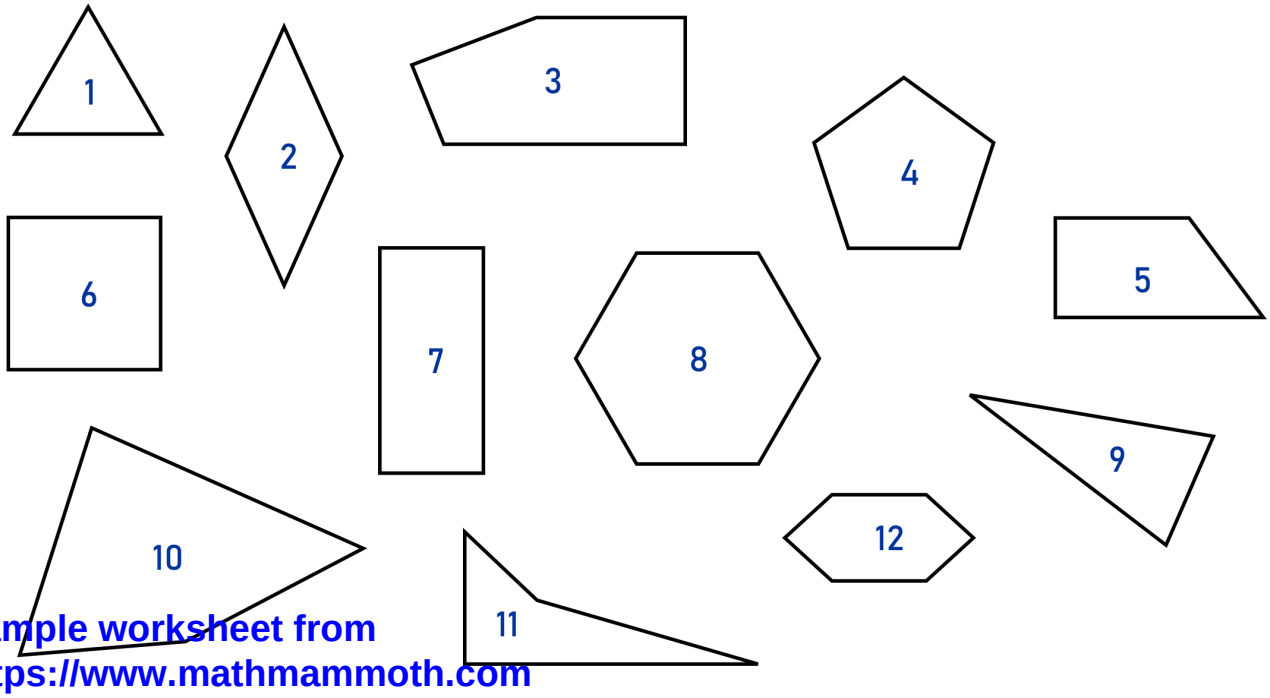


6. Shape-guessing game! **Gameplay:** This is a two-player game. Player 1 secretly chooses a shape from the collection. Player 2 then asks yes/no questions from Player 1, until they can tell which shape Player 1 had chosen.

   Players are not allowed to use the names of the shapes (square, rhombus, etc.) in the questions, but strictly keep to the attributes of the shape. Example questions include: Does it have equal sides? Does it have any right angles? Does it have five sides? Etc.

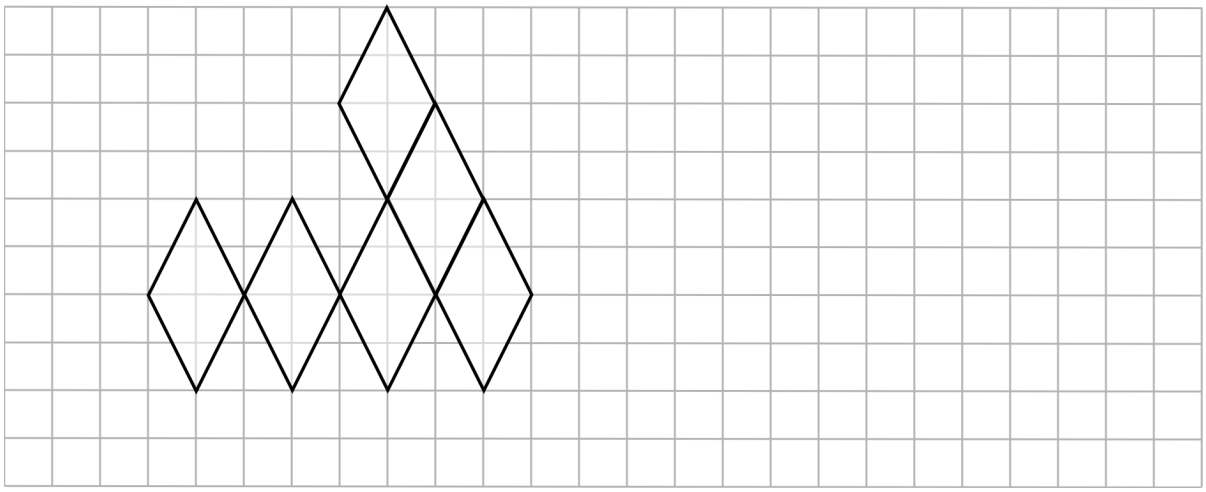
   On each round, the player who is guessing will get points using this formula: points = 5 − the number of questions it took to guess correctly. For example, if it took three questions to find the other player's secret shape, the player gets 2 points.

   The game ends when one player reaches 20 points.

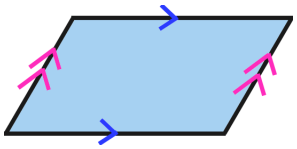


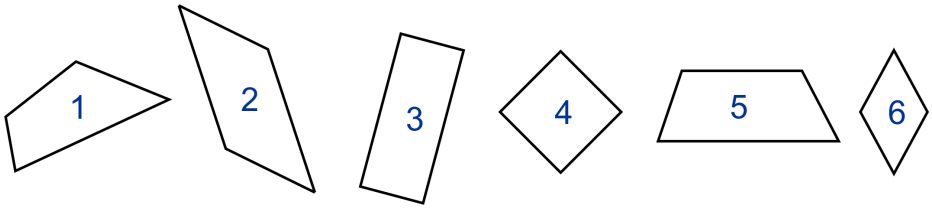
7. Sketch here two quadrilaterals that are *not* rectangles *nor* rhombi, but have two equal sides.

8. This is a tiling with rhombi. Continue it, and color it.



Two lines are parallel if they would never meet, if continued. In other words, they go in the same direction. A **parallelogram** is a quadrilateral with two pairs of parallel sides. The arrowheads signal how the sides are parallel ("go in the same direction").





Look at the collection of shapes above. Matthew said that he found only ONE parallelogram in it, whereas Rosa said she found three. Who is right? Explain.

Puzzle Corner

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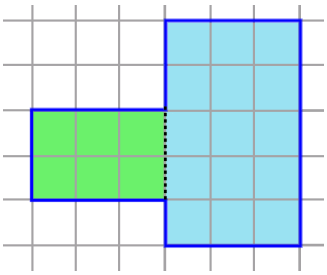
Area of Compound Shapes 1

Example: To find the area of this figure, we can divide the shape into two rectangles. We then use two multiplications, and add their results:

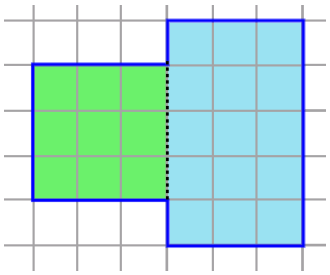


$$3 \times 2 \; + \; 3 \times 5 \; = \; 6 + 15 \; = \; 21$$

The area is 21 square units.

1. Write two multiplications to find the total area.

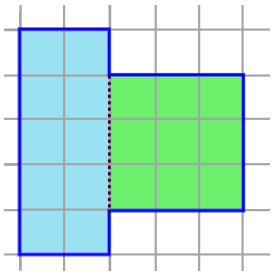
a.



____ × ____ + ____ × ____ = _____

Area = _____ square units

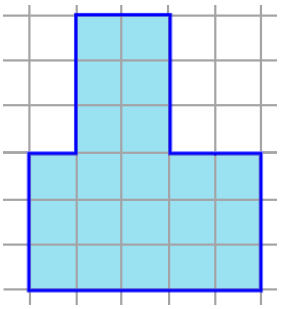
b.



____ × ____ + ____ × ____ = _____

Area = _____ square units

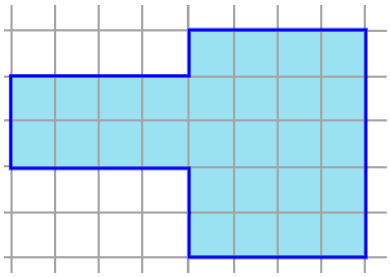
c.



_____

Area = _____ square units

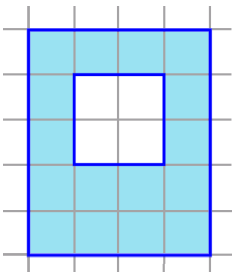
d.



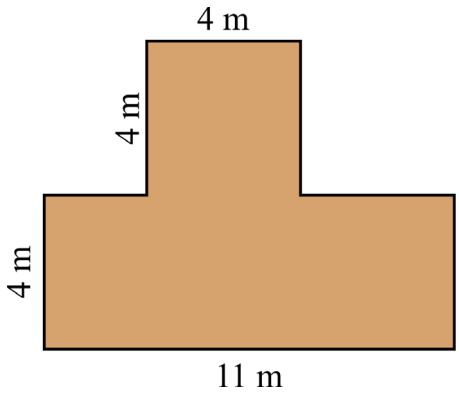
_____

Area = _____ square units

2. Write a number sentence for the shaded area that uses multiplication and *subtraction*.

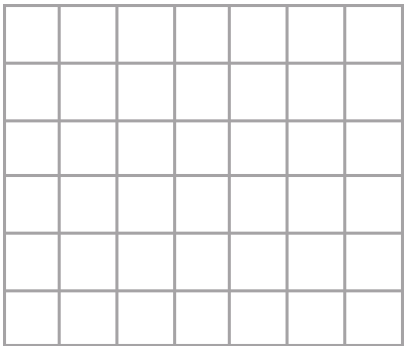


3. Find the area of this children's playground.
   Use the correct unit for area.



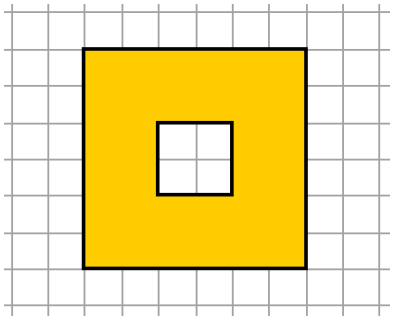
4. A 4-by-5 rectangle has a hole in the middle that measures three square units (similar to what you see in question #2).

   What is the area of that figure?



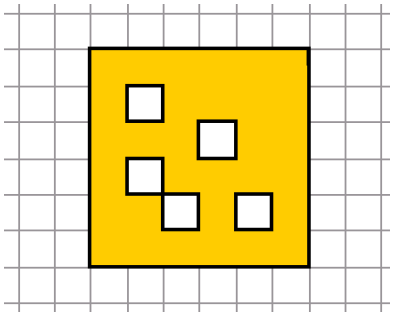
5. Find the areas.

a.



The area is _____ square units.

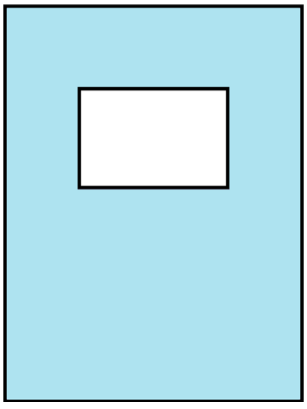
b.



The area is _____ square units.

6. A notebook measures 6 in. by 8 in. On its cover is a white rectangle. The white rectangle is 3 in. by 2 in.

   What is the area of the shaded (blue) part?



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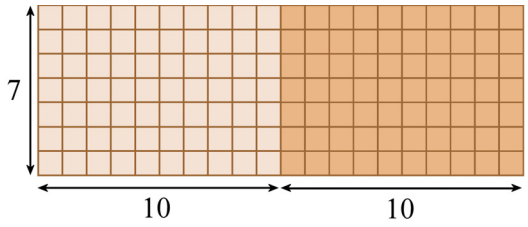
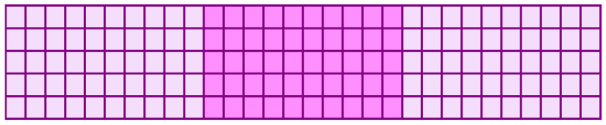
Multiplying by Multiples of Ten

1. The picture shows a particular idea for solving 7×20. What is that idea?



2. Solve 5×30 by dividing the rectangle into parts.



$5 \times 30 =$ _____

We can solve multiplication problems, such as 5×60, by repeated addition.

$$5 \times 60 = 60 + 60 + 60 + 60 + 60$$

We could also solve it by breaking the multiplication into several parts, like you did in exercises 1 and 2. But here's another idea for solving 5×60.

- First, 60 is equal to 6×10, isn't it? So, to solve $5 \times$ **60**, we can multiply $5 \times$ **6×10**.
- Then, **5×6** $\times 10$ is the same as **30** $\times 10$.
- Lastly, 30×10 is just 30 with a zero tagged on the end of it... or 300.

3. Break each multiplication into another where you multiply three numbers, one of them being 10. Multiply and fill in.

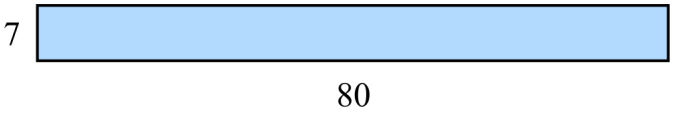
a. 7×90 $= 7 \times 9 \times 10$ $=$ _____ $\times 10$ $=$ _____	**b.** 4×80 $=$ ____ $\times$ ____ $\times 10$ $=$ _____ $\times 10$ $=$ _____	**c.** 6×40 $=$ ____ $\times$ ____ $\times 10$ $=$ _____ $\times 10$ $=$ _____
d. 9×90 $=$ ____ $\times$ ____ $\times 10$ $=$ _____ $\times 10$ $=$ _____	**e.** 30×12 $= 10 \times$ ____ $\times$ ____ $= 10 \times$ _____ $=$ _____	**f.** 80×3 $= 10 \times$ ____ $\times$ ____ $= 10 \times$ _____ $=$ _____

Shortcut for multiplying by multiples of ten (20, 30, 40, etc.)	
Example 2. 6 × 20 Multiply 6 × 2 = 12. Tag a zero to 12, to get 120.	**Example 3.** 50 × 12 Multiply 5 × 12 = 60. Tag a zero to 60, to get 600.

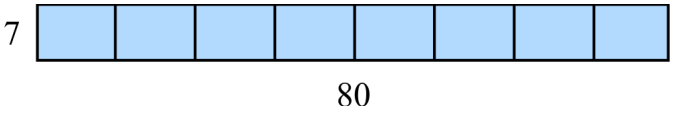
4. Multiply using the shortcut.

a.	**b.**	**c.**	**d.**
7 × 70 = _____	6 × 80 = _____	40 × 11 = _____	60 × 12 = _____
3 × 40 = _____	5 × 120 = _____	70 × 5 = _____	80 × 3 = _____

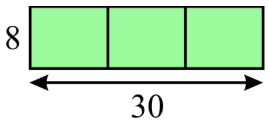
5. This rectangle is 7 units high and 80 units long. What is its area?



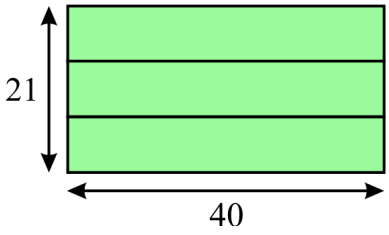
6. This rectangle is divided into 8 equal parts. What is the area of each small part?



7. Find the total area of this rectangle, and also the area of each little part.



8. Find the total area.



Puzzle Corner

a. 30 × 20 = _____ **b.** 200 × 8 = _____

c. 1,200 × 8 = _____ **d.** 50 × 40 = _____ **e.** 300 × 20 = _____

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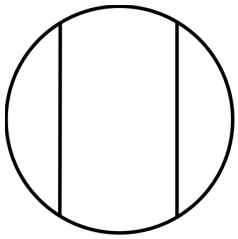
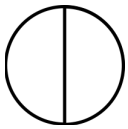
Understanding Fractions 1

Example: Three friends share a pizza. Here you see how the pizza is divided into three parts. Would you say that each person will get a fair share?

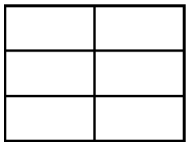


Why or why not?



Here, one whole is divided into two equal parts. Each part is one-half of the whole.

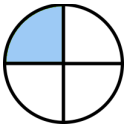
Here, one whole is divided into three equal parts. Each part is one-third of the whole.



Here, one whole is divided into six equal parts. Each part is one-sixth of the whole.

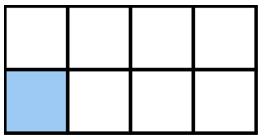
One whole is divided into four equal parts. One part is colored.

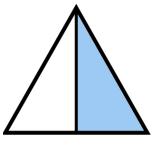
That one part is 1 fourth of the whole, and is written as $\frac{1}{4}$.



One whole is divided into eight equal parts. One part is colored.

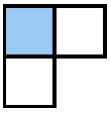
That one part is 1 eighth of the whole, and is written as $\frac{1}{8}$.





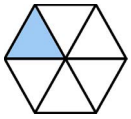
1 half

$\frac{1}{2}$



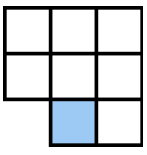
1 third

$\frac{1}{3}$



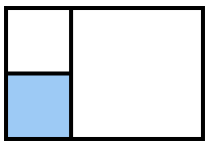
1 sixth

$\frac{1}{6}$



1 eighth

$\frac{1}{8}$

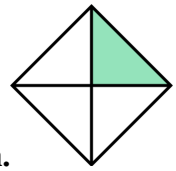


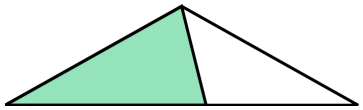
Here, the whole is not divided into equal parts, so we cannot easily tell what fraction this is.

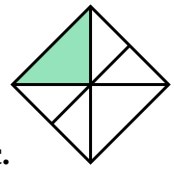
The fractions $\frac{1}{2}$, $\frac{1}{3}$, $\frac{1}{4}$, $\frac{1}{6}$, $\frac{1}{8}$ and so on are called **unit fractions**.

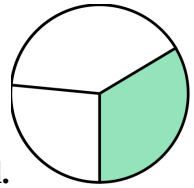
A unit fraction signifies ONE part of a whole, when the whole is divided into *equal* parts.

1. In each picture, one part is shaded. **<u>If</u>** the one whole is divided into *equal* parts, write the fraction that is formed, and otherwise not.

a. 

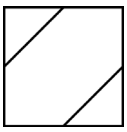
b. 

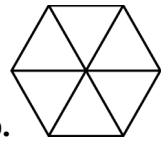
c. 

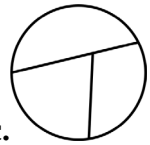
d. 

e. 

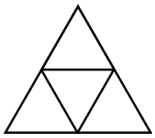
2. Is the one whole divided into equal parts or not? If yes, shade one of the pieces and write the resulting fraction.

a. 

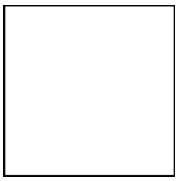
b. 

c. 

d. 

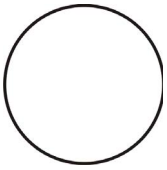
e. 

3. Divide each shape into equal parts. Shade one of the parts. Write the unit fraction.



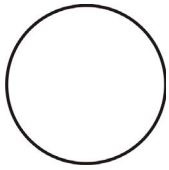
a. four equal parts

b. three equal parts

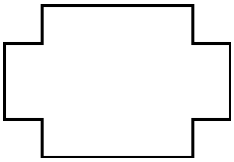


c. eight equal parts

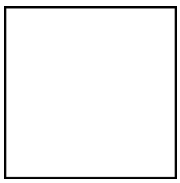
d. six equal parts



e. four equal parts



f. two equal parts

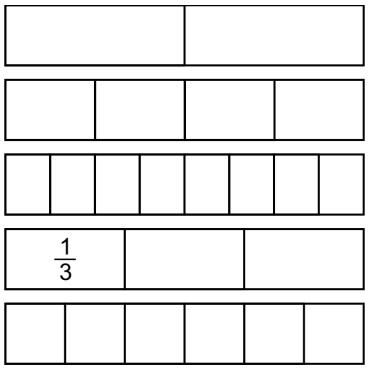


g. eight equal parts

h. three equal parts

Sample worksheet from https://www.mathmammoth.com

4. **Activity: fraction strips**



You will need: Five identical strips of paper, approximately 6 inches long and 1 inch tall.

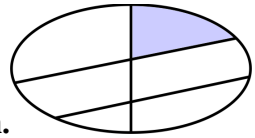
Fold three of the strips of paper so that you will get halves, fourths, and eighths. Fold the other two so that you will get thirds and sixths. See the illustration.

Label the individual unit fractions. In the illustration, one of the thirds is marked. Use pretty colors.

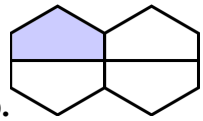
5. Mandy drew a shape, divided it into equal parts, and colored $\frac{1}{6}$ of it.

Which ones of these shapes below could be the one she drew?

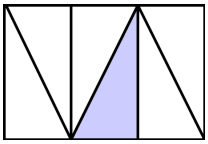
a.



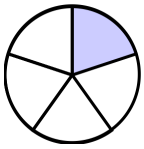
b.



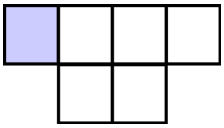
c.



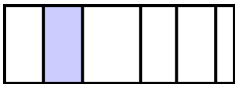
d.



e.

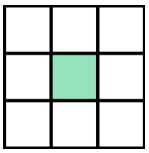


f.



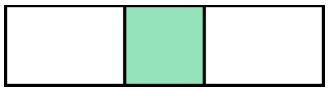
6. Students wrote what fraction of the shape is shaded. Which students made an error? Explain why they are in error.

Student 1:



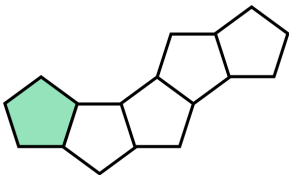
$\frac{1}{8}$

Student 2:



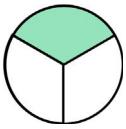
$\frac{1}{3}$

Student 3:



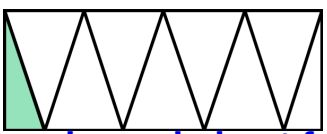
$\frac{1}{5}$

Student 4:



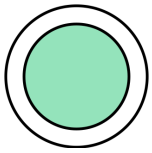
$\frac{1}{2}$

Student 5:



$\frac{1}{9}$

Student 6:

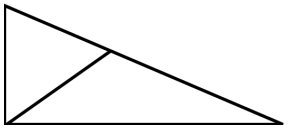


$\frac{1}{2}$

Use questions 7 and 8 for extra practice.

7. IF the shape is divided into equal parts, shade one of the parts. Then write the fraction.

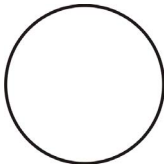
a.



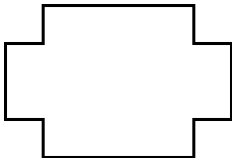
b.

c.

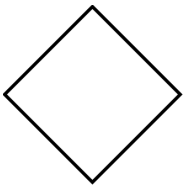
8. Divide each shape into equal parts. Shade one of the parts. Write the unit fraction.



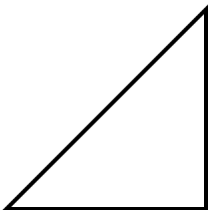
a. six equal parts



b. four equal parts

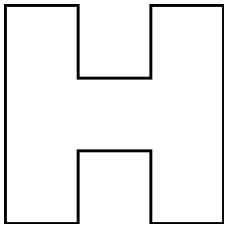


c. eight equal parts

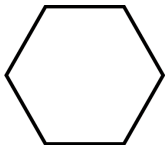


d. two equal parts

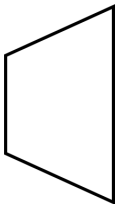
e. eight equal parts



f. four equal parts



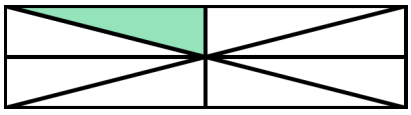
g. six equal parts



h. two equal parts

Puzzle Corner

Is it true that 1/8 of the shape is shaded?
Explain.



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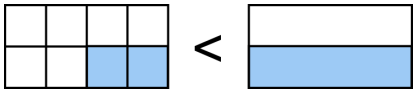
Comparing Fractions 1

Example 1. In the illustration, each rectangle is one whole. We can see that 2/8 is less than 1/2.

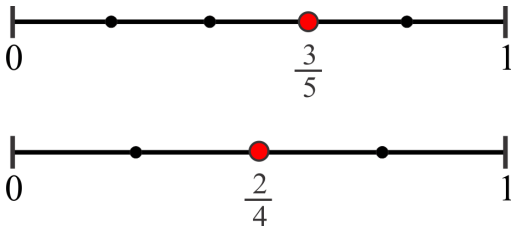


$\frac{2}{8} < \frac{1}{2}$

Example 2. With number lines, the point that is furthest from 0 marks the bigger number. And, fractions are numbers, too.

(Imagine a rectangle drawn from 0 to the given fraction. Which rectangle will be longer?)

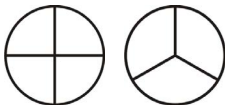
We can see that 3/5 is greater than 2/4.



$\frac{3}{5} > \frac{2}{4}$

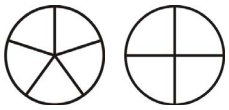
1. Compare and write > or < between the fractions. You can color pieces to help.

a.



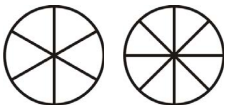
$\frac{1}{4}$ $\frac{1}{3}$

b.



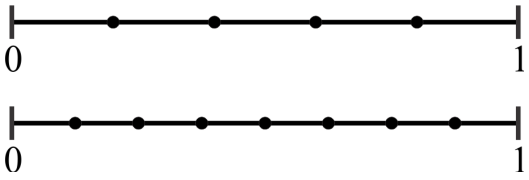
$\frac{4}{5}$ $\frac{3}{4}$

c.

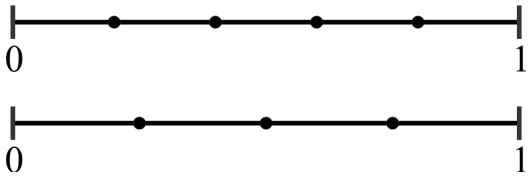


$\frac{5}{6}$ $\frac{6}{8}$

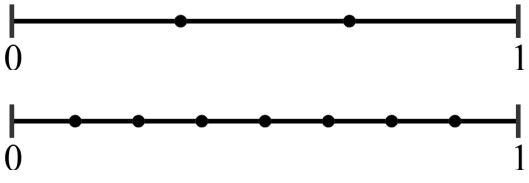
2. Compare and write > or < between the fractions.



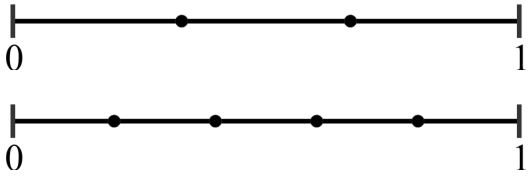
a. $\frac{1}{5} \square \frac{1}{8}$



b. $\frac{2}{5} \square \frac{1}{4}$



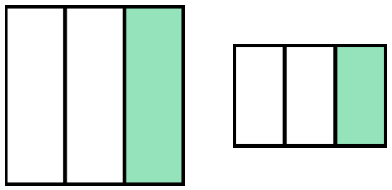
c. $\frac{1}{3} \square \frac{3}{8}$



d. $\frac{2}{3} \square \frac{2}{5}$

Example 3. If these were some kind of food, which colored part would give you more to eat?

Obviously, the one on the left. Yet they are both 1/3 of the entire shape! Does this mean that 1/3 is greater than 1/3 sometimes?! What is going on?



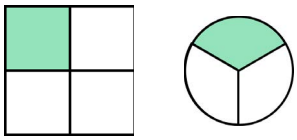
$\frac{1}{3}$ $\frac{1}{3}$

The problem is caused by the fact that the wholes are not the same size. This means we cannot make valid comparisons using fractions. We *can* say that the piece on the left is bigger (in area) than the piece on the right, but we should not do a comparison using fractions.

For a comparison with fractions to be valid, **the fractions have to refer to a whole that is the same size.**

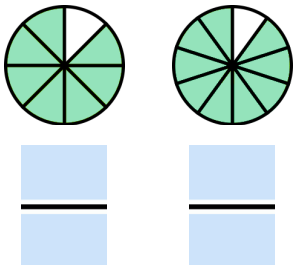
3. Compare the fractions, writing > or < between them, but only if the comparison is valid. If the comparison would not be valid, cross out the entire problem.

a.

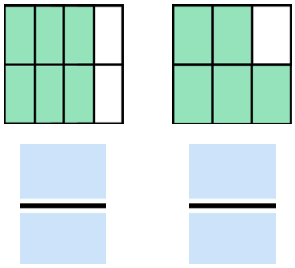


$\frac{1}{4}$ $\frac{1}{3}$

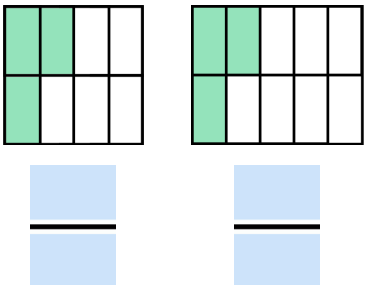
b.



c.



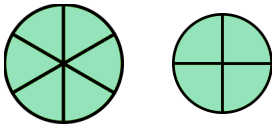
d.



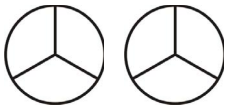
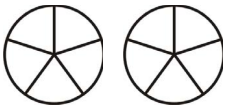
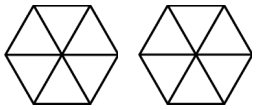
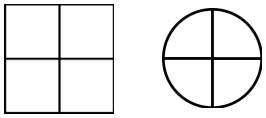
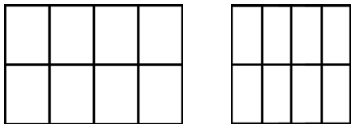
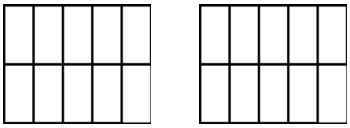
4. Finn says that these fractions are equal, because both 6/6 and 4/4 are equal to 1.

Hazel says that is not true, because one of them has "more to eat", because it's bigger.

What do you think?



5. Compare and write > or < between the fractions. If the comparison cannot be made in a valid way, cross the entire problem out.

a.  $\frac{2}{3}$ $\frac{1}{3}$	**b.**  $\frac{1}{5}$ $\frac{4}{5}$	**c.**  $\frac{1}{6}$ $\frac{3}{6}$
d.  $\frac{3}{4}$ $\frac{1}{4}$	**e.**  $\frac{3}{8}$ $\frac{4}{8}$	**f.**  $\frac{7}{10}$ $\frac{4}{10}$

6. Now look at the *valid* comparisons above. Explain how to find the bigger fraction if two fractions have the same denominator (they have the same kind of parts)?
For example, how do you tell which is the bigger fraction, 5/8 or 3/8?
What about 7/6 or 1/6?

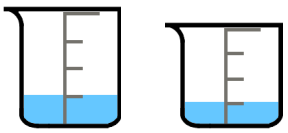
_____

_____

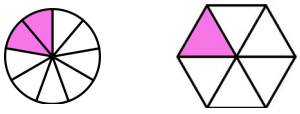
7. Compare, writing > or < between the fractions.

a. $\frac{3}{4}$ ☐ $\frac{5}{4}$	**b.** $\frac{3}{6}$ ☐ $\frac{1}{6}$	**c.** $\frac{9}{8}$ ☐ $\frac{8}{8}$	**d.** $\frac{5}{5}$ ☐ $\frac{2}{5}$
e. $\frac{13}{10}$ ☐ $\frac{3}{10}$	**f.** $\frac{3}{3}$ ☐ $\frac{5}{3}$	**g.** $\frac{3}{6}$ ☐ $\frac{6}{6}$	**h.** $\frac{5}{2}$ ☐ $\frac{2}{2}$

8. These two pitchers are both 1/4 full.
Do they have the same amount of water?
Explain.



9. Who got to eat more pie?
Can you tell?



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