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Foreword

Math Mammoth Grade 3, Canadian Version, comprises a complete math curriculum for the third grade mathematics studies. This curriculum is essentially the same as the U.S. version of Math Mammoth Grade 3, only customized for Canadian audiences in a few aspects (listed below). The curriculum meets the Common Core Standards in the United States, but it may not perfectly align to the third grade standards in your province (it will more likely match with various 4th grade Canadian standards).

The Canadian version of Math Mammoth has been customized for Canadian audiences in these aspects:

- The currency used in the money chapter (chapter 6) is the Canadian dollar. (The download version of the curriculum also includes this chapter for the U.S., British, European, South African, Australian and New Zealand currencies.)
- The curriculum uses only metric measurement units.
- The spelling conforms mostly to American English, taking into account a few key differences where where Canadian English follows British English.
- Large numbers are formatted with a space as the thousands separator (such as 12 394). (Decimals are formatted with a decimal point, as in the US version.)
- The pages are formatted for Letter-size paper.

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 1000, 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/** .

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	15 days
Chapter 9	8 days
Chapter 10	22 days
Chapter 11	15 days
TOTAL	**71 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	209	86	2.43	12.2
3-B	87	10	175	72	2.43	12.2
Grade 3 total	180	22	384	158	2.43	12.2

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 + _____ = 1000). 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 "outside 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 Mammoth.com website.

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.

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.

The Lessons in Chapter 7	page	span	suggested pacing	your pacing
Thousands	14	*4 pages*	1 day	
Four-Digit Numbers and Place Value	18	*5 pages*	2 days	
Comparing Numbers	23	*2 pages*	1 day	
Add and Subtract Four-digit Numbers 1	25	*2 pages*	1 day	
Add and Subtract Four-digit Numbers 2	27	*2 pages*	1 day	
Add Four-digit Numbers in Columns	29	*2 pages*	1 day	
Subtract Four-digit Numbers with Regrouping	31	*3 pages*	1 day	
More Practice	34	*3 pages*	1 day	
Word Problems	37	*2 pages*	1 day	
Mixed Review Chapter 7	39	*2 pages*	1 day	
Review Chapter 7	41	*2 pages*	1 day	
Chapter 7 Test (optional)				
TOTALS		*29 pages*	11 days	

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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. 5000 + _____ + 50 + _____

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

b. 7000 + 0 + _____ + _____

2. Fill in the blanks, and write each number as a sum of the values of its digits.

a.

thousands	hundreds	tens	ones
1	0	3	4

$= \underline{1000} + \underline{0} + \underline{30} + \underline{4}$

b.

thousands	hundreds	tens	ones
5	6	7	0

$= \_\_\_\_ + \_\_\_\_ + \_\_\_\_ + \_\_\_\_$

c.

Th	H	T	O
3	5	0	8

$= \_\_\_\_ + \_\_\_\_ + \_\_\_\_ + \_\_\_\_$

d. 8389 $= \_\_\_\_ + \_\_\_\_ + \_\_\_\_ + \_\_\_\_$

e. 9007 $= \_\_\_\_ + \_\_\_\_ + \_\_\_\_ + \_\_\_\_$

f. 6050 $= \_\_\_\_ + \_\_\_\_ + \_\_\_\_ + \_\_\_\_$

g. 216 $= \_\_\_\_ + \_\_\_\_ + \_\_\_\_ + \_\_\_\_$

3. Fill in.

a. Five thousand nine hundred ninety

Th	H	T	O

b. Six thousand sixteen

Th	H	T	O

c. Six thousand three hundred three

Th	H	T	O

d. Eight thousand seven hundred

Th	H	T	O

e. Nine thousand two hundred forty-five

Th	H	T	O

f. Ten thousand

ten thousands	Th	H	T	O
1	0	0	0	0

4. These numbers are written as sums. Write them in the normal way.

a. 2000 + 90 = _____ 3000 + 200 = _____	**b.** 8000 + 5 = _____ 1000 + 80 + 7 = _____
c. 8000 + 200 + 20 = _____ 2000 + 500 + 90 + 8 = _____	**d.** 4000 + 50 = _____ 2000 + 800 + 7 = _____

5. What part of these numbers is missing?

a. 5000 + 80 + _____ = 5083	**b.** 7000 + _____ + 5 = 7605
c. _____ + 3000 = 3050	**d.** _____ + 700 + 1 = 2701

6. Write the numbers immediately after and before the given number.

a. _____ 6049 _____

b. _____ 2324 _____

c. _____ 1800 _____

d. _____ 8809 _____

e. _____ 7385 _____

f. _____ 9244 _____

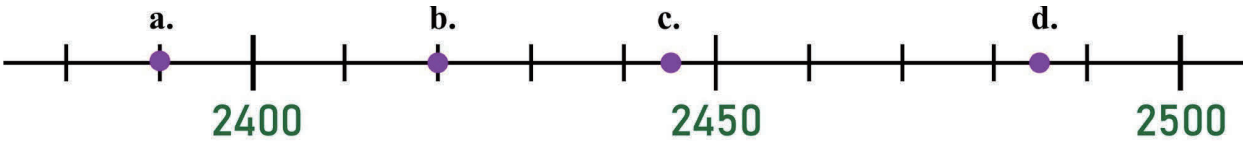
7. These numbers are written as sums in a scrambled order! Write them as normal numbers.

a. 8 hundreds 7 thousands 8 ones = _____	**b.** 5 hundreds 9 thousands = _____
c. 4 ones 3 thousands = _____	**d.** 5 thousands 6 tens = _____
e. 4000 + 900 + 7 = _____	**f.** 80 + 8000 + 6 = _____
g. 7 + 2000 + 40 = _____	**h.** 20 + 600 + 4000 = _____

8. What part of these numbers is missing?

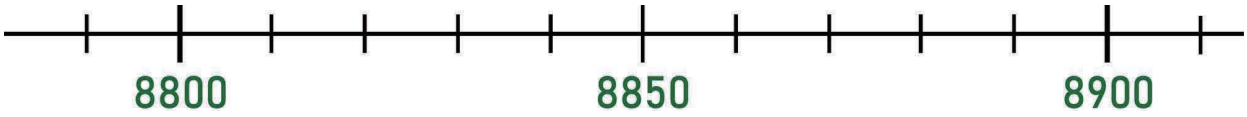
a. 900 + 2 + _____ = 8902	**b.** 5000 + 40 + _____ = 5046
c. _____ + 6000 + 40 = 6540	**d.** _____ + 4000 + 300 = 4340
e. 5 + _____ + 8000 = 8205	**f.** 80 + _____ + 9 = 7089

9. This number line has tick-marks for every 10. Write the numbers marked by the dots.

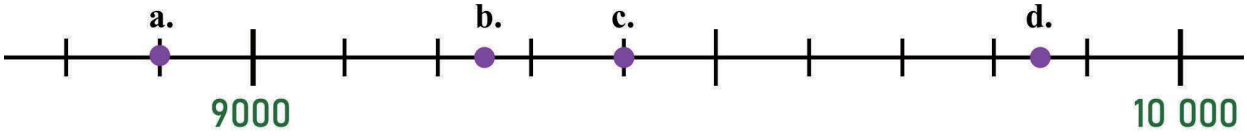


a. _____ **b.** _____ **c.** _____ **d.** _____

10. Mark the numbers on the number line (approximately):
8870 8821 8895 8795 8834



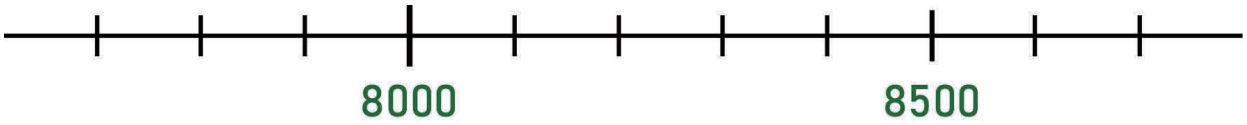
11. This number line goes from 9000 to 10 000 (ten thousand). The tick marks are at every hundred now (not at every ten). Write the numbers marked by the dots.



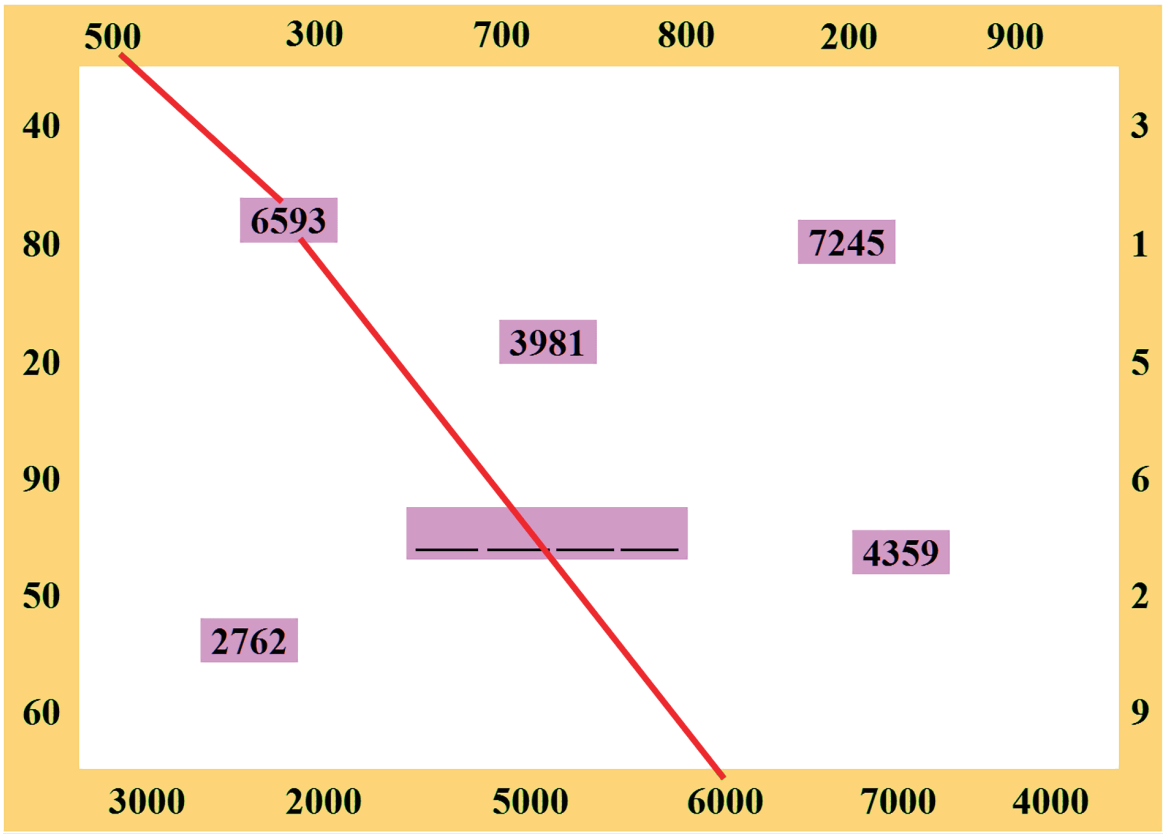
a. _____ **b.** _____ **c.** _____ **d.** _____

12. Place the following numbers (approximately) on the number line:

8100 7990 8240 8570 7750



13. Connect each number inside the puzzle to its thousands, hundreds, tens and ones that it contains. For example, 6593 is connected to 6000 and to 500 (for starters). Add the unused numbers from the border to form the missing number inside.



Puzzle Corner

Place the digits 1, 2, 5, 6 and 8 into the boxes so that the number sentences become true.

□ × □ + □□□ = 569 □□ × □ + □ × □ = 112

Comparing Numbers

Example: Which is more, 5721 or 5278?

Th	H	T	O
5	7	2	1
5	2	7	8

We can use a place value table to compare them. (The heading "Th" signifies thousands, "H" is hundreds, "T" is tens, and "O" is ones.)

First, we compare how many THOUSANDS the numbers have.
Both of these have 5 thousands. So, that doesn't tell us which is more.

Then if they have the same amount of thousands, we compare the hundreds. Here, the first number has more hundreds than the second (7 versus 2). So, 5721 > 5278.

We don't need to check the tens and the ones. (Why?)

To compare two numbers, start with the largest place. In four-digit numbers, the thousands place is the largest place.

If the numbers have the same amount of thousands, compare the hundreds.
Then if they also have the same amount of hundreds, compare the tens.
And if everything else is the same, then compare the ones.

1. Circle or underline the greatest number.

a. Th H T O 7 5 0 5 6 5 0 3 8 5 0 2	**b.** Th H T O 5 4 1 0 5 2 1 0 5 7 1 0	**c.** Th H T O 3 8 0 5 3 8 1 1 3 8 0 9	**d.** Th H T O 5 7 4 3 5 7 3 4 5 7 2 1
e. 5078 5098 5100	**f.** 4500 6101 3099	**g.** 9056 9834 9275	**h.** 6309 9603 3609

2. Compare the numbers, writing < or > between them.

a.	**b.**	**c.**	**d.**
1050 < 5095	220 1020	1307 1032	4012 4284
2400 2750	8060 6999	4906 6029	5008 5040
6005 4500	1007 1705	5077 5570	1890 1897

3. One of the three numbers fits on the empty line so that the comparisons are true.
Which one? Circle the number (or write it on the line).

a. 6550 7601 7550	**b.** 2435 2338 2350
7500 < _____ < 7600	2335 < _____ < 2345
c. 7099 7110 7080	**d.** 1232 1212 1223
7089 < _____ < 7100	1203 < _____ < 1222
e. 1809 1908 1890	**f.** 3489 3589 3458
1806 < _____ < 1812	3469 < _____ < 3579

4. Compare. Write < , > or = in the box.

a. 800 + 7000 ☐ 700 + 80 + 7000

b. 500 + 6000 ☐ 6000 + 500

c. 300 + 2000 ☐ 20 + 3000

d. 900 + 8 ☐ 9000 + 8

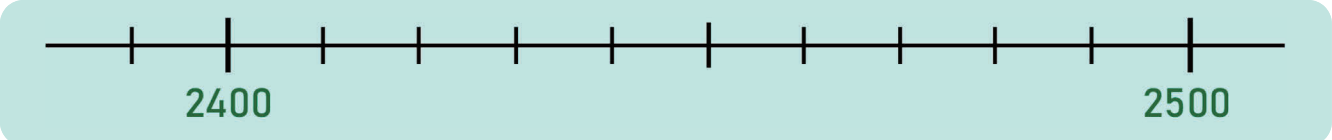
e. 4000 + 80 ☐ 80 + 4 + 800

f. 30 + 6000 + 3 ☐ 300 + 60 + 3000

g. 500 + 3000 + 80 + 6 ☐ 6 + 80 + 500 + 3000

5. Mark the following numbers (approximately) on the number line.

2417 2455 2462 2487 2390



6. Write the numbers in order from smallest to greatest: 3899 3040 4330 4203 4003.

_____ < _____ < _____ < _____ < _____

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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-sized 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.

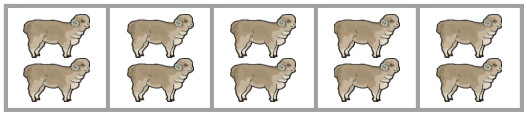
$2 \times 6 = 12$

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

$12 \div 6 = 2$

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

_____ × 2 = _____

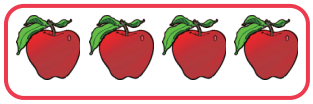


_____ divided into ***groups of 2*** is ___ groups.

_____ ÷ 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.

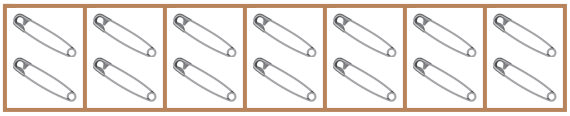
_____ × 1 = _____

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

_____ ÷ 1 = _____

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

_____ × _____ = _____

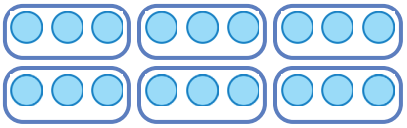


_____ divided into ***groups of 2*** is ___ groups.

_____ ÷ _____ = _____

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

_____ × _____ = _____

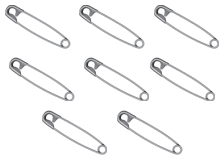


_____ divided into ***groups of 3*** is ___ groups.

_____ ÷ _____ = _____

2. Make groups. Then write the division and multiplication facts that the pictures illustrate.

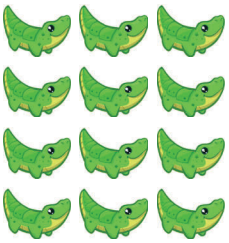
a. Make groups of four.



_____ × 4 = 8

8 ÷ 4 = _____

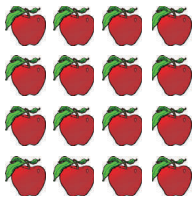
b. Make groups of two.



_____ × 2 = _____

_____ ÷ 2 = _____

c. Make groups of four.



_____ × 4 = _____

_____ ÷ 4 = _____

d. Make groups of six.

_____ × 6 = _____

_____ ÷ 6 = _____

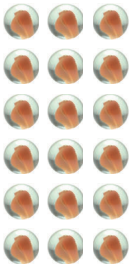
e. _____ × 4 = _____

_____ ÷ 4 = _____

f. _____ × 7 = _____

_____ ÷ 7 = _____

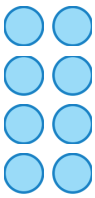
g.



_____ × 6 = _____

_____ ÷ 6 = _____

h.



_____ × 2 = _____

_____ ÷ 2 = _____

i.

_____ × 5 = _____

_____ ÷ 5 = _____

3. Now draw sticks or circles to illustrate each problem.
Write the division and multiplication sentences.

a. Draw 15 sticks.
Make groups of 5.

_____ × 5 = _____

_____ ÷ 5 = _____

b. Draw 24 sticks.
Make groups of 8.

_____ × _____ = _____

_____ ÷ _____ = _____

c. Draw 30 sticks.
Make groups of 5.

_____ × _____ = _____

_____ ÷ _____ = _____

You can solve a division problem by thinking of the *matching multiplication*.

$30 \div 6 =$ ___

___ $\times 6 = 30$

Think: what times 6 is 30?

Since you already know the multiplication tables, learning division is easy!

4. For each division, think of the matching multiplication, and solve.

a. $14 \div 2 =$ _____ ____ $\times 2 = 14$	**b.** $18 \div 2 =$ _____ ____ $\times 2 =$ _____	**c.** $21 \div 7 =$ _____ ____ $\times 7 =$ _____
d. $54 \div 6 =$ _____ ____ $\times$ ____ $=$ _____	**e.** $24 \div 4 =$ _____ ____ $\times$ ____ $=$ _____	**f.** $30 \div 3 =$ _____ ____ $\times$ ____ $=$ _____
g. $32 \div 4 =$ _____	**h.** $56 \div 7 =$ _____	**i.** $55 \div 5 =$ _____

5. Divide. Again, think of multiplication.

a.	b.	c.	d.
$24 \div 4 =$ _____	$15 \div 5 =$ _____	$32 \div 8 =$ _____	$48 \div 6 =$ _____
$16 \div 2 =$ _____	$35 \div 5 =$ _____	$40 \div 8 =$ _____	$56 \div 8 =$ _____
$20 \div 2 =$ _____	$49 \div 7 =$ _____	$50 \div 5 =$ _____	$81 \div 9 =$ _____
$36 \div 9 =$ _____	$54 \div 9 =$ _____	$42 \div 6 =$ _____	$100 \div 10 =$ _____

Puzzle Corner

Think of multiplication, and solve.

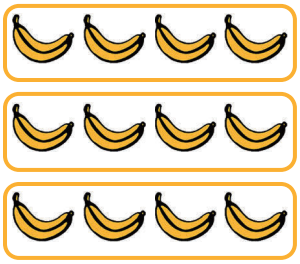
a. $1000 \div 100 =$ _____ **b.** $400 \div 50 =$ _____ **c.** $200 \div 4 =$ _____

d. $1000 \div 500 =$ _____ **e.** $800 \div 800 =$ _____ **f.** $200 \div 40 =$ _____

Multiplication and Division Fact Families

Below, 12 bananas are arranged in an array. We can actually get **two** multiplication facts AND **two** division facts from the picture.

Bananas divided into rows:

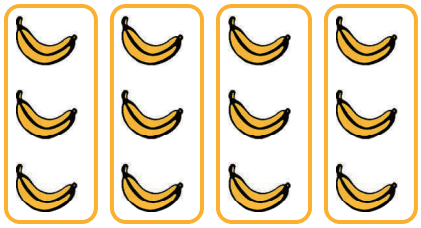


12 bananas in groups of four is three groups.

12 ÷ 4 = 3

3 × 4 = 12

The same bananas divided into columns:



12 bananas in groups of three is four groups.

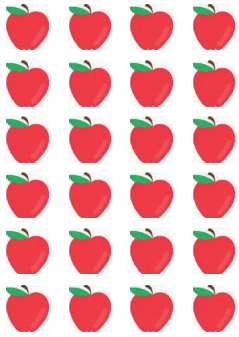
12 ÷ 3 = 4

4 × 3 = 12

Just like with addition and subtraction, we can form **fact families** that have two multiplication facts and two division facts.

1. Make two division sentences and two multiplication sentences to match each array. Think of dividing the objects either into rows or into columns.

a.



4 × 6 = _____

6 × 4 = _____

_____ ÷ 4 = _____

_____ ÷ 6 = _____

b.

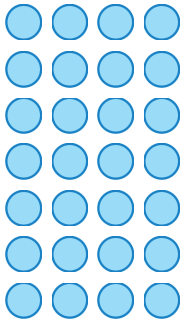
_____ × _____ = _____

_____ × _____ = _____

_____ ÷ _____ = _____

_____ ÷ _____ = _____

c.



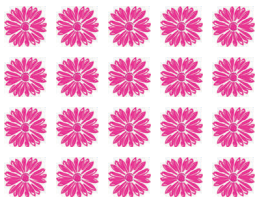
_____ × _____ = _____

_____ × _____ = _____

_____ ÷ _____ = _____

_____ ÷ _____ = _____

d.



_____ × _____ = _____

_____ × _____ = _____

_____ ÷ _____ = _____

_____ ÷ _____ = _____

2. Write a fact family to match the array.

_____ × _____ = _____

_____ × _____ = _____

_____ ÷ _____ = _____

_____ ÷ _____ = _____

3. Write a fact family, and draw an array to illustrate it.

_____ × _____ = _____

_____ × _____ = _____

18 ÷ _____ = 3

_____ ÷ _____ = _____

4. Fill in the missing numbers to complete each fact family.

a.	**b.**	**c.**
7 × _____ = 35	_____ × _____ = _____	12 × 4 = _____
_____ × _____ = _____	_____ × _____ = _____	_____ × _____ = _____
_____ ÷ _____ = _____	_____ ÷ 8 = 9	_____ ÷ _____ = _____
_____ ÷ _____ = _____	_____ ÷ _____ = _____	_____ ÷ _____ = _____

5. Joanna arranged 28 toy blocks in an array, in four columns.
How many rows does her array have?

6. Alice drew a picture of trees in an orchard. She had three rows of trees, with five trees in each row. She also drew three mangos in each tree.

Explain what information you can find out about this situation. Calculate to find it.

7. A meeting hall had 45 chairs arranged in five rows.
What information can you find out about this situation? Calculate to find it.

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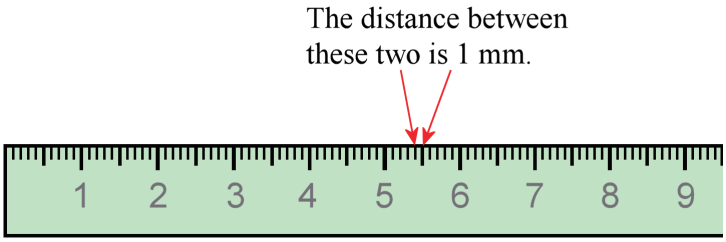
Centimetres and Millimetres

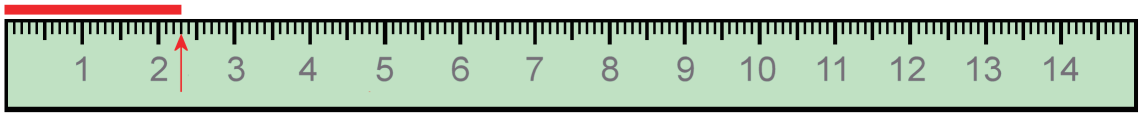
This ruler measures in centimetres. The numbers signify whole centimetres. All the shorter lines between those are for *millimetres*.

The distance from one short line to the next is *1 millimetre*. We write 1 mm. Millimetres are very tiny!



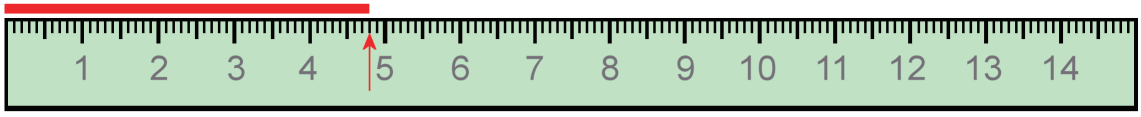
Look at the ruler: **there are 10 millimetres in each centimetre.**

Measuring lines: First see how many whole centimetres long the line is. Then count how many little millimetre-lines beyond that it reaches.



This line is 2 cm 3 mm long. At the same time, it is 23 mm long. Why?

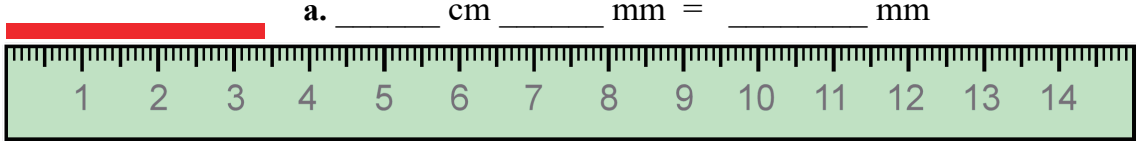
Each centimetre is 10 mm, so 2 cm is 20 mm. So, 2 cm 3 mm makes 23 mm in total.



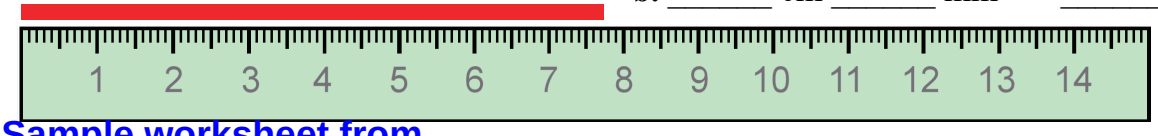
This line is 4 cm 8 mm long. At the same time, it is 48 mm long.

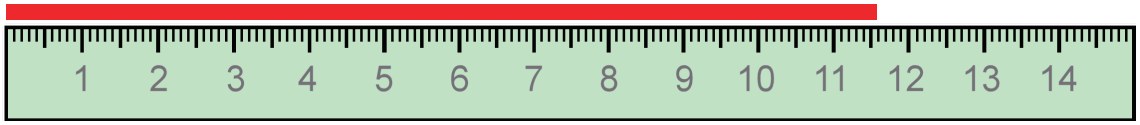
1. Measure the lines using the ruler, first in whole centimetres and millimetres. Then write their lengths using millimetres only.

a. _____ cm _____ mm = _____ mm

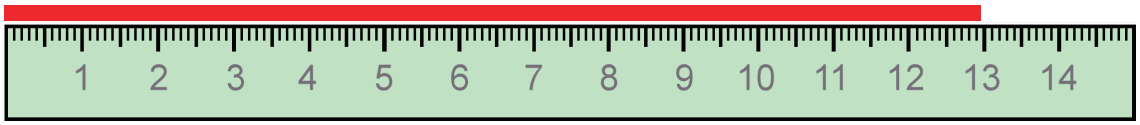


b. _____ cm _____ mm = _____ mm

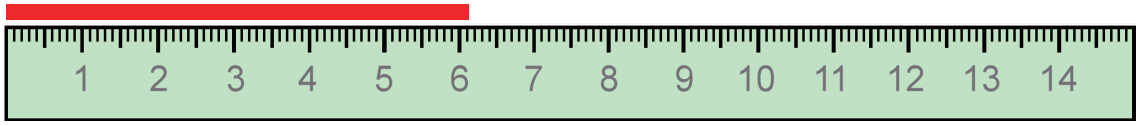




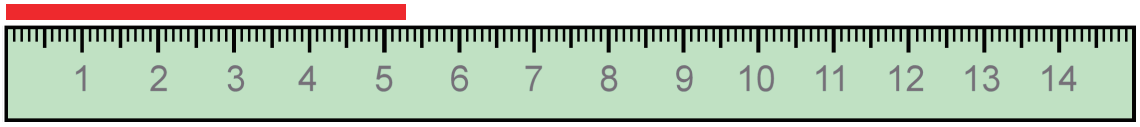
c. _____ cm _____ mm = _____ mm



d. _____ cm _____ mm = _____ mm



e. _____ cm _____ mm = _____ mm



f. _____ cm _____ mm = _____ mm

2. Draw lines using a ruler.

a. 7 cm 8 mm

b. 10 cm 5 mm

c. 14 mm

d. 55 mm

e. 126 mm

3. Measure items, using a centimetre-millimetre ruler. If the item is not exactly as long as the markers on the ruler, choose the nearest mark.

Item	Length

4. Change between centimetres and millimetres. Remember that 1 cm = 10 mm.

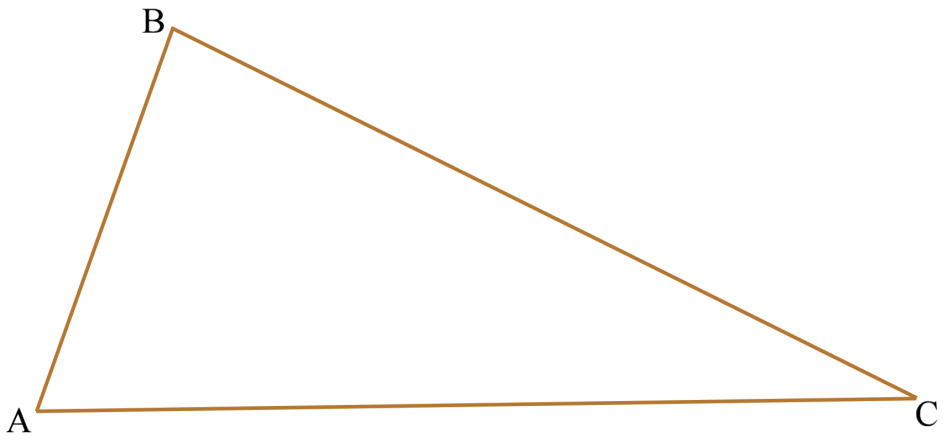
a.	b.	c.
2 cm = _____ mm	1 cm 1 mm = *11* mm	4 cm 5 mm = _____ mm
5 cm = _____ mm	1 cm 8 mm = _____ mm	7 cm 8 mm = _____ mm
8 cm = _____ mm	2 cm 3 mm = _____ mm	10 cm 4 mm = _____ mm

5. Measure the sides of this triangle in millimetres.

Side AB: _____ mm

Side BC: _____ mm

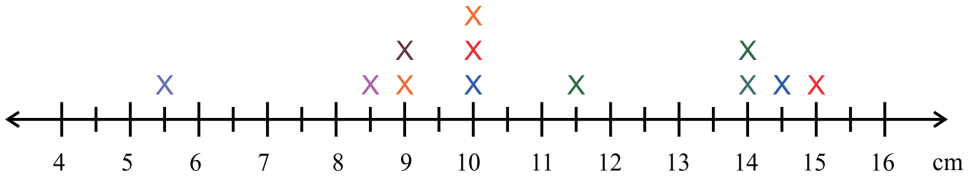
Side CA: _____ mm



6. If you went all the way around the triangle in #5, what distance would you travel?

Line Plots

Amanda measured the length of some of her coloured pencils.
She recorded her results in a **line plot** below. For each pencil, she put an "x" mark above the number line to show how many centimetres long it was.



For example, Amanda's longest pencil (red x-mark) is 15 centimetres long.

1. Look carefully at the line plot above, and answer:

   a. How many pencils does Amanda have that are 10 centimetres long?

   b. How long is the pencil that is *between* 8 and 9 centimetres long?

   c. How long is Amanda's shortest pencil?

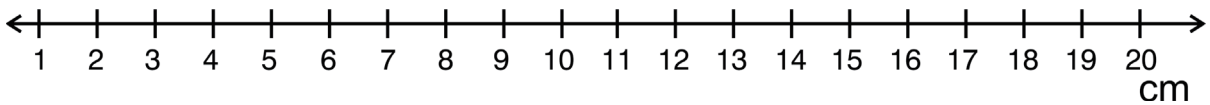
2. Measure many pencils of different lengths to the nearest centimetre.
   Write the lengths below.

_____ cm _____ cm _____ cm _____ cm _____ cm

_____ cm _____ cm _____ cm _____ cm _____ cm

_____ cm _____ cm _____ cm _____ cm _____ cm

Now, make a line plot about your pencils. Write an "X" mark for each pencil.



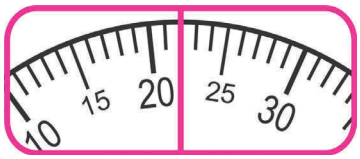
Grams and Kilograms

We can measure objects using different types of scales, to find out how heavy they are.

In this lesson we will use scales that show kilograms (kg) and grams (g). Those are units for mass. The **mass** of an object means how much material (or substance or "stuff") is in it. And the more material is in it, the heavier it is!

- A **gram** (abbreviated "g") is a very small unit of mass. One large paperclip has a mass of about 1 gram.
- A **kilogram** (kg) is a larger unit of mass. For example, a baby might have a mass of 4 kg. A litre bottle of water has a mass of 1 kg.
- A thousand grams make one kilogram: 1000 g = 1 kg.

In this lesson, you will need:



- A bathroom scale that measures in kilograms. An analogue scale is great; digital is fine.
- A kitchen scale that measures in grams. An analogue scale is great; digital is fine, too.
- Paperclips, thumbtacks, pencils and other small objects.
- A book, water bottle, or other object with a mass of (approximately) 1 kg.
- An object with a mass of 100 g (a small apple, tomato or a potato will do).
- Objects to weigh.

1. Let's weigh stuff!

a. How many paperclips do you need to make the scale show 10 grams? Use both small and large paperclips if you have them.

Note: one paperclip may not make a scale to show anything, because it may be less than one gram. (Small paperclips are about 1/4 to 1/3 of a gram.)

b. Place 20 paperclips on the scale. Then do the same with 20 thumbtacks. Which is heavier, *one* paperclip or *one* thumbtack?

c. Estimate (make a guess) the mass of a ruler and a pencil. Then check with the scale.

(Note to the teacher: Technically speaking, scales measure weight, not mass. Weight of an object is a force; it is how much gravity pulls on an object. Scales measure the pull of gravity on an object. But, scales we will be using here do not show a measurement of force (which would be in Newtons) but use kilograms or grams which are units of mass. In other words, the scales use gravity to indirectly measure an object's mass. In this lesson, it is alright to use the word "weight" since that is common in everyday usage, and since that is what scales in reality do measure. However, it is also good to get students used to the word and idea of "mass".)

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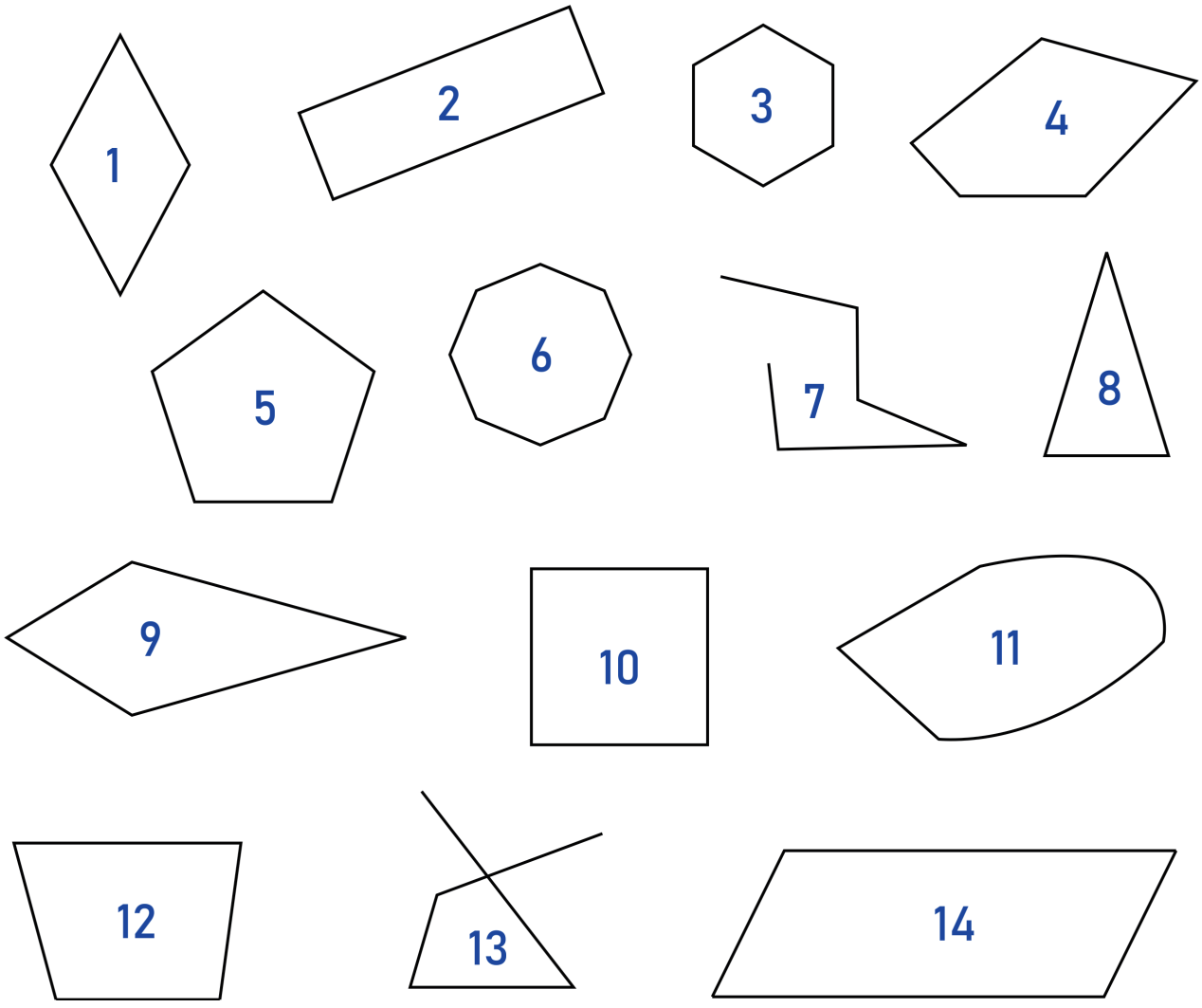
Polygons

1. **a.** Find a way to sort these shapes (there are many possible ways). You can cut them out! Explain why you sorted them the way you did.

b. Now sort them in a different way.



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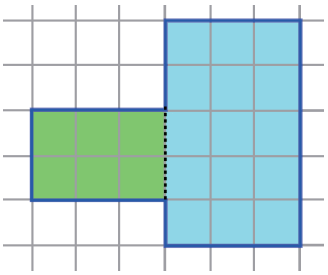
Area of Compound Shapes 1

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:

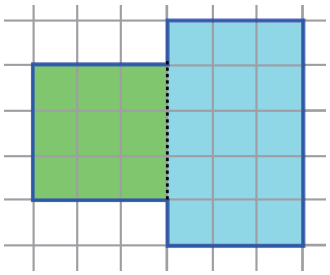
$$3 \times 2 \; + \; 3 \times 5 \; = \; 6 + 15 \; = \; 21$$

The area is 21 square units.



1. Write two multiplications to find the total area.

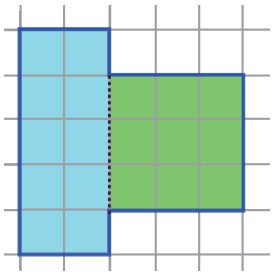
a.



____ × ____ + ____ × ____ = _____

Area = _____ square units

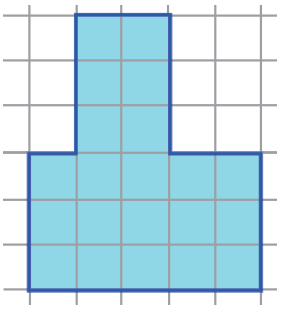
b.



____ × ____ + ____ × ____ = _____

Area = _____ square units

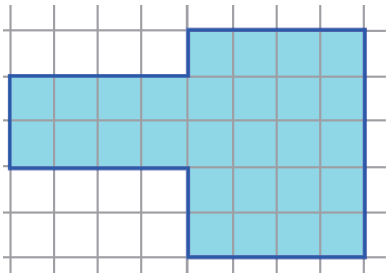
c.



_____

Area = _____ square units

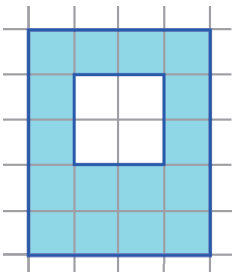
d.



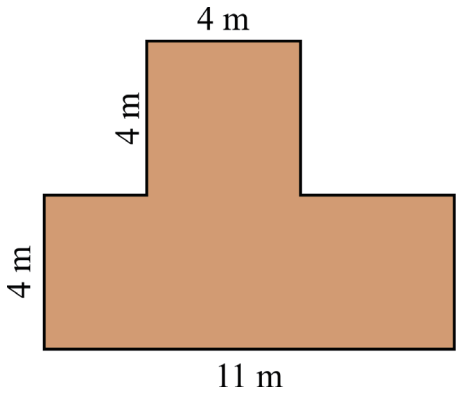
_____

Area = _____ square units

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

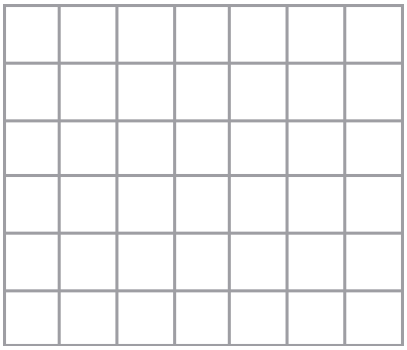


3. Find the area of this children's playground.
   Use the correct unit for area.

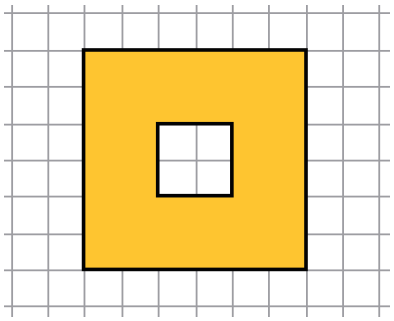


4. A 4-by-5 rectangle has a hole in the middle that measures three square units (similar to what you see in question #2).

   What is the area of that figure?

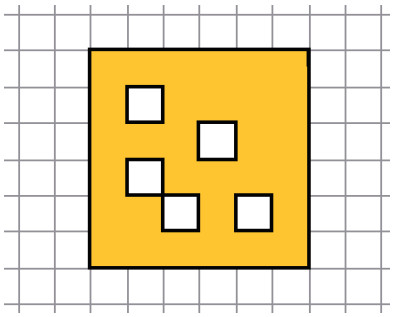


5. Find the areas.



a.

The area is _____ square units.

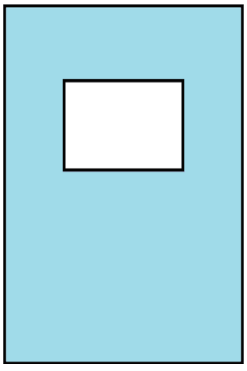


b.

The area is _____ square units.

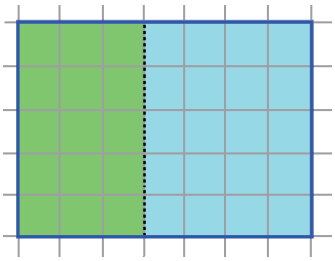
6. A notebook measures 10 cm by 15 cm. On its cover is a white rectangle. The white rectangle is 6 cm by 4 cm.

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



Area of Decomposed Rectangles

1. This rectangle is divided into two parts.



a. What is the area of the smaller part? Write a multiplication.

b. What is the area of the larger part? Write a multiplication.

c. What is the area of the entire rectangle? Write a multiplication.

d. You've written three multiplications. What is same about each one?

e. If we write the length of this rectangle as $3 + 4$, then what would $5 \times (3 + 4)$ signify?

2. **a.** Draw here a rectangle that is divided into two smaller rectangles in this manner:

The entire rectangle is 4 units high by 12 units long.
The first part will be 4 units high by 3 units long.
The second part is 4 units high by 9 units long.

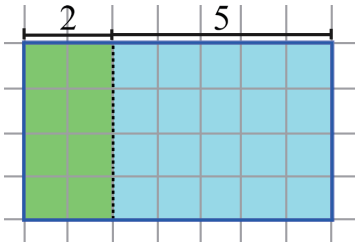
b. Write a multiplication for the area of the smaller part.

c. Write a multiplication for the area of the larger part.

d. Write a single multiplication for the area of the entire rectangle.

e. What would $4 \times (3 + 9)$ signify in this context?

The **height** of this rectangle is **4** units. Since the rectangle is divided into two parts, we can write its **length** as the sum **2 + 5**.



All in all, the area of the entire rectangle is **4 × (2 + 5)** = 4 × 7 = 28 square units.

But we can also think of it this way. The area of the first part is 4 × 2, or 8, and the area of the larger part is 4 × 5, or 20.

Adding those together, the area of the entire rectangle can be written as **4 × 2 + 4 × 5**.

Both of those calculations give us the area of the entire rectangle — so they are equal:

$$4 \times (2 + 5) \quad = \quad 4 \times 2 \quad + \quad 4 \times 5$$

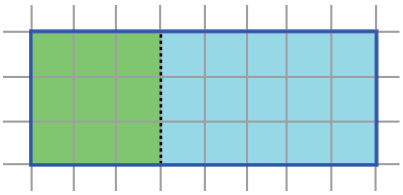
area of the whole rectangle | area of the first part | area of the second part

3. Fill in the missing parts to match the expressions (number sentences) for the area.

a.

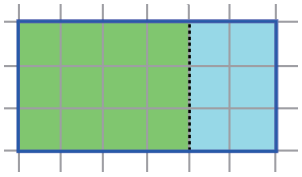
___ × (___ + ___) = ___ × ___ + ___ × ___

area of the whole rectangle | area of the first part | area of the second part



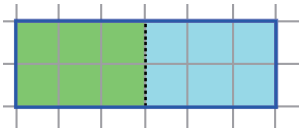
b.

___ × (___ + ___) = ___ × ___ + ___ × ___



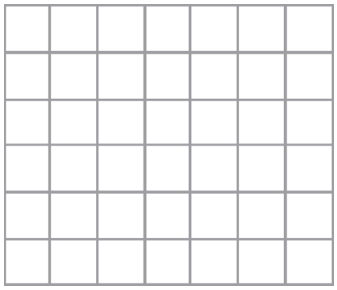
c.

___ × (___ + ___) = ___ × ___ + ___ × ___

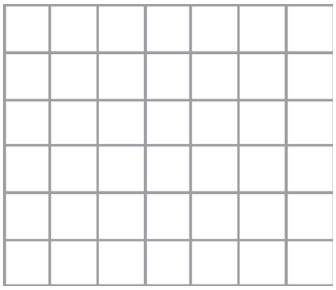


4. Draw a rectangle that matches the given expression (number sentence). Also find its area.

a. 3 × (2 + 4) =



b. 5 × (1 + 4) =

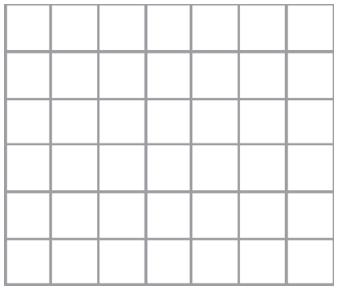


5. Draw a rectangle that matches the given expression, and fill in the missing parts.

a.

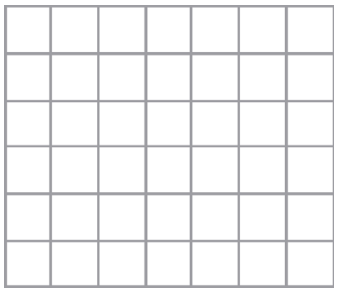
$4 \times (3 + 1)$ = ___ × ___ + ___ × ___

area of the whole rectangle | area of the first part | area of the second part



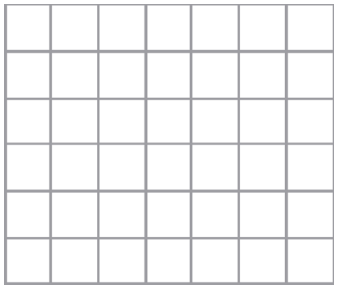
b.

___ × (___ + ___) = 3×2 + 3×1



c.

___ × (___ + ___) = 2×5 + 2×2

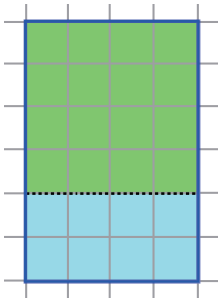


6. Write expressions for the area of each rectangle, thinking of it as one rectangle or two. (This time, the parts are divided by a horizontal line, not a vertical.)

a.

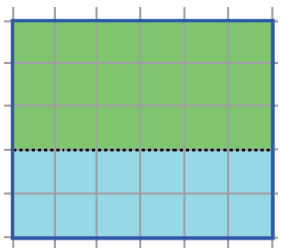
___ × (___ + ___) = ___ × ___ + ___ × ___

area of the whole rectangle | area of the first part | area of the second part



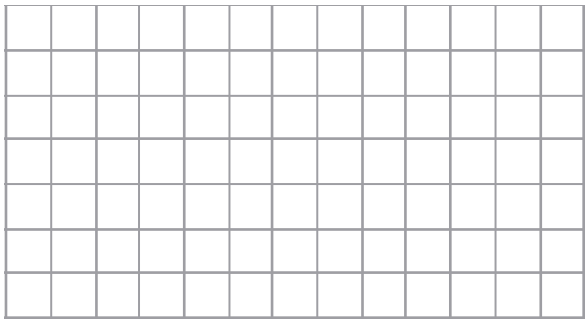
b.

___ × (___ + ___) = ___ × ___ + ___ × ___

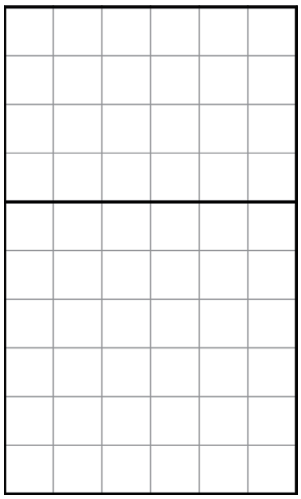


7. Draw a rectangle to show that $6 \times (2 + 9)$ equals $6 \times 2 + 6 \times 9$.

   Explain how your rectangle shows that.



8. Which expressions match the area model shown by the rectangle?



(i) $6 \times (4 + 6)$

(ii) $6 \times 4 + 6 + 4$

(iii) $6 \times 4 \times 6 \times 6$

(iv) $6 \times 4 + 6 \times 6$

(v) $6 \times 4 \times 6 + 4$

(vi) $6 \times (4 + 4)$

(vii) $4 \times (6 + 6)$

9. Draw a two-part rectangle that matches the given expression.

a. $5 \times (7 + 6)$

b. $7 \times 1 + 7 \times 6$

Find the value of the unknown in each case.

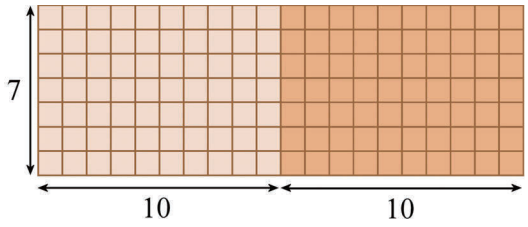
Puzzle Corner

a. $5 \times (2 + b) = 10 + 40$

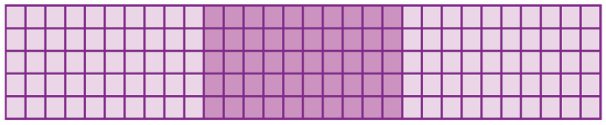
b. $104 = 8 \times (s + 7)$

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** $\times$ **10**.
- Then, **5** $\times$ **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 $= 10 \times$ ____ $\times$ ____ $= 10 \times$ _____ $=$ _____

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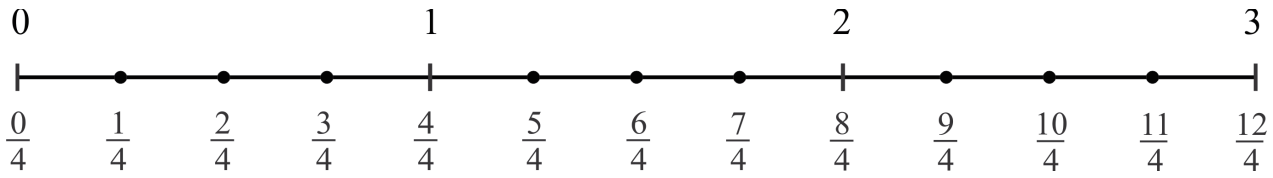
Fractions on a Number Line 2

Here, the interval from 0 to 1 on the number line is divided into **four** parts. The interval from 1 to 2 is also divided into **four** parts, and similarly from 2 to 3.

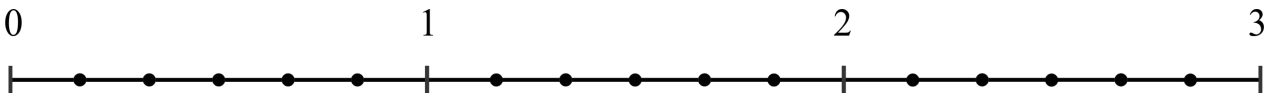


We can count in fourths, starting with zero fourths, then 1 fourth, 2 fourths and so on.

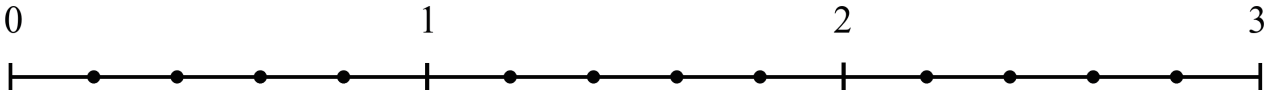
Notice especially: $1 = \frac{4}{4}$, $2 = \frac{8}{4}$ and $3 = \frac{12}{4}$.

1. Mark the fractions on the number lines. Note: some of them are whole numbers!

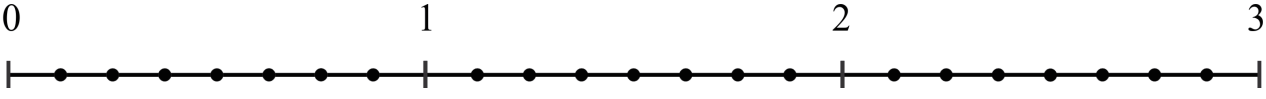
a. $\frac{7}{6}$, $\frac{11}{6}$, $\frac{18}{6}$, $\frac{3}{6}$, $\frac{13}{6}$



b. $\frac{6}{5}$, $\frac{11}{5}$, $\frac{15}{5}$, $\frac{9}{5}$, $\frac{13}{5}$



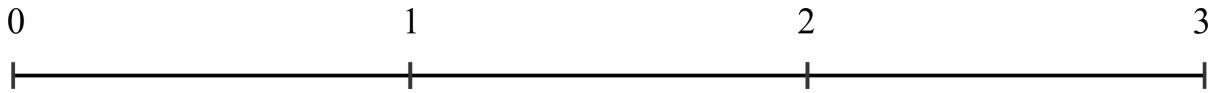
c. $\frac{12}{8}$, $\frac{17}{8}$, $\frac{21}{8}$, $\frac{5}{8}$, $\frac{16}{8}$



d. Write the whole number 2 as a fraction using sixths. (One of the number lines can help.)

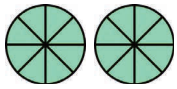
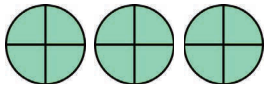
e. Write the whole number 3 as a fraction using eighths.

2. Divide each interval from one whole number to the next into three parts. Then mark these fractions on the number line: $\frac{2}{3}$, $\frac{5}{3}$, $\frac{9}{3}$, $\frac{8}{3}$, $\frac{4}{3}$.



3. Write 4 as a fraction using thirds. (You can imagine extending the above number line.)

4. Write these whole numbers as fractions. You can use pie pictures or the number lines from previous exercises to help. Try to find a **shortcut** or a **general principle** that will allow you to write a whole number as a fraction with a given denominator.

a.  $1 = \frac{\square}{\square}$	**b.**  $2 = \frac{\square}{\square}$	**c.**  $3 = \frac{\square}{\square}$		
d. $2 = \frac{\square}{6}$	**e.** $3 = \frac{\square}{5}$	**f.** $3 = \frac{\square}{3}$	**g.** $2 = \frac{\square}{8}$	**h.** $3 = \frac{\square}{5}$

5. Did you find a shortcut? Check with your teacher or on the next page.
Also, explain how to write 5 as a fraction, using eighths, and also, using thirds.

6. Mark these fractions on the number line: $\frac{7}{3}$, $\frac{14}{3}$, $\frac{10}{3}$, $\frac{12}{3}$, $\frac{9}{3}$.

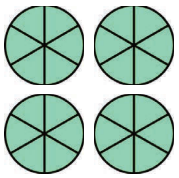
7. Partition the number line below into halves. Then mark a fraction for each tick mark, including for the whole numbers.

To write a whole number as a fraction, you can use multiplication.

Example: Write 4 as a fraction, using sixths.

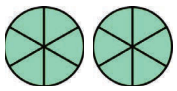
Each whole is six sixths. So, 4 wholes is 4 × 6 sixths, or 24 sixths.

In other words, $4 = \frac{24}{6}$.

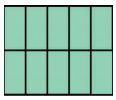


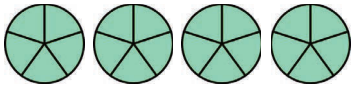
We just saw that $\frac{24}{6} = 4$. This is the same as the division 24 ÷ 6 = 4! In fact, the fraction line works as a division symbol! Similarly, $\frac{40}{8}$ equals 40 ÷ 8, so, it is 5.

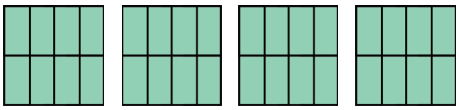
8. Write the whole numbers as fractions.

a.  $2 = \frac{\quad}{\quad}$

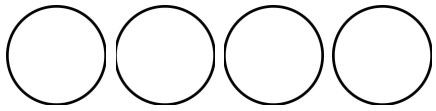
b.  $3 = \frac{\quad}{\quad}$

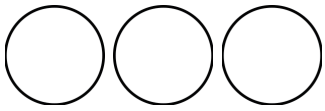
c.  $1 = \frac{\quad}{\quad}$

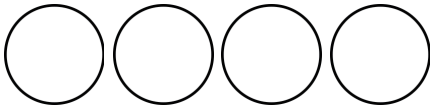
d.  $4 = \frac{\quad}{\quad}$

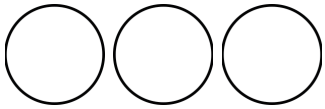
e.  $4 = \frac{\quad}{\quad}$

9. Divide the pies into parts, and colour the pies. Write the whole numbers as fractions.

a.  $4 = \frac{\quad}{2}$

b.  $3 = \frac{\quad}{8}$

c.  $4 = \frac{\quad}{4}$

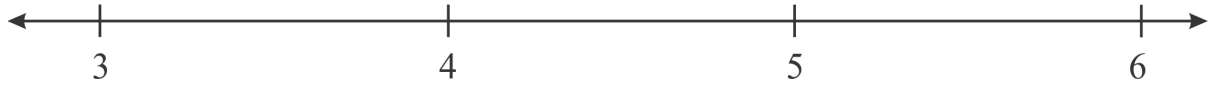
d.  $3 = \frac{\quad}{6}$

10. Find three different ways to write number 2 as a fraction.

11. These fractions are actually whole numbers! Which ones?

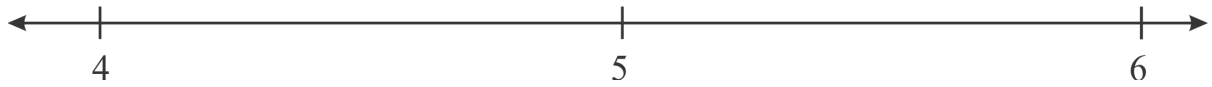
a. $\frac{6}{6} =$	**b.** $\frac{21}{7} =$	**c.** $\frac{24}{6} =$	**d.** $\frac{20}{2} =$
e. $\frac{20}{4} =$	**f.** $\frac{8}{8} =$	**g.** $\frac{12}{3} =$	**h.** $\frac{30}{5} =$

12. Mark these fractions on the number line: $\frac{19}{4}$, $\frac{13}{4}$, $\frac{21}{4}$, $\frac{24}{4}$, $\frac{18}{4}$.



13. Mark these fractions on the number line: $\frac{30}{6}$, $\frac{26}{6}$, $\frac{35}{6}$, $\frac{22}{6}$, $\frac{31}{6}$.

14. Mark these fractions on the number line: $\frac{37}{8}$, $\frac{40}{8}$, $\frac{39}{8}$, $\frac{42}{8}$, $\frac{47}{8}$.

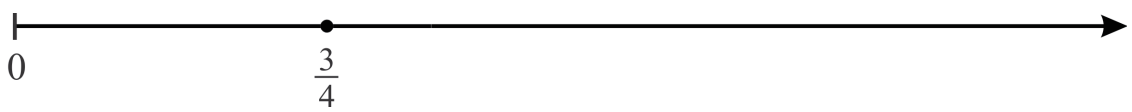


15. Joanna says that the fraction $\frac{69}{8}$ is between 6 and 7. Bill says it is between 7 and 8. Who is right? Explain.

16. Which is the greatest number? $\frac{40}{5}$, $\frac{40}{8}$, $\frac{36}{6}$, $\frac{36}{4}$, $\frac{36}{3}$

Puzzle Corner

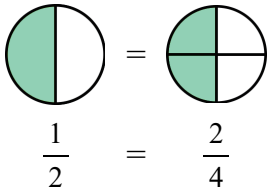
Mark these numbers on the number line: $\frac{5}{4}$, $\frac{1}{2}$, 2, $\frac{5}{2}$, $\frac{9}{4}$.



Equivalent Fractions 1

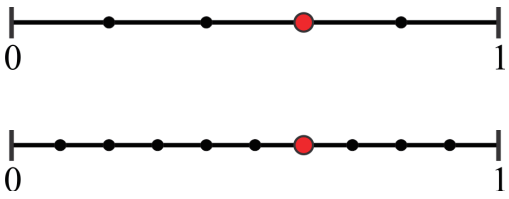
If you eat half of a pizza, or 2/4 of a pizza, you have eaten the same amount. The two fractions are ***equivalent***.

We can write an equal sign between them: $\frac{1}{2} = \frac{2}{4}$.

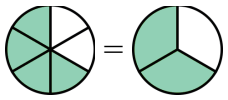


$\frac{1}{2} = \frac{2}{4}$

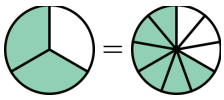
The dot for $\frac{3}{5}$ is in the same place on the number line as the dot for $\frac{6}{10}$. Again, the two fractions are *equivalent*. We can write $\frac{3}{5} = \frac{6}{10}$.



1. Write the equivalent fractions.

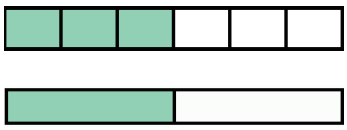


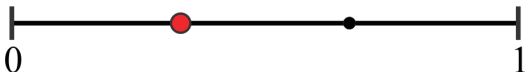
a. ☐/☐ = ☐/☐

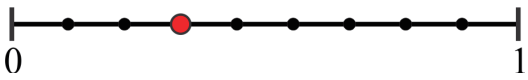


b. ☐/☐ = ☐/☐

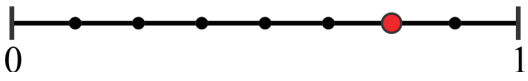
c. ☐/☐ = ☐/☐

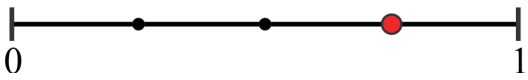






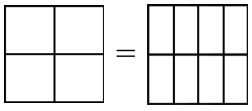
d. ☐/☐ = ☐/☐



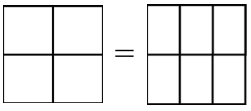


e. ☐/☐ = ☐/☐

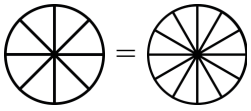
2. Shade the parts for the first fraction. Shade the same *amount* in the second picture. Write the second, equivalent fraction.



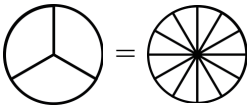
a. $\frac{1}{4}$ =



b. $\frac{2}{4}$ =



c. $\frac{6}{8}$ =



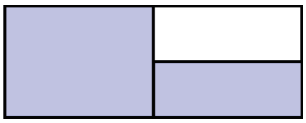
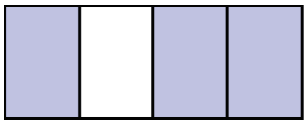
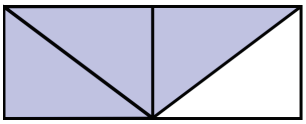
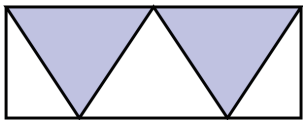
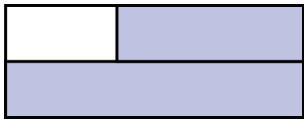
d. $\frac{2}{3}$ =

3. Draw an illustration to show the equivalence of the fractions. You can use any fraction model you feel works the best.

a. $\frac{3}{4} = \frac{6}{8}$	**b.** $\frac{1}{3} = \frac{2}{6}$

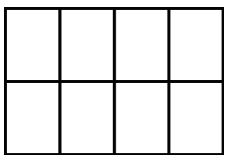
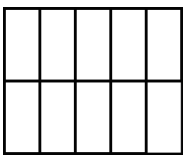
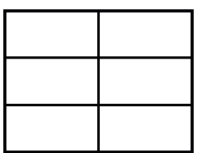
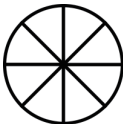
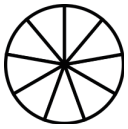
4. Write at least three fractions that are equivalent to 1/2. Also, use illustrations to show why they are equivalent.

5. Find all the pictures that show a fraction equivalent to 3/4.

a. 	**b.** 	**c.** 
d. 	**e.** 	**f.** 

6. Are 3/3 and 4/4 equivalent fractions? Why or why not?

7. Shade a fraction that is equivalent to the given fraction.

a. $\frac{3}{4}$ 	**b.** $\frac{3}{5}$ 	**c.** $\frac{1}{3}$ 
d. $\frac{1}{4}$ 	**e.** $\frac{1}{3}$ 	**f.** $\frac{3}{4}$