MATH MAMMOTH
Grade 4-A
Complete Worktext

- Addition, subtraction, graphs, and money
- Big numbers & place value
- Multi-digit multipication
- Time and measuring

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www.MathMammoth.com

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Foreword

Math Mammoth Grade 4-A and Grade 4-B worktexts comprise a complete math curriculum for the fourth grade mathematics studies.

In the fourth grade, students focus on multidigit multiplication and division, learning to use bigger numbers, solving multi-step word problems that involve several operations, and get started in studying fractions and decimals. This is of course accompanied by studies in geometry and measuring.

The year starts out with review of addition and subtraction, graphs, and money. We illustrate word problems with bar diagrams and study finding missing addends, which teaches algebraic thinking. Children also learn addition and subtraction terminology, order of operations, and statistical graphs.

Next come large numbers -- up to millions, and the place value concept. At first the student reviews thousands and some mental math with them. Next are presented numbers till one million, calculations with them, place value concept and comparing. In the end of the chapter we find more about millions and an introduction to multiples of 10, 100, and 1000.

The third chapter is all about multiplication. After briefly reviewing the concept and the times tables, the focus is on learning multidigit multiplication (multiplication algorithm). The children also learn why it works when they work on multiplying in parts. We also study order of operations again, touch on proportional reasoning, and do more money and change related word problems.

The last chapter in part A is about time, temperature, lenght, weight, and volume. Students will learn to solve more complex problems using various measuring units and to convert between measuring units.

In part B, we first study division. The focus is on learning long division and using division in word problems. The geometry chapter introduces students to measuring angles, and we do lots of drawing of different shapes and circles. Area and perimeter are other important topics in geometry.

Fractions and decimals are presented last in the school year. These two chapters practice only some of the basic operations with fractions and decimals. The focus is still on the conceptual understanding, building a good foundation towards 5th grade math, where fractions and decimals will be on focus.

When you use these books as your only or main mathematics curriculum, they can be like a "framework", but you do have some liberty in organizing the study schedule. Chapters 1, 2, and 3 should be studied in this order, but you can be flexible with chapters 4 (Time and Measuring) and 6 (Geometry) and schedule them somewhat earlier or later if you so wish. Chapter 3 (Multiplication) needs to be studied before long division in Chapter 5. Many topics from chapters 7 and 8 (Fractions and Decimals) can also be studied earlier in the school year; however finding parts with division should naturally be studied only after mastering division.

This product also includes an HTML page that you can use to make extra practice worksheets for computation.

I wish you success in your math teaching!

Maria Miller, the author

Concerning Challenging Word Problems

I would heartily recommend supplementing this program with regular practice of challenging word problems and puzzles. You could do that once a week to once every two weeks. The goal of challenging story problems and puzzles is to simply **develop children's logical and abstract thinking and mental discipline**. Fourth grade is a good place to start such a practice because 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 people from doing such in earlier grades, either.

I have made lots of word problems for the Math Mammoth curriculum. Those are for the most part multi-step word problems. I have included several lessons that utilize the bar model for solving problems and tried to vary the problems.

Even so, the problems I've created are usually tied to a specific concept or concepts. I feel children can also benefit from problem solving practice where the problems require "out of the box" thinking, or are puzzle-type in nature, or are just different from the ones I have made. Additionally, I feel others are more capable of making very different, very challenging problems.

So I'd like for you to use one or several of the resources below for some different problems and puzzles. Choose something that fits your budget (most of these are free) and that you like using.

Math Kangaroo Problem Database
Easily make worksheets of challenging math problems based on actual past Math Kangaroo competition problems.
http://www.kangurusa.com/clark/pdb/

Primary Math Challenging Word Problems 3 U.S. Edn
Singapore Math is known for its challenging word problems. Choose the 3rd grade book to approximately match Math Mammoth 4. The books include answer key, worked examples, practice problems, and challenging problems. $8.20, paperback. **ISBN:** 9789814208826.
http://www.singaporemath.com/Pri_Math_Challenging_Word_Problems_3_U_S_Edn_p/pmcwpus3.htm

Primary Grade Challenge Math by Edward Zaccaro
The book is organized into chapters, with each chapter presenting a type of problem and the ways to think about that problem. And then there is a series of related story problems to solve, divided into 4 levels. $25, **ISBN** 978-0967991535
You can find this at Amazon.com or various other bookstores.
http://www.amazon.com/Primary-Grade-Challenge-Edward-Zaccaro/dp/0967991536/

Problem Solving Decks from North Carolina publich schools
Includes a deck of problem cards for grades 1-8, student sheets, and solutions. Many of these problems are best solved with calculators. All of these problems lend themselves to students telling and writing about their thinking.
http://community.learnnc.org/dpi/math/archives/2005/06/problem_solving.php

Math Stars Problem Solving Newsletter (grades 1-8)
These newsletters are a fantastic, printable resource for problems to solve and their solutions.
http://community.learnnc.org/dpi/math/archives/2005/06/math_stars_news.php

Mathematics Enrichment - nrich.maths.org
Open-ended, investigative math challenges for all levels from the UK. Find the past issues box down in the left sidebar. Use Stage 2, 1-star or 2-star problems for 4th grade.
http://nrich.maths.org/public/
http://nrich.maths.org/public/themes.php lets you find problems organized by mathematical themes.

Figure This! Math Challenges for Families
Word problems related to real life. They don't always have all the information but you have to estimate and think. For each problem, there is a hint, other related problems, and interesting trivia. Website supported by National Council of Teachers of Mathematics.
http://www.figurethis.org/

MathStories.com
Over 12,000 interactive and non-interactive NCTM compliant math word problems, available in both English and Spanish. Helps elementary and middle school children boost their math problem solving and critical-thinking skills. A membership site.
http://www.mathstories.com/

"Problem of the Week" (POWs)
Problem of the week contests are excellent for finding challenging problems and for motivation. There exist several:

- **Math Forum: Problem of the Week**
  Five weekly problem projects for various levels of math. Mentoring available.
  http://mathforum.org/pow/
- **Math Contest at Columbus State University**
  Elementary, middle, algebra, and "general" levels.
  http://www.colstate.edu/mathcontest/
- **Aunty Math**
  Math challenges in a form of short stories for K-5 learners posted bi-weekly. Parent/Teacher Tips for the current challenge explains what kind of reasoning the problem requires and how to possibly help children solve it.
  http://www.auntymath.com/
- **Education Place Brain Teasers**
  Has a separate one for for grades 3-4, grades 5-6, and grades 7-8.
  http://www.eduplace.com/math/brain/index.html
- **Grace Church School's ABACUS International Math Challenge**
  This is open to any child in three different age groups.
  http://www.gcschool.org/pages/program/Abacus.html
- **MathCounts Problem of the Week Archive**
  Browse the archives to find problems to solve. You can find the link to the current problem on the home page.
  http://www.mathcounts.org/webarticles/anmviewer.asp?a=142&z=7
- **Math League's Homeschool Contests**
  Challenge your children with the same interesting math contests used in schools. Contests for grades 4, 5, 6, 7, 8, Algebra Course 1, and High School are available in a non-competitive format for the homeschoolers. The goal is to encourage student interest and confidence in mathematics through solving worthwhile problems and build important critical thinking skills. By subscription only.
  http://www.mathleague.com/homeschool.htm

Chapter 1: Addition, Subtraction, Graphs and Money
Introduction

The first chapter of *Math Mammoth Grade 4-A Complete Worktext* covers addition and subtraction topics, word problems, graphs, and money problems.

At first, we review the "technical aspects" of adding and subtracting: mental math techniques plus adding and subtracting in columns. If these are fairly easy for your student(s), you can choose to skip some problems.

Going beyond those, the chapter includes lessons in addition and subtraction terminology. These lessons are already preparing your child for algebraic thinking.

In the next lessons, the student reviews the addition/subtraction connection, and solves word problems with the help of bar diagrams. Next, we solve simple missing addend equations using subtraction, such as $x + 20 = 60$. We use bar diagrams to illustrate these and connect them with fact families.
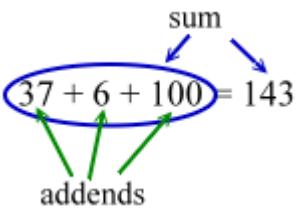
The lesson on the order of operations contains some review but it goes beyond that. In many of the problems, the student builds the mathematical expression (calculation) needed for a certain real-life situation.

Going towards applications of math, the chapter contains lessons on bar graphs, line graphs, rounding, estimating, and money problems.

The Lessons in Chapter 1

Addition Review

Remember **addition**? sum $37 + 6 + 100 = 143$ addends	You can write any number as a **SUM** of the different units such as whole thousands, whole hundreds, whole tens, and ones. $5,248 = 5,000 + 200 + 40 + 8$ thousands hundreds tens ones

You can add in parts: $56 + 124$ $= 100 + 50 + 20 + 6 + 4$ $= 100 + 70 + 10 = 180$	Add in any order: $7 + 90 + 91 + 3$ $= 7 + 3 + 90 + 91$ $= 10 + 90 + 91 = 191$	Trick: add first a bigger number, then subtract to correct the error: $76 + 89$ $= 76 + 90 - 1$ $= 166 - 1 = 165$

1. Add mentally. You can add in parts (tens and ones separately).

a. $70 + 80 =$ ___

$77 + 80 =$ ___

$77 + 82 =$ ___

b. $140 + 50 =$ ___

$141 + 50 =$ ___

$144 + 55 =$ ___

c. $50 + 60 =$ ___

$54 + 65 =$ ___

$58 + 62 =$ ___

d. $80 + 90 =$ ___

$82 + 93 =$ ___

$88 + 91 =$ ___

2. Write the numbers as a sum of whole thousands, whole hundreds, whole tens, and ones.

a. $487 =$

b. $2,103 =$

c. $8,045 =$

d. $650 =$

3. Solve the problems.

a. Two of the addends are 56 and 90. The sum is 190. What is the third addend?

b. Four of the addends equal 70 and five other addends equal 80. What is the sum?

4. Add and compare the results. The addition problems are "related"!

a. $7 + 8 = $ ___	b. $4 + 9 = $ ___	c. $6 + 8 = $ ___
$57 + 8 = $ ___	$34 + 9 = $ ___	$16 + 8 = $ ___
$70 + 80 = $ ___	$40 + 90 = $ ___	$600 + 800 = $ ___
$700 + 800 = $ ___	$240 + 90 = $ ___	$560 + 80 = $ ___

5. Write here four different addition problems that are "related" to the problem $5 + 8 = 13$.
   See examples above!

6. Add in parts.
a. $80 + 5 + 2 + 30 + 4 + 44$ **b.** $127 + 500 + 4 + 3 + 9 + 90$

7. Explain an easy to way to add 99 to any number. For example,
   explain how to do easily $56 + 99$ and $487 + 99$.

8. Add in parts, or use other "tricks".

a. $71 + 82 = $ ___	b. $42 + 47 = $ ___	c. $89 + 92 = $ ___
$37 + 42 = $ ___	$64 + 64 = $ ___	$82 + 19 = $ ___
$57 + 64 = $ ___	$12 + 99 = $ ___	$51 + 98 = $ ___

9. Continue the patterns.

a. 600	b. 900	c. 100	d. 500
$+ 600 = $ ___	$+ 900 = $ ___	$+ 75 = $ ___	$+ 45 = $ ___
$+ 600 = $ ___	$+ 900 = $ ___	$+ 75 = $ ___	$+ 45 = $ ___
$+ 600 = $ ___	$+ 900 = $ ___	$+ 75 = $ ___	$+ 45 = $ ___
$+ 600 = $ ___	$+ 900 = $ ___	$+ 75 = $ ___	$+ 45 = $ ___
$+ 600 = $ ___	$+ 900 = $ ___	$+ 75 = $ ___	$+ 45 = $ ___
$+ 600 = $ ___	$+ 900 = $ ___	$+ 75 = $ ___	$+ 45 = $ ___

10. Double and halve the numbers.

Half the number	_10_								
Number	20	90	110	120	480	500	900	1,600	4,010
Its double	_40_								

11. **a.** There are five people in the Brill family and they went to a concert. Children's tickets were $20 each and the two parents' tickets were $28 a piece.
What was the total cost of the tickets for the family?

  b. In another concert, adult ticket cost $30 and children's tickets were half that price.
What was the total cost for the Brill family?

12. Fill in the table - add 999 each time.

n	56	69	125	156	287	569	788	950	999
n + 999									

Puzzle corner   John is writing very simple "missing addend" problems for first graders. For example, he wrote the problem 2 + ___ = 8. The first addend is given, and the second addend is missing.
John uses whole numbers from 0 on up to the number that is the sum.

  a. How many such problems can he write when the sum is 8?

  b. How many such problems can he write when the sum is 10?

  c. How many such problems can he write when the sum is 20?

  d. You should see a pattern in the above answers. Now use the pattern to solve this:
How many such problems could he write when the sum is 100 (for second-graders)?

Adding in Columns

1. Add in columns. Check by adding the numbers in each column in different order (for example from down up).

a.	b.	c.	d.
	$1.82	245	1738
384	$40.59	139	2390
2912	$9.97	30	1078
2008	$10.29	2931	364
209	$1.09	594	2803
+ 26	+ $0.43	9593	211
		+ 526	+ 99

2. Write the numbers under each other carefully, and add in columns.

   a. 5,609 + 1,388 + 89 + 402

   b. $8.05 + $0.29 + $38.40 + $293 + $203.20 + $46.49 + $94

3. The map shows some main cities in Kentucky and distances between the cities. For example, from Louisville to Frankfort is 54 miles. The one distance not marked is mentioned below the map: from Frankfort to Lexington is 28 miles.

   Calculate the total driving miles, if a family goes on a field trip like this:

   a. Covington - Lexington - Paducah - Lexington - Covington

   b. A round trip from Lexington via Covington, Louisville, and Frankfort, and back to Lexington.

Subtraction Review

<table>
<tr>
<td>Compare the methods the children use.</td>
<td>Marie: "I subtract in parts."

$35 - 7$

$= 35 - 5 - 2$

$= 30 - 2 = 28$</td>
<td>John: "I use a helping problem that I know."

$15 - 7 = 8$, so $35 - 7 = 28$.</td>
</tr>
</table>

1. Subtract from whole hundreds. You can subtract in parts.

a. $100 - 2 =$	**b.** $200 - 4 =$	**c.** $500 - 5 =$	**d.** $400 - 7 =$
$100 - 20 =$	$200 - 40 =$	$500 - 50 =$	$400 - 70 =$
$100 - 22 =$	$200 - 45 =$	$500 - 56 =$	$400 - 71 =$

2. Subtract.

a. $35 - 7 =$ ___   **b.** $45 - 9 =$ ___   **c.** $52 - 6 =$ ___   **d.** $36 - 8 =$ ___

   $63 - 7 =$ ___ $23 - 9 =$ ___ $84 - 6 =$ ___ $55 - 7 =$ ___

   $56 - 7 =$ ___ $64 - 9 =$ ___ $23 - 5 =$ ___ $93 - 8 =$ ___

3. Subtract and compare the results. The problems are "related"!

a. $12 - 8 =$ ___	**b.** $15 - 9 =$ ___	**c.** $13 - 7 =$ ___
$42 - 8 =$ ___	$75 - 9 =$ ___	$73 - 7 =$ ___
$120 - 80 =$ ____	$150 - 90 =$ ____	$1300 - 700 =$ ____
$520 - 80 =$ ____	$650 - 90 =$ ____	$430 - 70 =$ ____

4. Write here four different subtraction problems that are "related" to the problem $14 - 8 = 6$.
   See examples above!

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Chapter 2: Place Value
Introduction

The second chapter of *Math Mammoth Grade 4-A Complete Worktext* covers large numbers (up to 9 digits) and place value concepts with those.

The first lessons only deal with thousands or numbers with a maximum of four digits. These are for review and for deepening the student's understanding of place value. It is crucial that the student understands place value with these numbers before moving on to larger numbers. Yet again, these larger numbers can be very easy as long as the student understands the basics of how our place value system works.

Besides the concept of place value, the chapter contains lessons on comparing numbers, adding and subtracting in columns, mental math problems, and the idea of multiples.

The Lessons in Chapter 2

Helpful Resources on the Internet

Place Value Payoff
Match numbers written in standard form with numbers written in expanded form in this game.
http://www.quia.com/mc/279741.html

Megapenny Project
Visualizes big numbers with pictures of pennies.
http://www.kokogiak.com/megapenny/default.asp

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Keep My Place
Fill in the big numbers to this cross-number puzzle.
http://www.mathsyear2000.org/magnet/kaleidoscope2/Crossnumber/index.html

Place value puzzler
Place value or rounding game. Click on the asked place value in a number, or type in the rounded version of the number.
http://www.funbrain.com/tens/index.html

Maths Teacher's Toolkit
Includes place value calculator, place value cards, an interactive number line, a hundred square, and other interactive Flash resources.
http://www.crick.northants.sch.uk/Flash%20Studio/cfsmaths/Toolkit/Toolkit.htm
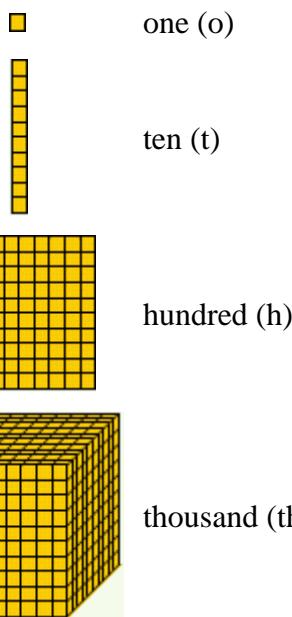
Estimation at AAA Math
Exercises about rounding whole numbers and decimals, front-end estimation, estimating sums and differences. Each page has an explanation, interactive practice, and games.
http://www.aaamath.com/B/est.htm

Thousands

one (o)

ten (t)

hundred (h)

thousand (th)

th	h	t	o
7	2	8	4

7,284 has
7 thousands, 2 hundreds,
8 tens, and 4 ones.

Look at the pictures. How many...
- ones go to a ten? ____
- tens go to a hundred? ____
- hundreds go to a thousand? ____

That is why our way of writing numbers
is called the *base ten* system.

Writing the number 5,608 in *expanded form* means we write
out the number **as a sum** of whole thousands, whole
hundreds, whole tens, and ones. You see all of it right from
the number:

- It has **5** thousands = 5,000.
- It has **6** hundreds = 600
- It has **0** tens = 0.
- It has **8** ones = 8.

Now write it as a sum: 5,608 = 5,000 + 600 + 0 + 8

1. Write the numbers in expanded form.

a. 8,325 = 8000 + 300 + 20 + 5   **b**. 4,935 =

c. 4,039 =   **d**. 3,002

e. 2,090 =   **f**. 9,405

2. Write in normal form.

a. 4000 + 500 + 90 + 3   **b**. 2000 + 90

c. 3000 + 200   **d**. 8000 + 5

e. 1000 + 80 + 7   **f**. 5000 + 600 + 9

g. 6 hundred 4 thousand   **h.** 8 tens 4 thousand

i. 3 ones 7 thousand   2 hundred   **j.** 4 hundred 5 ones 1 thousand

k. fifty, 7 thousand   **l**. 4 thousand, 5

m. 9, sixty, 4 thousand   **n**. 8 hundred, 3 thousand, 9

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The 7, 2, 8, and 4 are called *digits* of the number 7,284.

But 7 in the number 7,284 actually means seven thousand. The *value* of the digit 7 is 7,000.
The 2 in the number 7,284 actually means two hundred. The *value* of the digit 2 is 200.
The *value* of the digit 8 is eighty or 80.
The *value* of the digit 4 is four.

The value of the digit depends on WHERE it is in the number.
Look where NINE is in these numbers:

6**9**0	"9" in 690 means ninety	The value of the digit "9" is 90.	"9" is in tens place.
9,055	"9" in 9,055 means nine thousand	The value of the digit "9" is 9,000.	"9" is in thousands place.
41**9**	"9" in 419 means just nine.	The value of the digit "9" is 9.	"9" is in ones place.
1,**9**70	"9" in 1,970 means nine hundred.	The value of the digit "9" is 900.	"9" is in hundreds place.

In other words, the *value* of the digit 9 depends on where it's at, or where its *place* is.
That is why this system of writing numbers is called the *place value* system.

If nine is in the hundreds' place, then its value is 900 (for example in number 5,900).
If nine is in the tens place, then its value is 90 (for example in number 498).

3. What is the value of the digit 5 in the following numbers?

a. 3,8**5**9 *fifty*

b. 65

c. 549

d. 2,506

e. 5,012

f. 3,050

4. Write the value of the underlined digit.

a. **5**09 *five hundred*

b. **9**,843

c. 9**4**0

d. 2,0**8**8

e. 1,**2**00

f. 4,00**2**

g. 7,**0**08

h. 4**0**5

i. 4,4**0**0

j. 9**0**

5. **a.** What is the largest possible number you can build by using the digits 2, 5, 8, and 4?

b. What is the least possible number you can build by using them?

6. What is the difference between the largest and the least possible
number you can build using the digits 6, 9, and 1?

> **What is 4,769 + 10?** 4,769 has 6 tens. One ten more means there will be 7 tens: 4,779.

> **What is 2,958 + 100?**
>
> 2,958 has nine hundreds. One hundred more means there will be 10 hundreds, but that makes a thousand. Our answer number will have 3 thousands, with no hundreds: 3,058.

7. Fill in the table - add 10, 100, or 1000. If in doubt, you can add in columns.

n	1,056	2,508	342	4,009	59	6,980	723	8,299
$n + 10$								
$n + 100$								
$n + 1000$								

8. What is missing?

   a. $4,036 = 4000 + $ ____ $ + 30$

   b. $483 = 80 + 3 + $ _____

   c. $9,328 = 300 + 9,000 + $ ____ $ + 20$

   d. $8,005 = 5 + $ _____

   e. $5,320 = 20 + $ _____ $ + 300$

   f. $7,609 = 9 + $ _____ $ + 7,000$

9. If you add 1 thousand, 1 hundred, 1 ten, and 1 to this number, it becomes 9,000.
   What is the number?

PuzzLe corNer

For the digits given, build the largest and the least possible number you can. Then find their *difference*. In which multiplication table can you find each of the *differences*?

a. 7 and 5	**b.** 2 and 9	**c.** 4 and 5	**d.** 8 and 3
75 and 57 *difference: 18*			

Do the same as above, but now with three digits. For each difference you find, add its digits. If you then get a two-digit number, add its digits as well. What do you notice?

e. 7, 1, 5	**f.** 9, 4, 7	**g.** 8, 9, 7	**h.** 4, 1, 8
751 and 157 *difference 594* *5 + 9 + 4 = 18* *1 + 8 = 9*			

You can also try the same with four digits!

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Chapter 3: Multiplication
Introduction

The third chapter of *Math Mammoth Grade 4-A Complete Worktext* covers multi-digit multiplication and some related topics.

While the first lessons briefly review the multiplication concept and the times tables, the focus in fourth grade is on multi-digit multiplication (also called algorithm of multiplication, or multiplying in columns).

We start out by multiplying by whole tens and hundreds. After this is mastered, comes the very important concept of **multiplying in parts**. This essentially means that 4×63 is done in two parts: 4×60 and 4×3, and the results are added.

The whole algorithm of multiplication is based on this principle, so it is important to master it. I don't want kids to multiply in columns "blindly", without understanding what is going on with that algorithm.

Before showing the traditional form of multiplying in columns, the lesson *Multiply in Columns - the Easy Way* shows a simplified form of the same, which is essentially just multiplying in parts. You may skip that lesson at your discretion or skim through it quickly if your child is ready to understand the standard form of the algorithm, which comes next.

Other lessons in this chapter practice estimation and order of operations, and multiplying with money. Many kinds of word problems abound.

The lesson "*So Many of the Same Thing*" could be entitled "Proportional Reasoning" but I wanted to avoid scaring parents and children with such a high-sounding phrase. The idea in that lesson is really simple, but it does prepare for proportions as they are taught in 7th grade and in algebra.

After that, we multiply by whole hundreds in order to prepare for double-digit multiplier problems, and to understand the algorithm of multiplication with more digits.

The Lessons in Chapter 3

Helpful Resources on the Internet

Math Playground
Learn how to think algebraically with these clever weighing scales.
http://www.mathplayground.com/algebraic_reasoning.html

Thinking Blocks
Thinking Blocks is an engaging, interactive math tool that helps students learn how to solve multistep word problems. Scroll down to Multiplication and Division.
http://www.mathplayground.com/thinkingblocks.html

Rectangle Multiplication
An interactive tool that illustrate multiplying in parts using the area model. Choose the "common" option for multiplying in parts.
http://nlvm.usu.edu/en/nav/frames_asid_192_g_2_t_1.html

Interactive Pan Balance
Each of the four shapes is assigned a certain weight. Place shapes on either side of the pan balance and figure out their relationships.
http://illuminations.nctm.org/ActivityDetail.aspx?ID=131

Scales Problems from Math Kangaroo Problem Database
http://www.kangurusa.com/clark/pdb/quiz.pl?
dir=./kangur/output&y1=2002&l1=0304&i1=10&y2=2004&l2=0304&i2=10&y3=2005&l3=02&i3=19&r

Multiplication Games
A list of times tables games and activities to practice multiplication facts.
http://www.homeschoolmath.net/math_resources_2.php#multiplication

Multiplication Concept

- Multiplication is repeated addition:
 $3 \times 5 = 5 + 5 + 5 = 15$
  $4 \times 20 = 20 + 20 + 20 + 20 = 80$
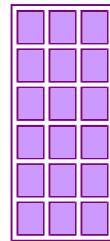
- Multiplying by 1 means taking the number once:
  $1 \times 17 = 17$.

- Multiplying by 0 means taking the number zero times:
  $0 \times 82 = 0$
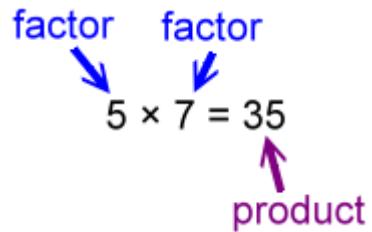
3×6 and 6×3 both are 18!

Multiplication terms

The numbers being multiplied are *factors*.
The result is called a *product*.

There may be more than 2 factors. For example, in
$4 \times 5 \times 2 = 40$, the numbers 4, 5, and 2 are all factors.

factor   factor
$5 \times 7 = 35$
product

1. Write the additions as multiplications, or vice versa. Solve.

a. $2 + 2 + 2 + 2 =$ __×__ = ___ $20 + 20 + 20 + 20 =$ __×__ = ___	**b.** $80 + 80 + 80 =$ __ ×__ = ___ $8 + 8 + 8 =$ __ ×__ = ___
c. _____ $= 4 \times 5 =$ ___ _____ $= 4 \times 50 =$ ___	**d.** _____ $= 2 \times 12 =$ ___ _____ $= 2 \times 120 =$ ___
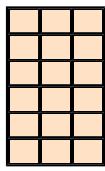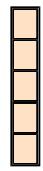
2. Write two multiplications!

a. __ rows, __ columns: __ ×__ = ___ __ columns, __ rows: __ ×__ = ___	**b.** __ rows, __ columns: __ ×__ = ___ __ columns, __ rows: __ ×__ = ___

3. Solve.

a. 8×2	**b.** 3×5	**c.** 2×8	**d.** 3×10
$8 \times 0 \times 7$	$1 \times 2 \times 5$	$2 \times 2 \times 2$	$3 \times 3 \times 3$

4. Find the products. You can often use addition.

a. 2×24	**d.** 2×150	**g.** $4 \times 1,000$	**j.** 2×34
b. 14×0	**e.** $3 \times 2,000$	**h.** 5×200	**k.** 3×21
c. 16×1	**f.** $4 \times 3,000$	**i.** 3×211	**l.** 4×50

5. Solve the problems. Write a multiplication fact for each.

a. Seven children have ___ toes.

b. Four cows have ____ feet.

c. Eight bicycles have ____ wheels.

d. Three dozen eggs is ___ eggs.

e. Five people have ___ hands.

f. Nine cars have ____ wheels.

---

6. **a.** Write the terms.

$2 \quad \times \quad 23 \quad = 46$
$\uparrow \qquad \uparrow \qquad \uparrow$
_____ _____

b. Write a multiplication problem with factors 4 and 8.

c. What happens if one of the factors is zero? The _____ is _____.

d. In one multiplication problem, two factors are 2 and 6. The product is 60. What is the third factor?

---

7. Write a single calculation to solve these problems. Your calculation will use several operations, not just one.

a. Mom had three dozen eggs in cartons and five in a bowl. How many eggs did she have all in all?

b. Jack bought six packages of magazines. Each had 10 magazines. He opened one package and gave three magazines to his friend. How many magazines does Jack have left?

c. Anna put crayons into boxes. Into four of the boxes, she put 10 crayons each, and into three boxes she put only six. How many crayons were there all in all?

d. Ernest bought three books for $11 each, and paid with $50. What is his change?

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Multiply in Parts

Multiply 3 × 46

Break 46 into two parts: 40 and 6.
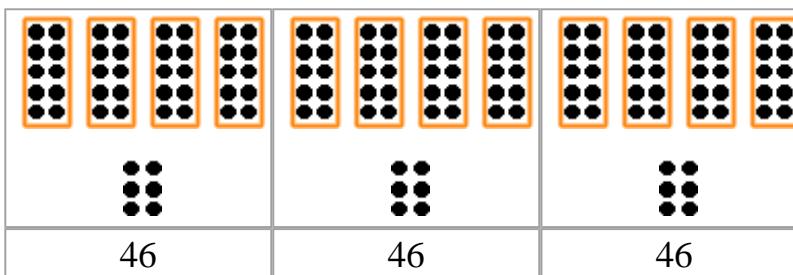
Then multiply those two parts separately by 3:
3 × 40 is 120, and 3 × 6 is 18.

Then add these two partial results: 120 + 18 = 138.

$$3 \times 46$$

$$40 + 6$$

$$\boxed{3 \times 40} \text{ and } \boxed{3 \times 6}$$

Here is another way of showing the same thing, using ten-bundles.

46	46	46

$$3 \times 46$$

$3 \times 40 = 120$

$3 \times 6 = 18$

$$\begin{array}{r} 120 \\ + \ 18 \\ \hline 138 \end{array}$$

Study these examples. Multiply tens and ones separately:

8 × 13 (10 + 3) 8 × 10 and 8 × 3 80 and 24 = 104	**5 × 24** (20 + 4) 5 × 20 and 5 × 4 100 and 20 = 120	**7 × 68** (60 + 8) 7 × 60 and 7 × 8 420 and 56 = 476

1. Multiply tens and ones separately. Then add to get the final answer.

a. 6 × 27 (20 + 7) 6 × ____ and 6 × __ ____ and ____ = _____	**b. 5 × 83** ( ) 5 × ____ and 5 × __ ____ and ____ = _____	**c. 9 × 34** ( ) 9 × ____ and 9 × __ ____ and ____ = _____

2. Break the second factor into tens and ones. Multiply separately, and add.

a. 6×19	b. 3×73	c. 4×67

$6 \times 10 =$ $6\,0$
 $6 \times 9 \ =$ $+ \ 5\,4$
            $\overline{1\,1\,4}$
	$3 \times \underline{}$
	 $3 \times \underline{}$ $+$
	               $\overline{}$	

d. 5×92	e. 9×33	f. 7×47
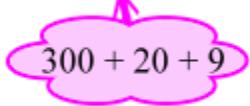
3. Multiply in parts. You can write the partial products under the problems, if you wish.

a. $5 \times 13 =$ _____	b. $9 \times 15 =$ _____	c. $5 \times 33 =$ _____
d. $8 \times 21 =$ _____	e. $4 \times 22 =$ _____	f. $4 \times 36 =$ _____
g. $6 \times 42 =$ _____	h. $7 \times 51 =$ _____	i. $5 \times 25 =$ _____

4. Solve. Write a number sentence for each problem.

a. How many seconds are there in one hour?

b. Jack bought 8 shirts for $14 each. What was his total bill?

c. Mary and Harry set up nine rows of seats in the school
auditorium, with 14 seats in each row. After that, they
had 56 seats unused. How many seats were there in all?

d. A package of small spoons costs $13. A whole silverware set is
four times as expensive. How much do both items cost together?

| It works with larger numbers, too:

7×329

$300 + 20 + 9$

$\boxed{7 \times 300}$ and $\boxed{7 \times 20}$ and $\boxed{7 \times 9}$ | Break 329 into *three* parts: 300 and 20 and 9.

Then multiply those parts separately by 7:
7×300 is 2,100, and 7×20 is 140, and $7 \times 9 = 63$.

Lastly add the partial results: $\begin{array}{r} 2{,}100 \\ 140 \\ +\ 63 \\ \hline 2{,}303 \end{array}$ |

5. Multiply hundreds, tens, and ones separately. Then add to get the final answer.

a. 3 × 127 $(100 + 20 + 7)$ $3 \times$ _____ and $3 \times$ _____ and $3 \times$ __ _____ and _____ and _____ = _____	**b. 5 × 243** ( ) $5 \times$ _____ and $5 \times$ _____ and $5 \times$ __ _____ and _____ and _____ = _____
c. 7 × 314 ( ) $7 \times$ _____ and $7 \times$ _____ and $7 \times$ __ _____ and _____ and _____ = _____	**d. 4 × 607** ( ) $4 \times$ _____ and $4 \times$ _____ and $4 \times$ __ _____ and _____ and _____ = _____

6. Break the second number (factor) into hundreds, tens and ones. Multiply separately, and add.

a. <u>4 × 128</u> $\begin{array}{lr} 4 \times 100 = & 400 \\ 4 \times 20 = & 80 \\ 4 \times 3 = & +\ 12 \\ \hline \end{array}$	b. <u>8 × 151</u> $+\ \underline{}$	c. <u>3 × 452</u> $+\ \underline{}$
d. <u>6 × 317</u> $+\ \underline{}$	e. <u>8 × 212</u> $+\ \underline{}$	f. <u>6 × 198</u> $+\ \underline{}$

7. Solve the word problems.

a. Katie prepares crafts for a craft club that has 23 kids.
For the upcoming club meeting she needs to get at least
10 cm of string, 3 sheets of paper, and two toilet paper
rolls for each kid. Write down her list of needed supplies.

b. A guitar class costs $18. Ernest paid for eight classes from
the $200 that he has saved. How much does he have left?

c. Susie orders roses for her flower shop in bunches of
six dozen (72 flowers) at a time. She needs a new batch
once a week. How many roses will Susie order in 5 weeks?

d. One batch of six dozen roses costs her $70.
How much will the roses she orders in five weeks cost her?

8. Compare. Write $<$, $>$, or $=$ in the boxes between the number expressions.

a. 10×10 ☐ 9×11 **b.** 6×12 ☐ 5×14 **c.** 8×22 ☐ 5×27

d. 100×26 ☐ 40×70 **e.** $5 + 195$ ☐ 40×5 **f.** 4×72 ☐ 300

9. The expressions are supposed to be equal, but something is missing. Fill in the missing numbers.

a. $6 \times 6 = 9 \times$ ____   **b.** ___ $\times 10 = 5 \times 24$

c. $20 +$ ___ $= 4 \times 10$ **d.** $6{,}000 = 30 \times$ _____

e. $120 - 75 = 5 \times$ ____   **f.** ____ $+ 750 = 5 \times 300$

g. $2{,}000 - 200 = 30 \times$ _____

> The equal sign "=" means
> that whatever is on the left
> side and on the right side of the
> sign are supposed to be equal:
>
> $$10 + 10 = 5 + 15$$
> $$2 \times 6 = 3 \times 4$$
> $$18 - 3 = 5 \times 3$$

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Multiplying in Columns, Standard Way

Here we learn the standard algorithm of multiplication. It is based on the same principle of multiplying in parts: you simply multiply ones and tens separately, and add. In the standard algorithm the *adding* is done at the same time as multiplying. The calculation looks more compact and takes less space.

```
   1
   63
 ×  4
 ─────
    2
```

Multiply the ones first.

$$4 \times 3 = 12$$

Place 2 under the line at the ones place, but the tens digit (1) is written above the tens column as a little memory note. This is called *carrying to tens*.

```
   1
   63
 ×  4
 ─────
  252
```

Then multiply the tens, and *add* the 1 ten that was carried over.

$$4 \times 6 \;+\; 1 = 25$$

Total of 25 tens, which actually signifies 250. Write the 25 in front of the ones digit (2).

```
    63
 ×   4
 ─────
    12
 + 240
 ─────
   252
```

Compare to the "multiplying in parts" method you have learned previously, where the adding is done without "carrying".

In the calculation $4 \times 6 \;+\; 1 = 25$, the 6 and the 1 are actually tens.
So in reality we calculate $4 \times 60 \;+\; 10 = 250$.

Look at other examples. In each case, some tens are carried as a result of multiplying the ones.

```
    2                 2
   27                27
 ×  4              ×  4
 ────             ─────
    8               108
```
$4 \times 7 = 28$ $4 \times 2 + 2 = 10$

```
    6                 6
   69                69
 ×  7              ×  7
 ────             ─────
    3               483
```
$7 \times 9 = 63$ $7 \times 6 + 6 = 48$

```
    2                 2
   54                54
 ×  6              ×  6
 ────             ─────
    4               324
```
$6 \times 4 = 24$ $5 \times 6 + 2 = 32$

```
   83                83
 ×  9              ×  9
 ────             ─────
```
$9 \times 3 =$ $9 \times 8 + 2 =$

```
    4                 4
   77                77
 ×  7              ×  7
 ────             ─────
```
$7 \times 7 =$

```
   38                38
 ×  5              ×  5
 ────             ─────
```

Compare the earlier method with the one in this lesson:

$$
\begin{array}{r}
75 \\
\times \quad 8 \\
\hline
40 \\
+ \ 560 \\
\hline
600
\end{array}
$$

OR

$$
\begin{array}{r}
{}^{4} \\
75 \\
\times \quad 8 \\
\hline
0
\end{array}
$$

$5 \times 8 = 40$,
4 is carried.

$$
\begin{array}{r}
{}^{4} \\
75 \\
\times \quad 8 \\
\hline
600
\end{array}
$$

$7 \times 8 + 4 =$
$56 + 4 = 60$

You can choose which one you use. Discuss it with your teacher.

1. Multiply. Be careful with the carrying.

a.
$$\begin{array}{r} 53 \\ \times \ 8 \\ \hline \end{array}$$

b.
$$\begin{array}{r} 51 \\ \times \ 6 \\ \hline \end{array}$$

c.
$$\begin{array}{r} 88 \\ \times \ 3 \\ \hline \end{array}$$

d.
$$\begin{array}{r} 79 \\ \times \ 3 \\ \hline \end{array}$$

e.
$$\begin{array}{r} 62 \\ \times \ 2 \\ \hline \end{array}$$

f.
$$\begin{array}{r} 46 \\ \times \ 7 \\ \hline \end{array}$$

g.
$$\begin{array}{r} 18 \\ \times \ 5 \\ \hline \end{array}$$

h.
$$\begin{array}{r} 19 \\ \times 3 \\ \hline \end{array}$$

i.
$$\begin{array}{r} 66 \\ \times \ 6 \\ \hline \end{array}$$

j.
$$\begin{array}{r} 39 \\ \times \ 9 \\ \hline \end{array}$$

k.
$$\begin{array}{r} 87 \\ \times \ 3 \\ \hline \end{array}$$

l.
$$\begin{array}{r} 67 \\ \times \ 2 \\ \hline \end{array}$$

m.
$$\begin{array}{r} 20 \\ \times \ 9 \\ \hline \end{array}$$

n.
$$\begin{array}{r} 54 \\ \times \ 8 \\ \hline \end{array}$$

o.
$$\begin{array}{r} 34 \\ \times \ 6 \\ \hline \end{array}$$

p.
$$\begin{array}{r} 46 \\ \times \ 2 \\ \hline \end{array}$$

q.
$$\begin{array}{r} 17 \\ \times \ 9 \\ \hline \end{array}$$

r.
$$\begin{array}{r} 43 \\ \times 4 \\ \hline \end{array}$$

s.
$$\begin{array}{r} 76 \\ \times \ 8 \\ \hline \end{array}$$

t.
$$\begin{array}{r} 35 \\ \times \ 9 \\ \hline \end{array}$$

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Chapter 4: Time and Measuring
Introduction

The fourth chapter of *Math Mammoth Grade 4-A Complete Worktext* includes time, temperature, length, weight, and volume related lessons.

The focus on fourth grade is no longer the actual act of measuring, but calculations that involve conversions between different measuring units.

In time lessons, the student gets to do fairly complex calculations concerning hours and minutes. In temperature, the student is introduced to negative numbers and gets to do a few simple calculations even.

The lessons concerning measuring units usually include a table that lists the units and the conversion factors.

For metric units, those tables always include all the units, even when they are not in common usage. For example, when studying metric units of volume, the chart looks like this:

liter	**L**	for larger amounts of volume
deciliter	dl	(not used much)
centiliter	cl	(not used much)
milliliter	**l**	for small amounts of volume

10
10
10

Only milliliters and liters are dealt with in the lesson. But the chart shows the two other units as well in order to get the student used to two basic ideas of metric measuring units:

1. How the units always differ by a factor of ten,

2. How the units are *named* consistently, with always the same prefixes such as milli-, centi-, deci-, deca-, hecto-, and kilo-. These prefixes and their meanings are NOT yet studied in detail in fourth grade; but I wanted to include the charts to familiriaze the students with the terms and the ideas. You may, of course, at your discretion, explain it all to the student.

The Lessons in Chapter 4

Helpful Resources on the Internet

Calculating Time from BBC SkillsWise
Factsheets, worksheets, and an online game to practice time calculations.
http://www.bbc.co.uk/skillswise/numbers/measuring/time/calculatingtime/

A Dictionary of Units of Measurement
Explains the common measuring systems and has lots of background info of their history.
http://www.unc.edu/~rowlett/units/

Measure It!
Practice measuring lines with either centimeters or inches. Multiple choice questions.
http://onlineintervention.funbrain.com/measure/index.html

Measures
Activities, revision bites, and quizzes about measuring time, weight, and capacity (in metric units).
http://www.bbc.co.uk/schools/ks2bitesize/maths/shape_space_measures.shtml

Measurements
Online lessons with interactive exercises on metric prefixes, symbols, number values, metric mass, length, volume, US length and volume, and temperature conversions.
http://www.aaamath.com/B/mea.htm

Units of Measurement Quizzes
Quizes for area, distance, volume, and mass - both metric and English systems.
http://www.quiz-tree.com/Units_of_Measurement_main.html

Reading a tape measure worksheets
Worksheet generator - you can choose to which accuracy to measure, inches, or inches & feet.
http://themathworksheetsite.com/read_tape.html

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Time Units

Pay close attention and memorize all these time units, if you don't know them yet.	60 seconds = 1 minute 60 minutes = 1 hour 24 hours = 1 day 7 days = 1 week	12 months = 1 year 365 days = 1 year 366 days = 1 leap year

1. Fill in the tables. Use your multiplication skills you've learned!

Minutes	1	2	3	4	5	6
Seconds						

Days	1	2	3	4	5	6	7
Hours							

Years	1	2	3	4	5	6
Months							

Years	1	2	3	4	5	6
Days							

2. Solve the problems.

   a. Brian puts $120 into his savings each month. After saving for a year, he bought a keyboard for $799. How much does he have left of his savings?

   b. How much money do you use if you buy a candy bar for $2 every day of the year?

   c. Joan finished the foot race in exactly two minutes, and Jean was 24 seconds faster. What was Jean's finishing time?

   d. John was given an antiobiotic for three whole days following his surgery. How many hours is that?

   e. Write a multiplication expression to find the number of seconds in one year. Use a calculator to find the product.

3. Convert minutes to hours and minutes and vice versa.

a. 70 min = ___h ____ min	**b.** 60 min = __ hour	**c.** 5 h = ___ min
100 min = ___h ____ min	72 min = __ h __ min	4 h 6 min = ___ min
170 min = ___h ____ min	114 min = __ h __ min	3 h 37 min = ___ min
220 min = ___h ____ min	145 min = __ h __ min	10 h 50 min = ___ min
560 min = ___h ____ min	189 min = __ h __ min	12 h 3 min = ___ min

4. Solve the problems.

a. Jennie helped her aunt on her strawberry farm during one busy week.
She kept track of her working hours:

Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
4 h 45 min	2 h 30 min	5 h 20 min	5 h 15 min	3 h	2 h 30 min	3 h 40 min

How much time did she work total?

She got paid $6 an hour. How much did she earn?

b. It takes about 40 minutes to drive to town from Raymond's home.
The family is going to spend about 3 hours shopping, and come back.
What is the total amount of time they will be gone on their shopping trip?

c. Raymond's family's shopping trip didn't go as planned, as they also
stopped for a visit at a friend's house for 1 hour and 10 minutes.
How much time did they take for everything?

d. The batteries on a portable CD player last for 8 hours.
You plan to use it every day while walking your dog,
which takes about 25 minutes each day.
How many days will the batteries last?

e. As a teacher, Raymond gives five 45-minute lessons each day.
How many hours/minutes does he teach in a day?
In a five-day week?

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Metric Units for Measuring Length

The basic unit in the metric system is the meter. All of the other metric units for measuring length have the word "meter" in them.

The conversion factors in the metric system are based on 10. That is why you will use either 10, 100, or 1,000 when changing one metric unit of length to another.

10 millimeters makes 1 centimeter.
10 centimeters makes 1 decimeter.
10 decimeters makes 1 meter. And so on.
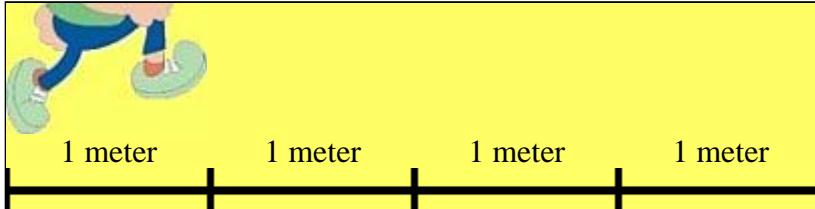
Units of length in the metric system

kilometer	**km**	1,000 meters
hectometer	hm	(not used)
decameter	dam	(not used)
meter	**m**	the basic unit
decimeter	dm	(not used much)
centimeter	**cm**	look at your ruler!
millimeter	**mm**	look at your ruler!

10
10
10
10
10
10

Remember that 1 meter is very close to 1 yard. 1 meter is a tiny bit longer than 1 yard.

1. Outside, or in a long corridor or room, draw two lines that start at the same place.

   a. Using a measuring tape, mark on the one line 1 m, 2 m, 3 m, and 4 m. Can you take "hops" 1 meter long?

   | 1 meter | 1 meter | 1 meter | 1 meter |

   b. Mark on the second line marks from 1 foot to 13 feet.
   Make 1-yard hops.
   Compare: do the two kinds of hops feel about the same?

2. Measure how tall you and other people are in centimeters.
   Write it also using whole meters and centimeters.

Name	How tall
	_____ cm = _1_ m _____ cm.

Conversions between units

Remember what millimeters look like on your ruler. 10 mm = 1 cm.
Decimeters aren't usually marked on rulers.10 centimeters make 1 decimeter.

10 decimeters end up being 100 centimeters, and that is 1 meter.

1 km = 1,000 m	**1 m = 100 cm**	**1 cm = 10 mm**

3. Convert between meters, centimeters, and millimeters.

a. 5 m = _____ cm	**b.** 4 m 6 cm = _____ cm	**c.** 800 cm = _____ m
12 m = _____ cm	10 m 80 cm = _____ cm	239 cm = ___ m ____ cm
6 m 20 cm = _____ cm	9 m 9 cm = _____ cm	407 cm = ___ m ____ cm
d. 58 mm = ___ cm ___ mm	**e.** 5 km = _____ m	**f.** 2 km 800 m = _____ m
78 cm = _____ mm	57 m = _____ m	6 km 50 m = _____ m
234 mm = ____cm ___ mm	5,000 m = _____ km	60,000 m = _____ km

4. Calculate. Give your answer using kilometers and meters.

   a. 5 km 200 m + 8 km 900 m   **b.** 3×2 km 800 m

   c. 1,500 m + 2 km   **d.** 6×700 m

5. Solve the problems.

   a. How many millimeters are in a meter?

   b. Mary can walk 1 km in 10 minutes. How far can she walk in 34 minutes?

   c. John jogs through a track 1 km 800 m long twice a day, five days a week.
     How long a distance does he jog in a week?

   d. A 10-meter wall is divided into five segments
     (not of equal length). Four of the segments
     are 1 m 20 cm each; how long is the fifth segment?

   e. Kathy's wallpaper has butterflies that are 80
     mm wide. She will put the wallpaper in her
     room. How many complete butterflies can
     she have on a wall 3 meters long?

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