Factor Pairs
All the Factors of Numbers up to 100

Factors of Forty-eight

48

1 x 48

2 x 24

3 x 16

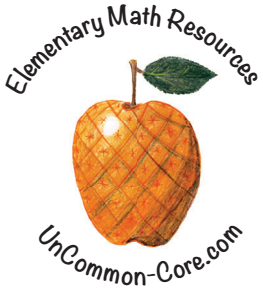
4 x 12

6 x 8

Forty-eight is a composite number with ten factors.

Forty-eight is a multiple of 1, 2, 3, 4, 6, 8, 12, 16, 24, and 48.

1, 2, 3, 4, 6, 8, 12, 16, 24, 48



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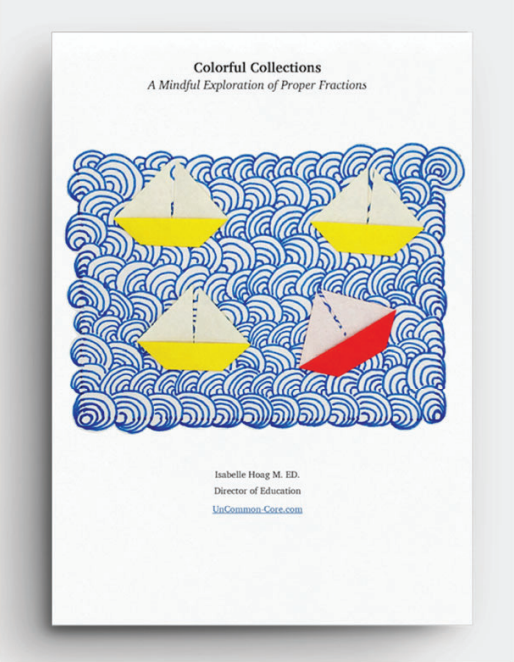
Hello Teachers,

Thank you for downloading this handout. After decades of teaching, now I am sharing some of the activities I designed for my students and some new ones as well.

Please, check out the self-paced teacher education courses on UnCommon-Core.com.



While you are there, sign up for your free copy of **Colorful Collections:** *A Mindful Exploration of Proper Fractions.*

Also, visit my Teachers Pay Teachers store UnCommon-Core dot com.

Thank you again. All the best,

Isabelle

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Finding ALL the Factors of Numbers to 100

Finding factors and multiples is a gentle introduction to prime and composite numbers. You could see it as the opposite of learning the times tables. Rather than finding the multiples of each factor, your students will look for each pair of factors that multiplies to a certain product. Using factor pairs is easy and methodical.

Before you dive in, take a moment to consider:

What do you want your students to know about factors and multiples?

- Factors come in pairs.
- Most Composite numbers have an even number of factors.
- Multiples have a set number of factors.
- Each multiple has a unique set of factors.
- Factors have an unlimited number of multiples.
- Every number has 1 as a factor.
- Every number has itself as a factor.
-

Big questions for your students to consider:

- Is the product of two factors always a multiple of those factors? Why or why not?
- Which type of composite numbers have an odd number of factors?
- Why are factors only listed once?
- Does the order of the factors change the product? How come?
- Why isn't one a prime number?
-

Read through the introduction and activities. This will give you an overview of what is available and a chance to decide which options are best for your class.

This is a work in process, which is why there isn't an answer key, quiz, or reflection questions. Please contact me with comments, ideas, or puzzles. Thank you!

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Introduce Finding Factor Pairs of Multiples:

After reviewing the vocabulary, ask students to suggest some factors of 48.

Collect a few, then stop. Ask how you can **make sure** to find **ALL** the factors for each number. Explain that you are looking for a systematic way to ensure every single factor pair is identified.

Materials: copies of hand out (whole page or quarter page), pencils, erasers, calculators

Demonstrate how to find every single pair of fractions for a number such as 48. Move quickly through the demonstration. Focus on the step by step decision making and knowing when the process is over. Ask your class if they are sure that you have identified all the factors of 48. See example on page 5.

Work through another example as a whole group. Go much slower this time, allowing students to think aloud and puzzle through the steps as needed. Explain each decision to your students.

At this point, **decide** whether or not to complete another example as a whole group, to let students work in pairs or small groups with your support, or to let each person work independently.

Bring the entire group together again for a discussion at the end of class. Based on the quality of student comments and questions in this discussion, decide whether or not to repeat this lesson with different numbers.

Continue lessons in this way until everyone is able to use factor pairs to find all the factors of any number under 100. Save their work in case you want to do some of the activities listed below:

Here is a systematic way to find ALL the factors of a number:

We know that one is a factor of every number. Multiplying a number by one does not change the identity of that number. For example, 1x48=48 so both 1 and 48 are factors of 48. 48 is a multiple of one, and a multiple of itself.

Working down the left hand side, list consecutive numbers that are factors of 48. Forty-eight is an even number, so it must be a multiple of two. What times two equals 48? 24.

After two, comes three. Is 48 a multiple of three? Yes, first of all its **digit sum (4+8=12 1+2=3)** is 3 so that tells us that it is a multiple of three. You could use mental math to divide 48 by three or use a calculator. In any case, we find that 3 x16 is 48.

We are testing each consecutive whole number to see if they are factors of 48. Notice how the factors on the left are growing and the factors on the right are diminishing. How will we know when to stop?

After three comes four. Dividing 48 by 4 is simple. 4x12=48 so 4 and 12 are factors of 48.

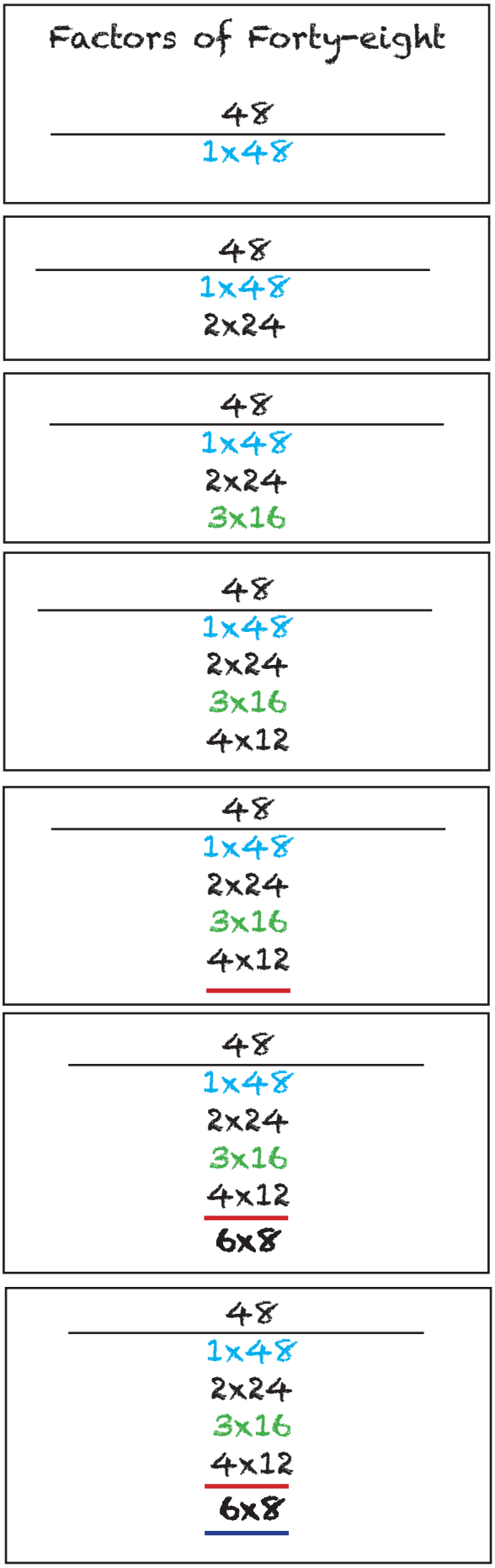
Fives are easy. Is 48 a multiple of 5? Does 48 show up in the five's times table? No. Only numbers with a zero or five in the unit's place are multiples of five. We put a line in place of a factor pair, because there is no factor pair that starts with five and ends up with 48.

After five comes six.6x8=48 is a familiar math fact. Clearly 6 and 8 are factors of 48. Forty-eight is a multiple of 6 and a multiple of 8.

Seven times seven is 49, so we know that seven can't be a factor of 48. Draw a line to show that we considered seven but it isn't a factor of 48.

What comes after seven? Eight, of course! But hang on, we already have 6x8 which is the same as 8x6. When you reach the point where factors repeat, you know you are done.

The factors of 48 are: 1, 2, 3, 4, 6, 8, 12, 16, 24, and 48.



Activity Ideas:

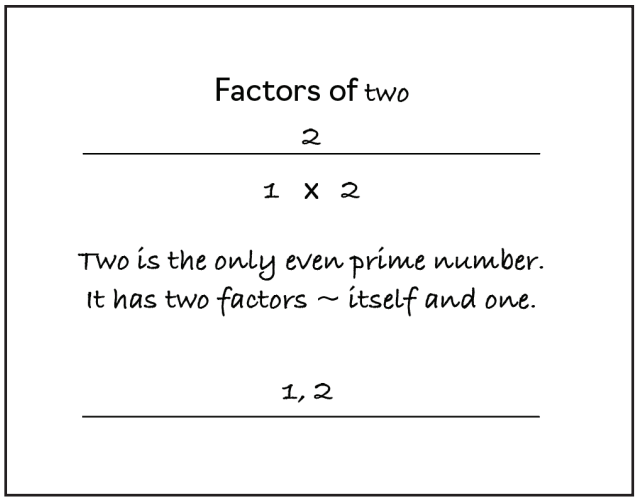
Class Project: Number Line

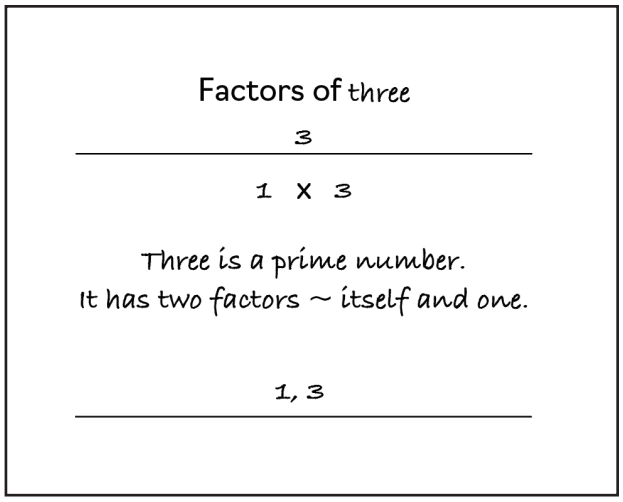
Once your students know how to find factors, encourage them to work as a class to find all the factors for *all* the numbers under 100.

Materials: Painter's tape, or long pieces of bulletin board paper. Yardsticks, markers, pencils, erasers, and tape or blue tack as needed, poster paper, sticky notes, pens, and yarn or string to tether them near the poster. Copies of quarter page hand outs. Consider using various colors of paper to show squares, primes, multiples of ten, numbers with the most factors (hint 60 and 72) or other interesting connections as desired.

Post a long number line in the hallway. Have a place for each number from 1 to 100.

As your students complete listing all the factors of each number, post their work on the number line. Once finished, take lots of photos. Invite comments from teachers, staff, admin, parents, and other students by posting a blank page by the number line with sticky notes and pens available for comments.



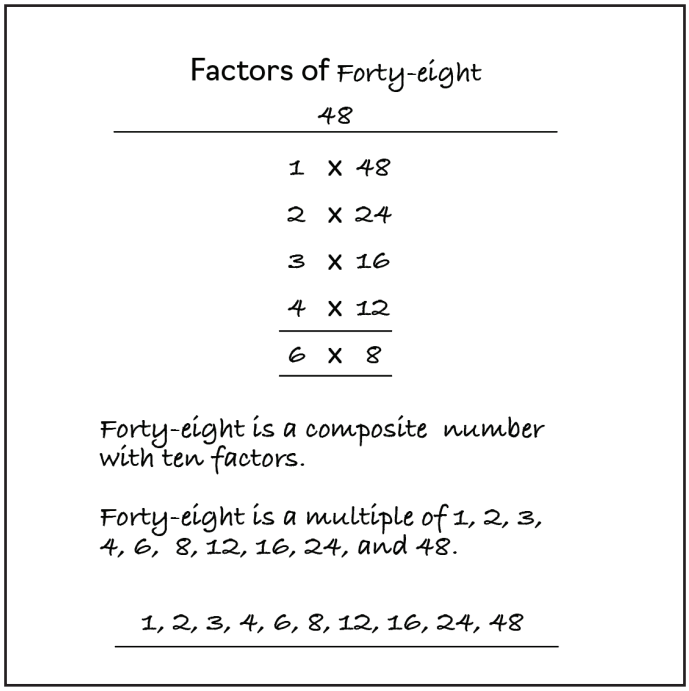


Class Project: 100 Chart

Materials: Bulletin board paper, or poster papers. Yardsticks, pencils, erasers, tape or blue tack. Wall space somewhere. Copies of quarter page handouts.

Have a parent or class helper make a large 100 chart so that each number has a quarter page (5.5 by 4.25 inch) space. Post the quarter pages that have already been completed as part of other lessons or assignments. Use sticky notes to show which numbers have not yet been factorized.

Have students take a sticky note, factorize that number, and turn in the sticky note with their work to be checked for accuracy. Once checked, add their work to the growing 100 chart.



Class Project: Factor Pairs to 100 Book

After your students learn how to find all the factor pairs of numbers, challenge them to find all the factors of each number from 1 to 100 so you can assemble the collection into a 3 ring binder.

Materials: 3 ring binder, 100 chart, sticky notes, 3 ring hole punch or transparent page protectors, copies of handouts.

Display a 100 chart. Cross out any numbers that have already been factorized as part of an earlier activity. Post the remaining numbers on sticky notes on or near the 100 chart.

Decide how you want your students to work on this challenge ~ independently? In pairs or small groups? In their math groups? In their free time?

Decide if you want them to work on full sheets of paper or quarter sheets. Full sheets might be easier to arrange, however they will use more paper. Quarter sheets will save paper (and possibly printing costs), but it will take more effort to arrange the numbers in sequence.

Let each student (pair, or group) choose a number, take the sticky note with that number from the 100 chart and find the factors for it. Then they should put the sticky note on their paper and turn it in to be checked and included in the book.

Let student or parent helpers keep the pages in order and make sure that all the pages have been collected.

When complete, let your students think of a title and any ways to make the book more user friendly such as printing prime numbers on blue paper. During the rest of the year, make a point of using the book as a reference as often as possible.

Glossary of Terms

It is essential for students to own the academic vocabulary that goes with every math unit they study. This project can run side by side with others.

Materials: (step 1) blank poster or space on the white board or wall, sticky notes and pens available to students, (step 2) paper, dictionaries, math texts, math sites online, a clip board or binder of some sort.

Step 1: Arrange a space in your classroom where students can post academic vocabulary words which they believe are essential for understanding factors and multiples ~ factor, multiple, prime, composite, product, multiplier, multiplicand, and ?

As words are added to the space, make sure to discuss their meaning with your students.

Step 2: Ask your students if there are any more words to add. If not, let each student or group write a definition for each word. Collect the definitions in alphabetical order, check for accuracy, and decide how to publish the glossaries.
You could simply create a poster with each word defined to share in class.

You might have a parent helper type them up and make a copy for each student, or simply bind them together as a class copy. Make a point of referring to the glossary during math class.

IF your class made a Factor Pairs book, why not add this glossary to the end? Check with the library or media center to see if they are accepting donations.

Explain why factors are only listed once:

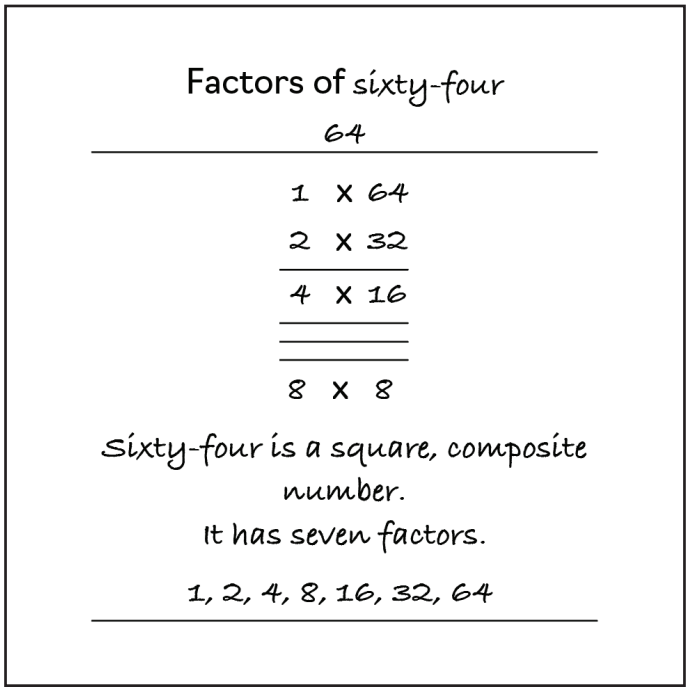
Give each student 90 seconds to list every store they visited in the last year. (Or every band they listened to in the last month. Or animals they've seen in their lives, or cities they've visited, or something like that.)

Be mindful of economic differences that might make this kind of activity an emotional minefield for some of your students. *Do not* have students share lists. The point is to find common ground.

Ask for a show of hands if the students wrote the name of a grocery store on their list. Then ask, how many times they wrote the name of that store on their list. Only once? But they must have visited several times? Hm, that's interesting! Even though they have visited the store several times, they only list it once.

Just as we would never even think of listing the name of the store the number of times we visited it, stores and factors are only listed once.

For example: 6x6=36, yet, the six is only listed once. *This is why square numbers will have an odd amount of factors even though factors come in pairs.*



Heads up: listing each factor once does not apply to prime factors. Each number has a unique list of prime factors which is like a fingerprint that identifies the number. In order to preserve the idiosyncratic list of each number's prime factors, every repetition has to be included. If repetitions were not included, the prime factorization of six could not be distinguished from twelve or twenty-four.

Explain why one is not a prime:

You might save this lesson for later, however if it comes up, or if you want to include it early on, keep it simple.

Materials: glossary or definitions of terms, understanding that each factor is only written once

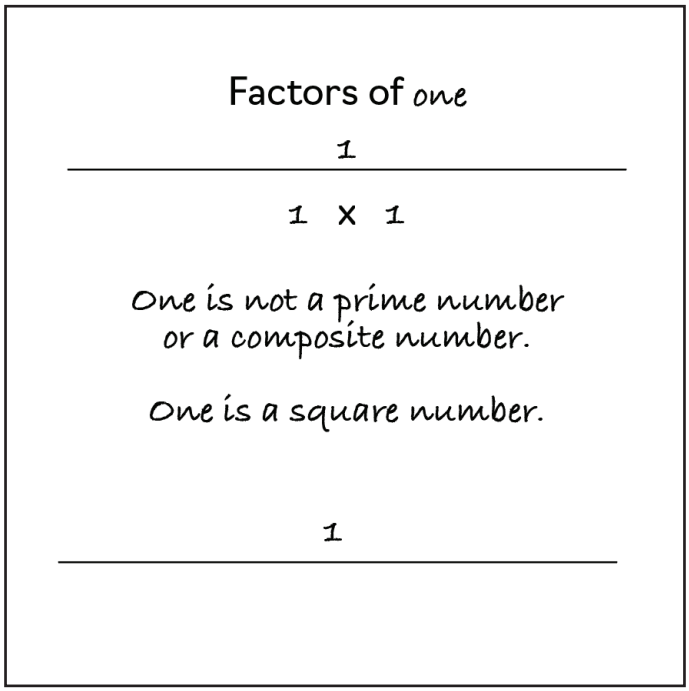
Prime numbers have two unique factors. Mathematicians don't bother to say that each factor is unique because they know *each factor is only written once*, meaning that a number with two factors must have two *different* factors.

Prime numbers are defined as numbers with only two factors. The number is a factor of itself, as are all numbers, and it also has 1 as a factor.

So, what about one? Well, one does not have two *unique* factors. It has one factor - itself. The only type of number with an odd amount of factors is a square. One is a square number.

Prime numbers have an even number of factors. So, 1 cannot be prime.

Composite numbers have more than two factors. Having more than two factors is the definition of a composite number. One is not a composite number.



Handouts

The handouts on the following pages can be copied to use with the activities as suggested.

Whole Page Template

Copy font and back for student use. Copy front only for use in a display. Page 13.

Quarter Page Template for Display

Copy front only. Cut along the dotted lines as indicated. Page 14.

Quarter Page Templates for student use

Copy these pages front to back. Please test your printer set up first in order to make sure everything looks the way you want. Pages 15 and 16.

Multiples and Factor Pairs

name:

Find ALL the factors of this number.
Write a description of the number.

Factors of

Factors of

name:

Factors of

name:

Factors of

name:

Factors of

name:

Multiples and Factor Pairs

name:

Find ALL the factors of each number. Write a description of the number.

Factors of

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