

The Fraction Tree

Teacher's Intro

OVERVIEW

In this lesson, we will use the fractal branching of a tree to explore some of the basics of fractions in a simple, tangible way.

Like all fractals, a tree grows by repeating a simple process. In this case, a tree trunk splits into two branches, each of which split again, making four branches, each of which split again, making 8 branches, etc.

The student can see how the number of branches doubles at each step, and how the various fractions within the tree add up to make a whole object. Using the Fraction Tree model, the student can also see how to add fractions with uncommon denominators.

NM Math Standards:

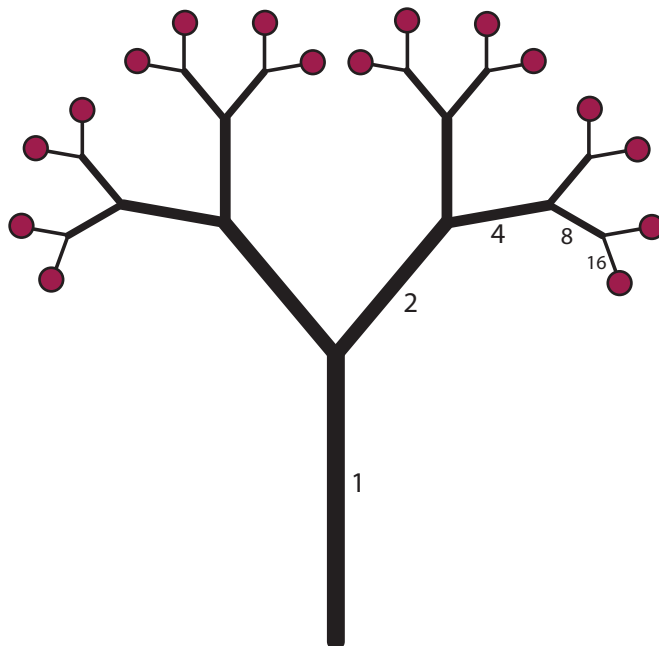
(K,1,2).A.1.3 Recognize, reproduce, describe, extend, and create repeating patterns.

2.G.1.1 Explore lines of symmetry in two-dimensional shapes

3.N.1.6 Demonstrate an understanding of fractions as parts of unit wholes, parts of a collection or set, and as locations on a number line.

3.A.1.6 Create, describe, and extend numeric and geometric patterns including multiplication patterns.

4.N.1.3 Add and subtract fractions with common and uncommon denominators using a variety of strategies.



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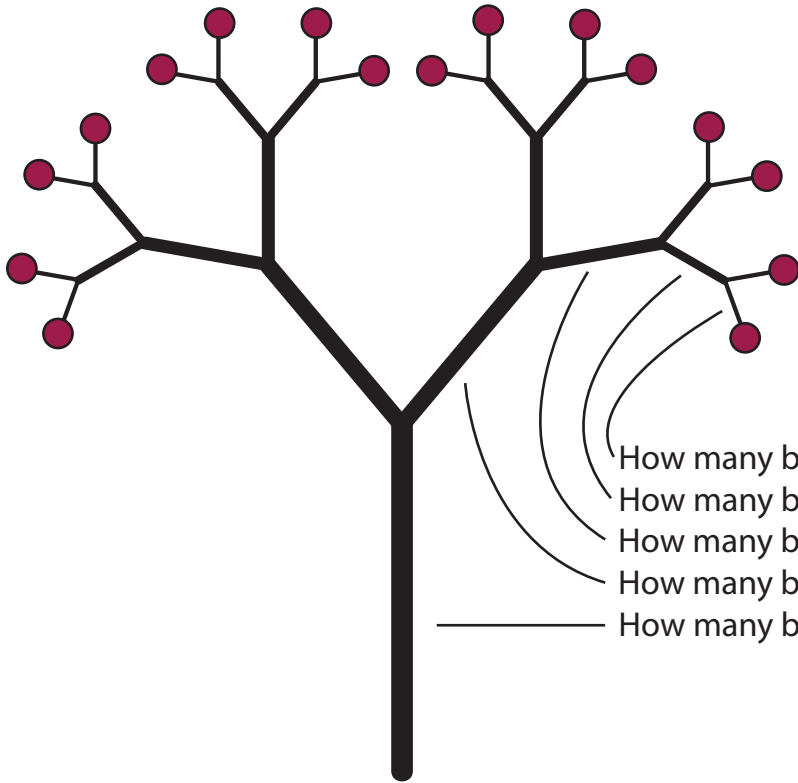
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The Fraction Tree

Here is a simple model of an apple tree, a tree we will call the Fraction Tree.

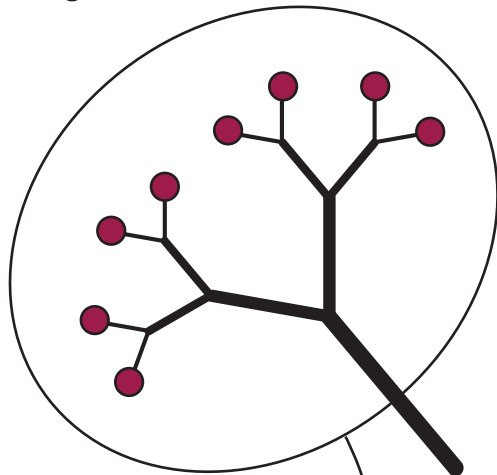
This tree grows from the bottom up by branching over and over again.

Trees are fractals, which means we see the same shape repeating at different sizes.

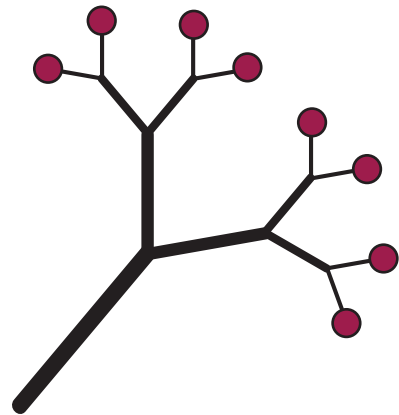


- How many branches are there at this level? ____
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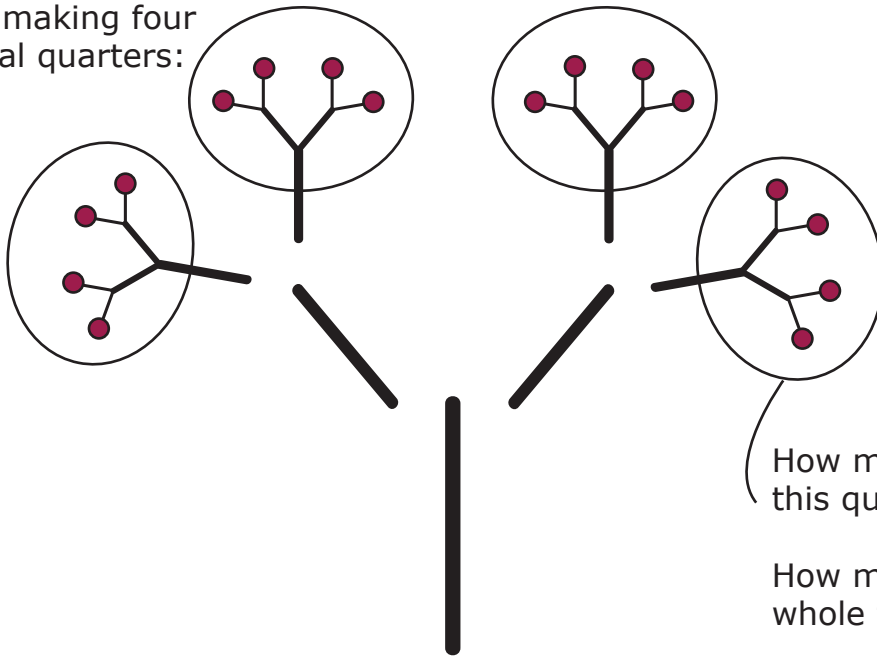
Next, we'll take the Fraction Tree apart:



How many apples are there in this half? ____



Next, we'll break each half in half again, making four identical quarters:



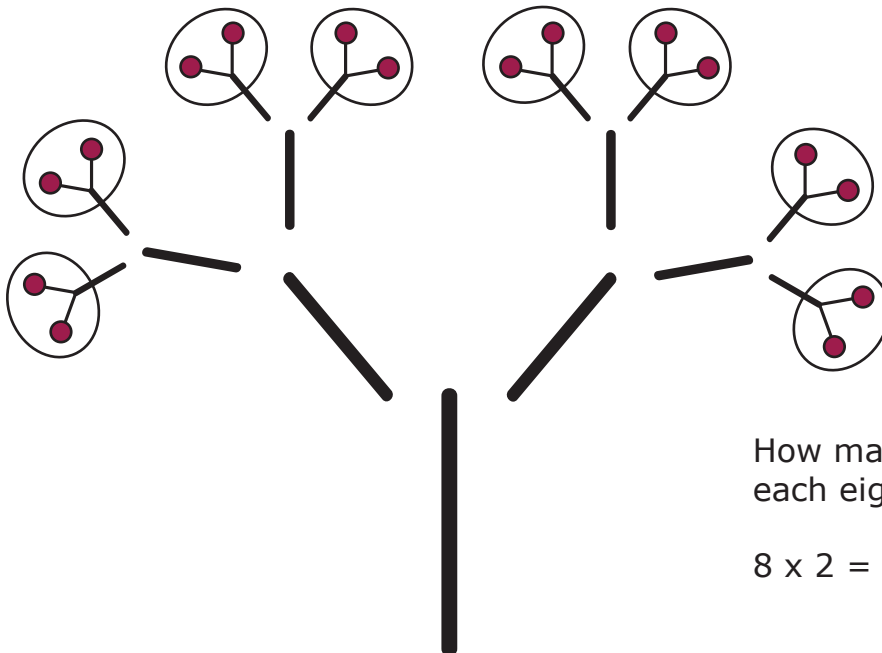
Half of one Half is one Quarter!

How many apples are there in this quarter? ____

How many apples are on the whole tree? ____

$$4 \times 4 = \underline{\quad}$$

Let's keep breaking the pieces in half. Now we have eight identical pieces:



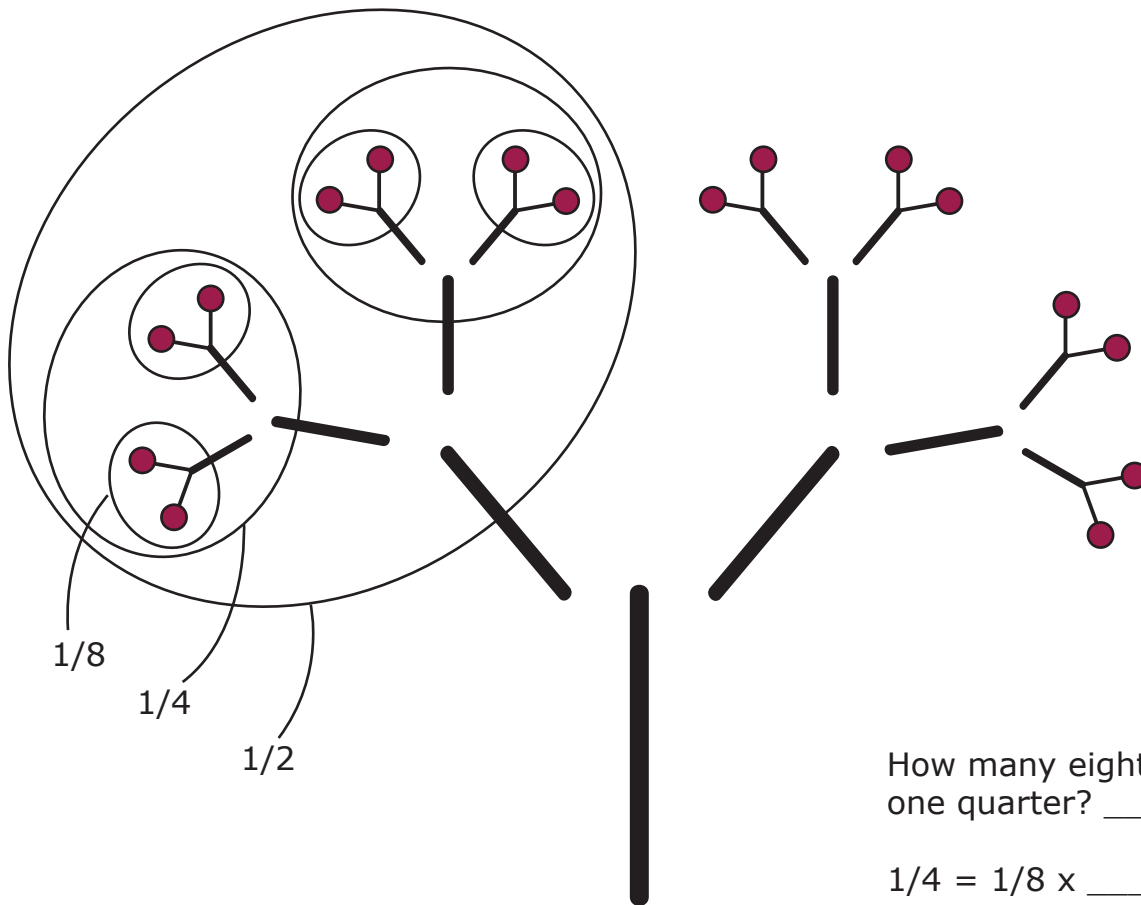
Half of one Quarter is one Eighth!

How many apples are there in each eighth? ____

$$8 \times 2 = \underline{\quad}$$

Half of one Eighth is one Sixteenth!

The ovals on the left half of the tree show that one half ($1/2$) is made up of two quarters ($2/4$), and it's also made up of four eighths ($4/8$).



How many eighths are there in one quarter? ____

$$1/4 = 1/8 \times \underline{\quad}$$

How many quarters are there in one half? ____

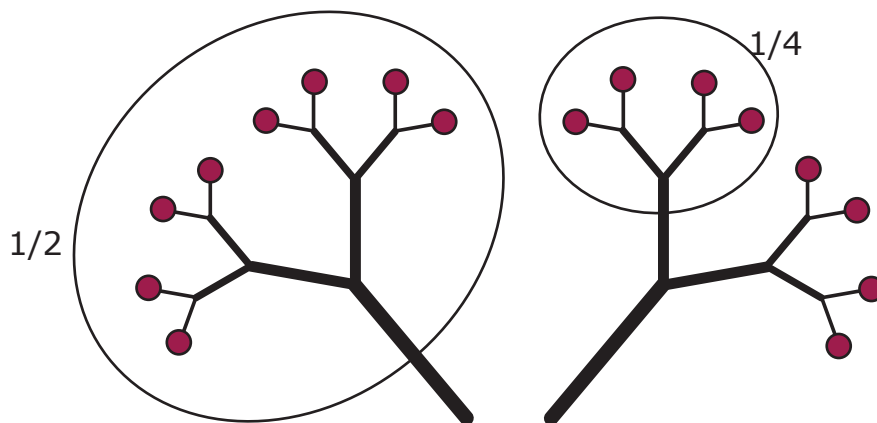
$$1/2 = 1/4 \times \underline{\quad}$$

How many eighths are there in one half? ____

$$1/2 = 1/8 \times \underline{\quad} t$$

We've seen that that we can add 2 eighths together to make a quarter, and two quarters together to make a half, and 2 halves together to make a whole tree. We can see that the whole tree is made up of 8 eighths, or 4 quarters, or 2 halves.

Now we'll explore how to add halves and quarters together. How much is $1/2 + 1/4$?

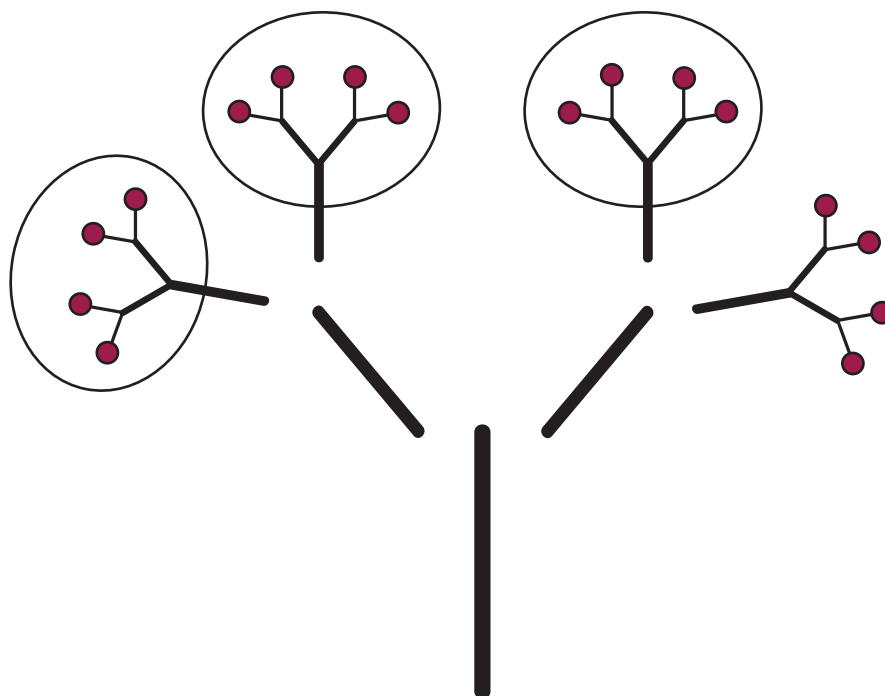


In this tree, the two ovals show $1/2$ of the tree and $1/4$ of the tree.

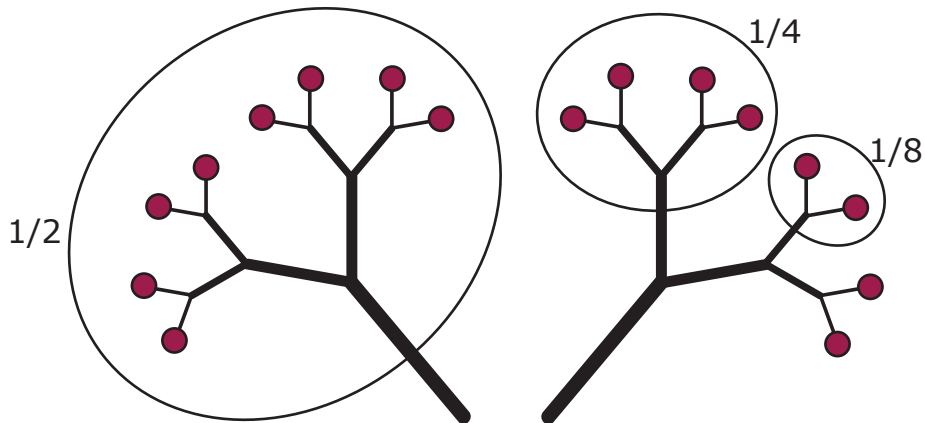
This means that $1/2 + 1/4$ really equals $2/4 + 1/4$

In order to add the $1/2 + 1/4$, we must remember that the half on the left is really made up of 2 quarters.

In the tree below, you can see that the answer is $3/4$



Next we'll explore how to add halves and quarters and eighths together.
 How much is $1/2 + 1/4 + 1/8$?



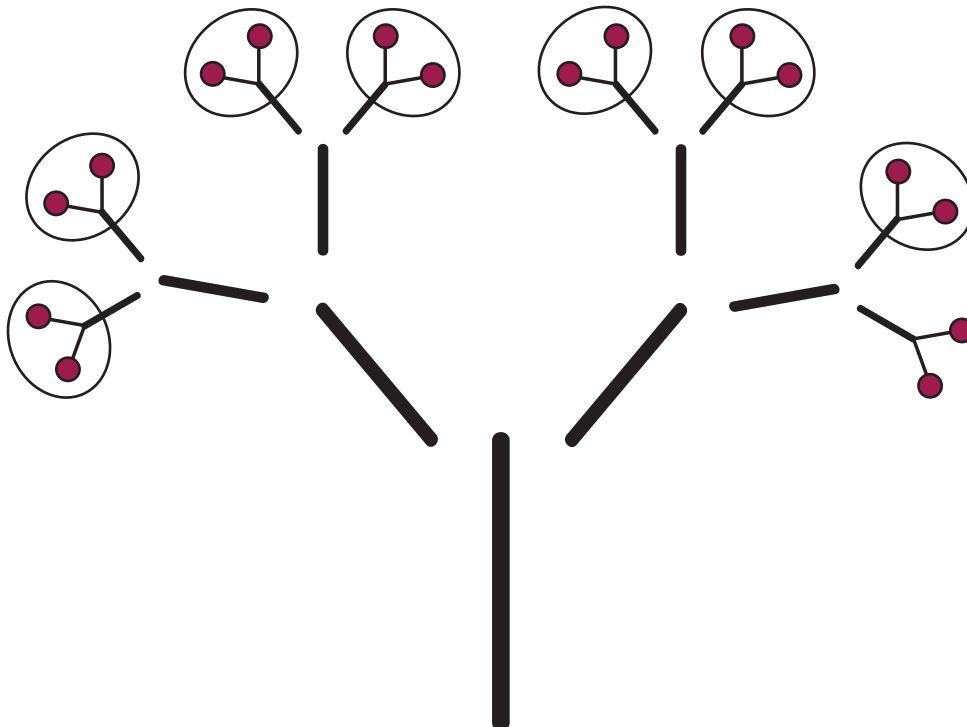
In this tree, we've circled a half, a quarter and an eighth of the tree.

To add them up, we have to remember that 1 quarter equals 2 eighths, and that 1 half equals 4 eighths. In other words,
 $1/2 = 4/8$ and $1/4 = 2/8$

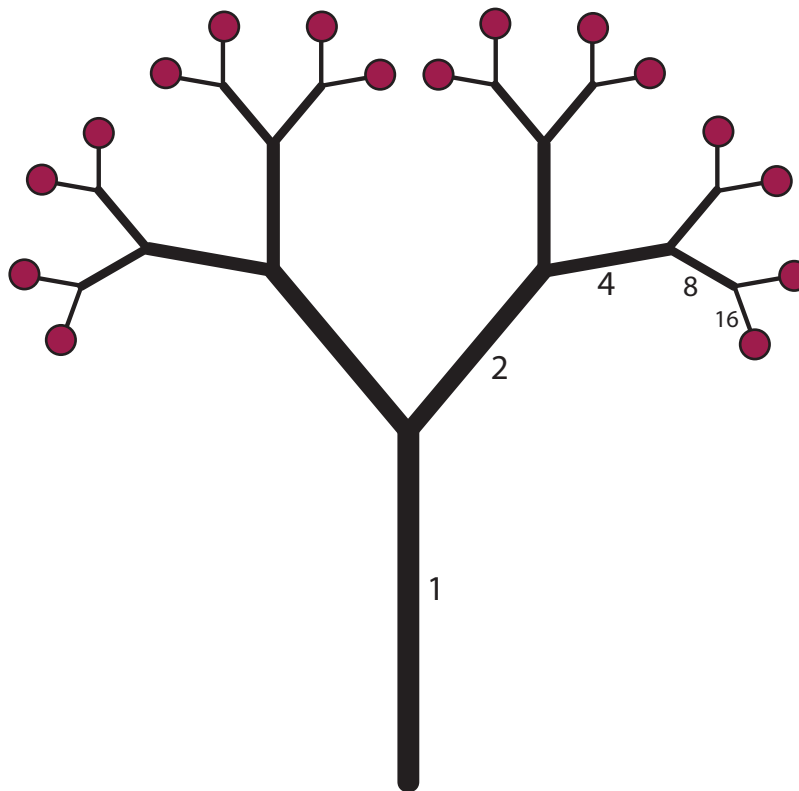
In the bottom tree, we've circled all the eighths that make up the half and the quarter.

$$1/2 + 1/4 + 1/8 = 4/8 + 2/8 + 1/8$$

Now that everything is written in eighths, we can add up the fractions easily, and in the tree below you can see that the answer is 7 eighths, or $7/8$



Finally, let's get back to counting apples. Since there are 16 apples all together, each apple is $\frac{1}{16}$ th of the pattern.



How many apples are there in half the tree? ____

How many apples are there in one quarter of the tree? ____

How many apples are there in $\frac{1}{4} + \frac{1}{8}$ of the tree? ____

What fraction of the tree is 4 apples? ____

What fraction of the tree is 12 apples? ____

What fraction of the tree is 10 apples? ____