

## Helping Kids Learn – Post #5 4/9/20

# STEM: Mathematics – Fractions

Math is a really important subject to understand. It helps us make sense of everyday problems and gives us strategies to persevere in solving them. It helps us reason – not just with numbers but with everything we do. When you think mathematically, you make connections, look for patterns and seek ways to apply them. Good readers and writers do the same thing. The following information can be adapted for many learners. See [Lift the Level](#) for suggestions.

## Be a Mathematician – Rethinking Fractions

Even the mention of the word “fractions” makes many people’s minds turn off. It’s not you – it’s the way you’ve been taught fractions. Don’t blame your teachers: it’s the way they were taught fractions, too. Unless you’re lucky enough to have learned fractions in an Asian country, you’ve probably suffered the same fate.

It’s really useful to understand fractions. So, set aside what you’ve been taught and think about fractions in a new way.

A fraction is a number. You can picture any number, including fractions. Look at these gold bars:

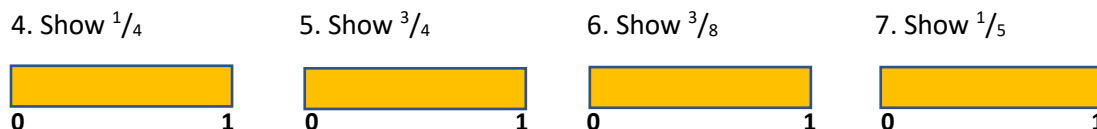


Using bars it’s easy to see that 2 bars is twice as much gold as 1 bar,  $\frac{1}{2}$  bar is half as much as 1 bar and so forth. Try these:

1. How many  $\frac{1}{2}$  bars does it take to make 1 bar?
2. How many  $\frac{1}{3}$  bars does it take to make 1 bar?
3. Which is more,  $\frac{1}{2}$  or  $\frac{1}{3}$ ?

The answers are at the end if you want to check but we bet you got them all right because the gold bars give you a **model** that makes it easy to see what’s going on.

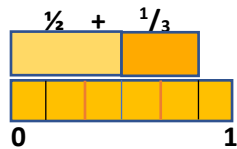
Now, try showing fractions. Each bar is 1:



You could measure the bars with a ruler, use the  $\frac{1}{2}$  bar in the example, fold the paper to show each number, but you don’t have to in order to get the gist of the problem. Even if you “eye-balled” instead of being precise, it’s easier with a bar than it would be with a circle – the pie model we’re all used to

seeing. Also, when you think of the fractions as numbers, you don't get bogged down in vocabulary – no worries about numerator and denominator. They're useful later but aren't needed now. Also, it's easy to answer which is greater:  $\frac{3}{4}$  or  $\frac{3}{8}$ , you can see that, in fact,  $\frac{3}{4}$  is twice as big (or as much) as  $\frac{3}{8}$ , and the relative sizes of the fractions compared to each other and to 1.

Operations with fractions can work with the bar model as follows:



This adds  $\frac{1}{2}$  and  $\frac{1}{3}$  and compares them to 1 at the same time. We shaded them a little differently so you could see them more easily. You know the sum is going to be less than 1 and a lot closer to 1 than to 0.

Mark the whole bar into

$\frac{1}{2}$  pieces (blue line) and  $\frac{1}{3}$  pieces (red lines). The middle part is split equally into  $\frac{1}{6}$  and  $\frac{1}{6}$ . Marking the others into  $\frac{1}{6}$ 's (black lines) lets you see that the sum of  $\frac{1}{2}$  and  $\frac{1}{3}$  is  $\frac{5}{6}$ .

We skipped a few steps to get this far. You really need to mess around with the bars for awhile to get the sense of them and to discover for yourself that, for example  $\frac{1}{2}$  is the same amount of gold bar (quantity) as  $\frac{3}{6}$ , they are **equivalent fractions**. At the end of this investigation there's a page with larger bars for you to cut out and mess around with.

**Lift the Level** You can make this lesson deeper and suitable for younger or older students by any of the following:

1. Use the bars on page 4 to figure out **equivalent fractions**.
2. Use the bars to add and subtract fractions. Follow the model above by placing the fractions on top of a 1 bar (unit).
3. Try multiplication and division. Caution: if you know the **algorithms** for these operations, do NOT use them to try to get the answers. Instead, think about what it means to multiply or divide a candy bar by 2 and then by less than 1.
4. Compare and order these fractions using the bars:  $\frac{1}{4}$ ,  $\frac{2}{3}$ ,  $\frac{3}{8}$ , and  $\frac{5}{6}$ .
5. Think of at least 5 things in life where fractions are really useful. What kinds of fractions do you need for each thing? How do you use fractions for each one? (for example, compare, add, estimate)

## NJ Student Learning Standards

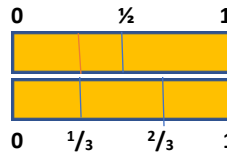
There's a set of "umbrella" mathematics standards that are used in all of the rest. For this investigation, the following Standards for Mathematical Practice are addressed:

- Make sense of problems and persevere in solving them.
- Reason (abstractly and) quantitatively
- Model with mathematics

Also Numbers standards: 3.NF.A.1 and .2; 4.NF.A.1, 4.NF.B.3.d, 5.NF.A.2, 6.NS.A.1, 7.NS, 8.NS, and N-RN with applications to Algebra I, II and Calculus.

## Answers

- How many  $\frac{1}{2}$  bars does it take to make 1 bar? **2**
- How many  $\frac{1}{3}$  bars does it take to make 1 bar? **3**
- Which is more,  $\frac{1}{2}$  or  $\frac{1}{3}$ ?  $\frac{1}{2}$  **Look at the pictures:**



The red line shows  $\frac{1}{3}$  on the top bar.

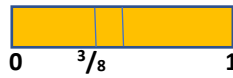
4. Show  $\frac{1}{4}$



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



6. Show  $\frac{3}{8}$

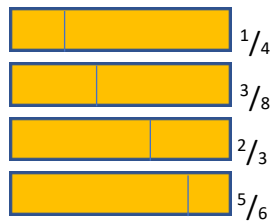


7. Show  $\frac{1}{5}$



For each problem,  $\frac{1}{2}$  is marked, also.

Lift the Level number 4:



$\frac{1}{4}$ ,  $\frac{2}{3}$ ,  $\frac{3}{8}$ , and  $\frac{5}{6}$ .

Lift the Level number 5:

There are many possible answers and possible uses. For example, measuring fabric, measuring lumber, measuring ingredients in a recipe in the U.S. (other countries weigh ingredients), cutting floor tiles to fit on your kitchen floor, measuring precisely the size of glass you need to replace your neighbor's window that broke when the baseball hit it.

**Bars to cut out are on page 4**

## STEM Hands On

Carefully cut out the bars. You'll want them very neat. You can ask an older kid or an adult for help.

Fold or measure the bars carefully to show halves, thirds, fourths, fifths, sixths, and eighths. Mark the folds with pencil, pen or marker if you want. Make two of each. For example, halves might be red, thirds orange, fourths yellow and so forth.

Then use them to explore and to solve the Lift the Level investigations. You may decide to cut up one bar. If you do, put all the pieces in a little bag or envelope so you can find them again. Use them lots of times to get good at recognizing the fractional parts.



No printer? No problem! Cut out rectangles 1 inch by 6 inches from newspaper, old wrapping paper, grocery store paper bags, or whatever you have. Stiffer paper works better.