



This material is copyrighted and protected by U.S. anti-piracy laws.

© 2019 by Teacher to Teacher Press. All rights reserved.

As a purchaser of this handout, you have a single-user license. You may duplicate student activity pages for your own classroom use only. Any unauthorized duplication of these materials by physical or electronic means or any public performance and demonstration of these materials without prior written consent of Teacher to Teacher Press are strictly prohibited.

If you should need written permission, you may contact Teacher to Teacher Press at their website, www.tttpress.com.

The Fabulous Fraction Finder



$$\frac{7}{9} > \frac{3}{4}$$

Common Core
Math Standards
included!

Comparing, Simplifying, Equivalency,
Adding & Subtracting, Proportions, Graphing

By Brad Fulton

Educator of the Year, 2005

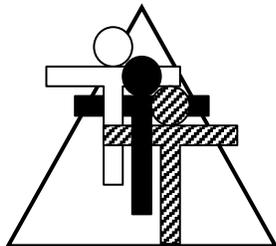
brad@tttpress.com www.tttpress.com

530-547-4687

P.O. Box 233, Millville, CA 96062

Teacher to Teacher Press

Join us!



Facebook: TeacherToTeacherPress



Twitter: @tttpress



YouTube™ /watchtttpress





Brad Fulton Educator of the Year

◆ Contact me to host a training at your site.

← Hawaii too! ✓

PO Box 233, Millville, CA 96062
(530) 547-4687
brad@tttpress.com

Known throughout the country for motivating and engaging teachers and students, Brad has co-authored over a dozen books that provide easy-to-teach yet mathematically rich activities for busy teachers while teaching full time for over 30 years. In addition, he has co-authored over 40 teacher training manuals full of activities and ideas that help teachers who believe mathematics must be both meaningful and powerful.

Seminar leader and trainer of mathematics teachers

- ◆ 2005 California League of Middle Schools Educator of the Year
- ◆ California Math Council and NCTM national featured presenter
- ◆ Lead trainer for summer teacher training institutes
- ◆ Trainer/consultant for district, county, regional, and national workshops

Author and co-author of mathematics curriculum

- ◆ Simply Great Math Activities series: six books covering all major strands
- ◆ Angle On Geometry Program: over 400 pages of research-based geometry instruction
- ◆ Math Discoveries series: bringing math alive for students in middle schools
- ◆ Teacher training seminar materials handbooks for elementary, middle, and secondary school

Available for workshops, keynote addresses, and conferences

All workshops provide participants with complete, ready-to-use activities that require minimal preparation and give clear and specific directions. Participants also receive journal prompts, homework suggestions, and ideas for extensions and assessment.

Brad's math activities are the best I've seen in 38 years of teaching!

Wayne Dequer, 7th grade math teacher, Arcadia, CA

"I can't begin to tell you how much you have inspired me!"

Sue Bonesteel, Math Dept. Chair, Phoenix, AZ

"Your entire audience was fully involved in math!! When they chatted, they chatted math. Real thinking!"

Brenda McGaffigan, principal, Santa Ana, CA

"Absolutely engaging. I can teach algebra to second graders!"

Lisa Fellers, teacher

Like my activities? How about giving me a favorable rating on the Teachers Pay Teachers website? Four stars would be much appreciated and would help me sleep better at night.



Like me even more? Then please don't make copies for your colleagues. I know it's tempting when they say, "Wow! Groovy activity! Can I have a copy?" But this is how I make my money, and why are they still saying "groovy" anyway?



If we make copies for our friends, can we honestly tell our students not to copy or take things that don't belong to them? (Ouch!)



Discounted site licensed copies are available on the TPT website. Please encourage them to take advantage of this affordable option. Okay?

Thanks and happy teaching,

Brad 

I want...

- a) Effective staff development
- b) Affordable staff development
- c) Ongoing staff development
- d) **ALL OF THE ABOVE!**

www.tttpress.com
brad@tttpress.com



Great DVD presentations offer quality mathematics staff development at a fraction of the cost!

- ◆ **Effective because** they are classroom-tested and classroom-proven. These popular DVDs of Brad's trainings have been utilized by teachers throughout the country for years.
- ◆ **Affordable because** they are site-licensed. Buy only one copy for your whole school, print as many copies of the handouts as you need.
- ◆ **Ongoing because** when you hire new staff, simply hit "play" and the training begins. There's no need to bring back the consultant.

Fraction Finder

Using Graph Paper to Understand Fractions

Overview:

This activity provides a very creative and visual way to understand fraction concepts such as simplifying and finding equivalent fractions. You can also help students compare fractions, solve proportions, and add and subtract fractions of unlike denominators. The concepts of slope and division of integers can also be illustrated using this strategy – all while practicing graphing. This is also a great activity for older students still struggling with fraction concepts.

Required Materials:

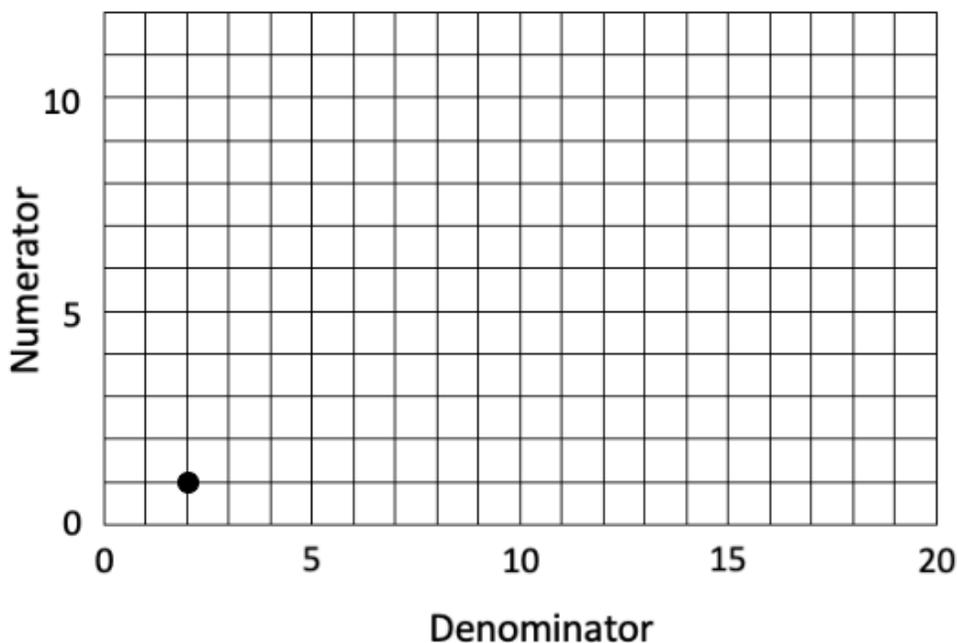
- Grid paper or activity master
- Rulers

Optional Materials:

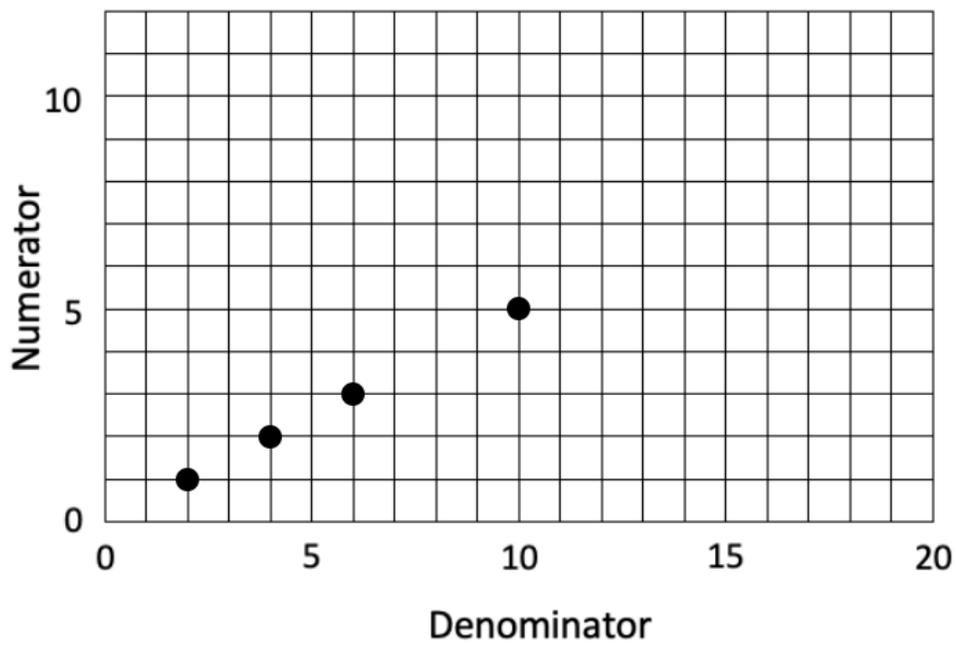
- Calculators

Procedure:

- 1 Pass out activity master 1. Write the fraction $\frac{1}{2}$ on the board and have them graph it as shown. Move two spaces to the right for the denominator, and one space upward for the numerator. It is critical that the numerator resides on the vertical axis and the denominator on the horizontal axis as it will transition into the concept of slope later.

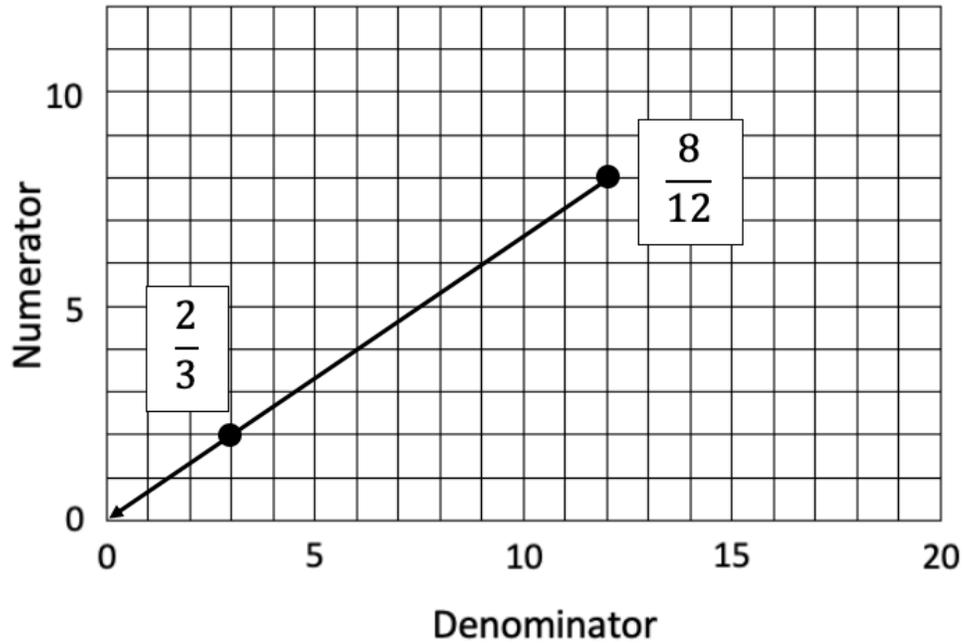


- 2 Now have students find fractions equivalent to $\frac{1}{2}$. Examples may include $\frac{2}{4}$, $\frac{3}{6}$, and $\frac{5}{10}$. Have them graph these. What do they notice? (They are all on the same straight line.) Have students use a ruler to connect all the fractions. What other fractions are in that line? Are they equal to $\frac{1}{2}$?

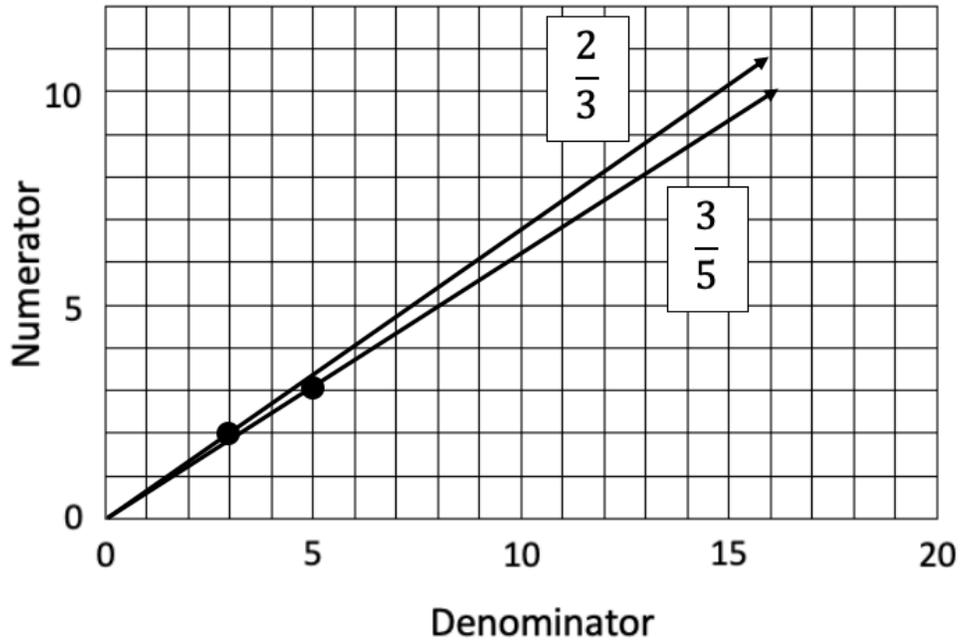


- 3 What about the fraction $\frac{5}{11}$? It is equal to $\frac{1}{2}$ also. Such fractions that do not have an integer for the numerator or denominator are called complex fractions.

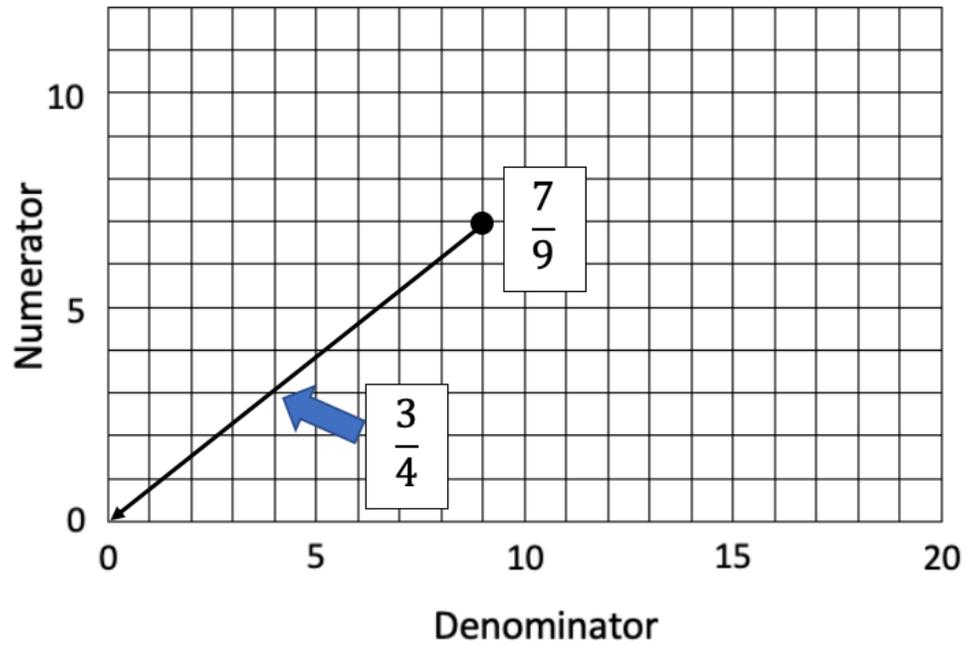
- 4 To simplify fractions, have the students graph $\frac{8}{12}$. Connect the point to the origin (0,0). Notice that it passes through $\frac{6}{9}$, $\frac{4}{6}$, and $\frac{2}{3}$. Since $\frac{2}{3}$ is closest to the origin, it is the simplified form of $\frac{8}{12}$. Why isn't the origin equal to $\frac{8}{12}$? (Written as a fraction, the origin would be $\frac{0}{0}$, and division by zero is undefined.)



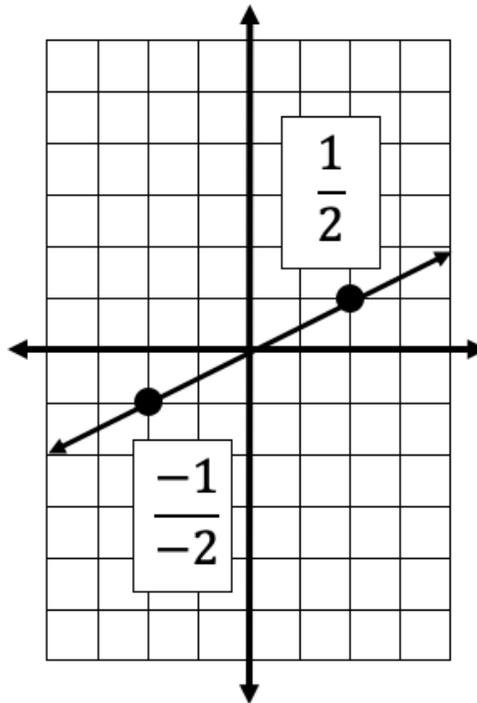
- 5 To compare fractions, have the students graph $\frac{3}{5}$ and $\frac{2}{3}$. Connect them to the origin. Which line has a steeper slope? That is, which line is higher? That line represents the fraction that is greater. The fraction is actually the slope of the line.



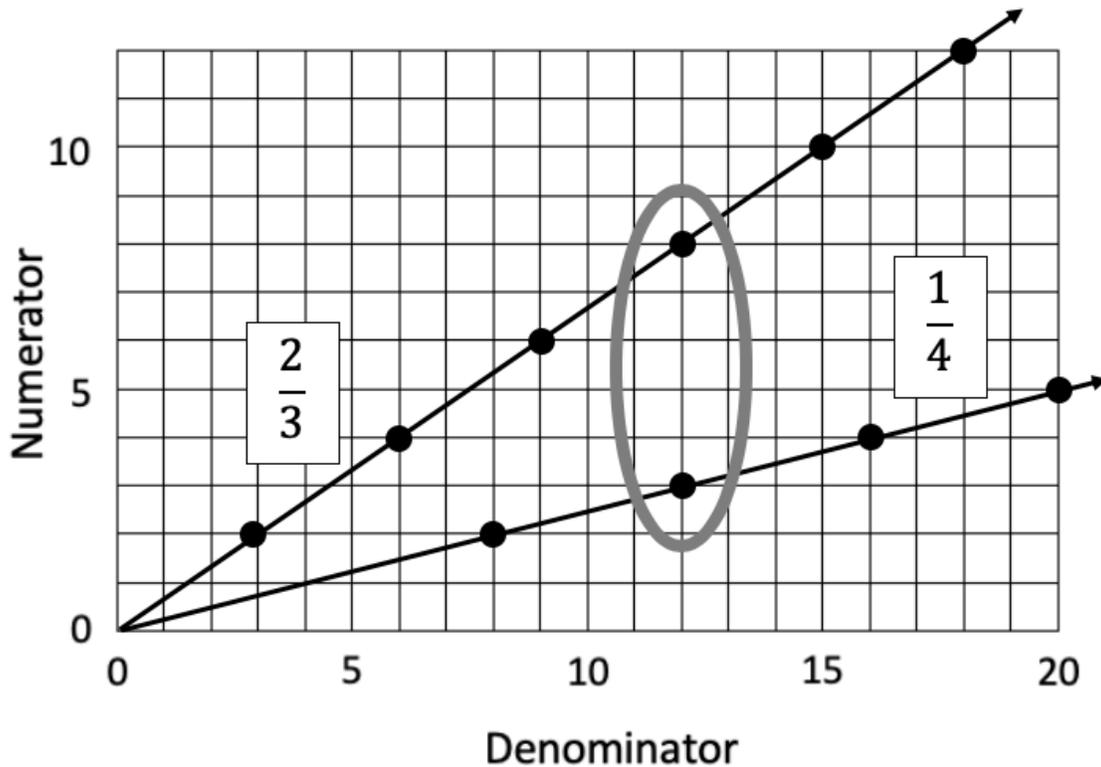
- 6 To “round” a fraction, have the students graph the fraction $\frac{7}{9}$. Connect it to the origin. Find another fraction that uses smaller numbers and is *close to* the line. We are looking for a coordinate point close to the line, but also closer to the origin. You can see that $\frac{3}{4}$ is close to and slightly less than $\frac{7}{9}$. Rounding fractions is a skill that is not often taught, yet most adults do this frequently. For example, if 15 of 32 students are boys, we know that the class is about $\frac{1}{2}$ boys.



- 7 To demonstrate that division of two negative numbers results in a positive quotient, put the origin in the center of a piece of graph paper and graph the fraction $\frac{1}{2}$. Use a ruler to connect it to the origin and extend the line downward to the left of it as shown. It can be seen that $\frac{-1}{-2}$ is also on the line, so it is also equal to $\frac{1}{2}$. Thus -1 divided by -2 is equal to +1 divided by +2 or $\frac{1}{2}$.



- 8 Students can also add and subtract fractions of unlike denominators using the Fraction Finder. We will use the example of $\frac{2}{3} + \frac{1}{4}$. First find $\frac{2}{3}$ on the graph. Then find its equivalent fractions as in step 2 above. Do the same for the fraction $\frac{1}{4}$. This is shown here.



Now we look at the points along *both* lines. We are searching for a pair of points that are *vertically aligned*. We see that the first such pair is shown in the oval. Notice that the denominator for this pair of points is at 12 on the horizontal (denominator) axis. This is the common denominator of the two fractions and will be the denominator of the answer.

The numerators are 8 and 3. To find the sum of the two fractions, we add the numerators and get $\frac{11}{12}$. If we want the difference between the two fractions, we subtract them to get $\frac{5}{12}$. Although this would be a slow and impractical way to add fractions of unlike denominators in general, it helps students to see what we are doing when we find a common denominator.



Journal Prompts:



Explain how you could use the Fraction Finder to tell which of these two fractions is greater.

$$\frac{9}{13} \qquad \frac{11}{16}$$

Seven of 30 students got A's on a recent test. Explain how the Fraction Finder could be used to find a fraction that is easier to use.

Homework:



Give students some fractions to graph on the Fraction Finder. List them from least to greatest when finished. You may wish to assign one of the activity masters instead.

Good Tip!



Have students use calculators to check the accuracy of their "rounded" fractions. Divide the numerator by the denominator. For example, $\frac{7}{9} = .77$ and $\frac{3}{4} = .75$. This is a difference on only .02. This will not only verify their accuracy, it will also demonstrate that fractions, division, decimals, and slope are related concepts.

Taking a Closer Look:



Have students explore "fraction chains" that are based on various patterns such as these:

$$\frac{2}{3}, \frac{4}{6}, \frac{6}{9}, \frac{8}{12} \qquad \frac{1}{1}, \frac{2}{2}, \frac{3}{4}, \frac{4}{8}, \frac{5}{16}$$

The first set is composed of equivalent fractions. The numerators add two each time while the denominators increase by three.

In the second set, the numerators add one each time, but the denominators are doubling.

Which ones are linear patterns? Which ones are non-linear? Why?

The numerators of the second set are increasing by addition (arithmetically) while the denominators are increasing by multiplication (geometrically).

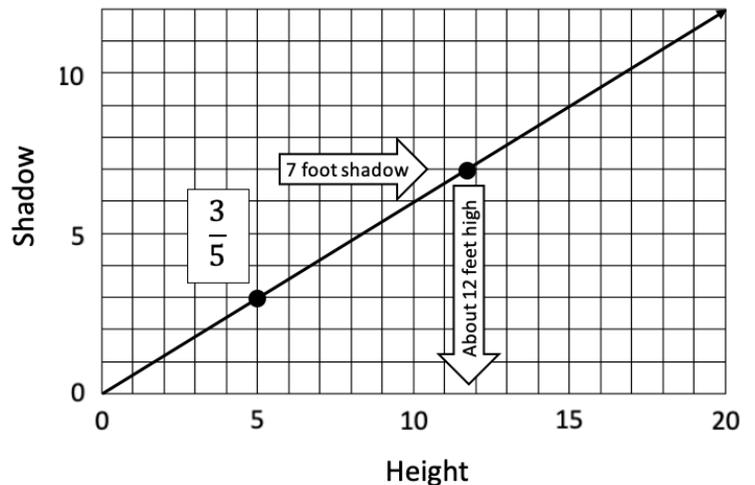
After working with the fraction finder, algebra students can easily see why these two formulas are equal:

$$y = \frac{2}{3}x + 5 \quad y = \frac{6}{9}x + 5$$

You can also demonstrate similar triangles to solve proportions using the fraction finder as shown here:

A person five feet in height casts a shadow three feet long. A nearby post casts a shadow seven feet long. How tall is the post?

First graph $\frac{3}{5}$. Then draw a line from the origin through $\frac{3}{5}$. Find a point on the ray that is seven units above the origin. (This represents a shadow of seven feet.) This point is about 12 units to the right of the origin. (Graphically: the answer is about twelve feet. Mathematically it is $11\frac{2}{3}$ feet.)



Assessment:

A quick glance at the graphs that result from a student's work will tell if he or she has understood the concept. If students work in pairs or groups, they can compare their work to self assess. If you assigned one of the activity masters, use the key below to check the work.

Answer Key:**Activity Master 2: Simplifying Fractions**

$10/15 = 2/3$

$3/12 = 1/4$

$16/20 = 4/5$

$9/18 = 1/2$

$20/15 = 4/3 = 1\frac{1}{3}$

$9/12 = 3/4$

$8/14 = 4/7$

$4/12 = 1/3$

$15/10 = 3/2 = 1\frac{1}{2}$

$20/20 = 1/1 = 1$

$14/35 = 2/7$

$12/28 = 3/7$

Activity Master 3: Equivalent Fractions (Answers may be in any order)

Family 1 $1/3$ $2/6$ $3/9$ Lowest terms: $1/3$

Family 2 $2/4$ $4/8$ $5/10$ Lowest terms: $1/2$

Family 3 $8/20$ $4/10$ $6/15$ Lowest terms: $2/5$

Family 4 $8/12$ $10/15$ $6/9$ Lowest terms: $2/3$

Yes, $2.5/5$ is equal to $1/2$ so it is in that family.

Activity Master 4: Comparing Fractions

least:

greatest:

$1/6$ $1/5$ $1/3$ $2/5$ $2/3$ $3/4$ $7/9$ $4/5$ $5/6$ $4/4$ $4/3$ $8/5$

$4/3$ and $8/5$ are greater than one since the numerator is greater than the denominator.

They also have a slope greater than one on the Fraction Finder.

Activity Master 5: Rounding Fractions (Answers may vary.)

$8/17 \approx 1/2$

$9/13 \approx 3/4$ or $2/3$

$11/15 \approx 2/3$

$7/19 \approx 1/3$ or $2/5$

$19/7 \approx 2\frac{2}{3}$ or $2\frac{3}{4}$

$7/16 \approx 1/2$

$17/22 \approx 3/4$ or $4/5$

$23/8 \approx 3$

$11/32 \approx 1/3$

$14/13 \approx 1$

$12/19 \approx 2/3$

$15/7 \approx 2$

A note about learning fractions:

Typical instruction in fractions includes examples with many different denominators, but in the mind of the learners, not all fractions are the same.

- Initially, instruction should be limited to unit fractions with denominators that are powers of two such as $\frac{1}{2}$, $\frac{1}{4}$, $\frac{1}{8}$. The term *unit fraction* means that the numerator is one. Powers of two include halves, halves of halves (fourths), and so on. Doubling and cutting numbers in half is a rudimentary skill that enables students to master this type of fraction first.
- Next, students can work with odd denominators.
- Ultimately, they can then explore non-unit fractions and mixed numbers.

The Common Core Connection:

Grade 4:

CCSS.MATH.CONTENT.4.NF.A.1

Explain why a fraction a/b is equivalent to a fraction $(n \times a)/(n \times b)$ by using visual fraction models, with attention to how the number and size of the parts differ even though the two fractions themselves are the same size. Use this principle to recognize and generate equivalent fractions.

CCSS.MATH.CONTENT.4.NF.A.2

Compare two fractions with different numerators and different denominators, e.g., by creating common denominators or numerators, or by comparing to a benchmark fraction such as $\frac{1}{2}$. Recognize that comparisons are valid only when the two fractions refer to the same whole. Record the results of comparisons with symbols $>$, $=$, or $<$, and justify the conclusions, e.g., by using a visual fraction model.

CCSS.MATH.CONTENT.4.NF.B.3.A

Understand addition and subtraction of fractions as joining and separating parts referring to the same whole.

Grade 5:

CCSS.MATH.CONTENT.5.NF.A.1

Add and subtract fractions with unlike denominators (including mixed numbers) by replacing given fractions with equivalent fractions in such a way as to produce an equivalent sum or difference of fractions with like denominators. *For example, $\frac{2}{3} + \frac{5}{4} = \frac{8}{12} + \frac{15}{12} = \frac{23}{12}$. (In general, $\frac{a}{b} + \frac{c}{d} = \frac{ad + bc}{bd}$.)*

CCSS.MATH.CONTENT.5.G.A.1

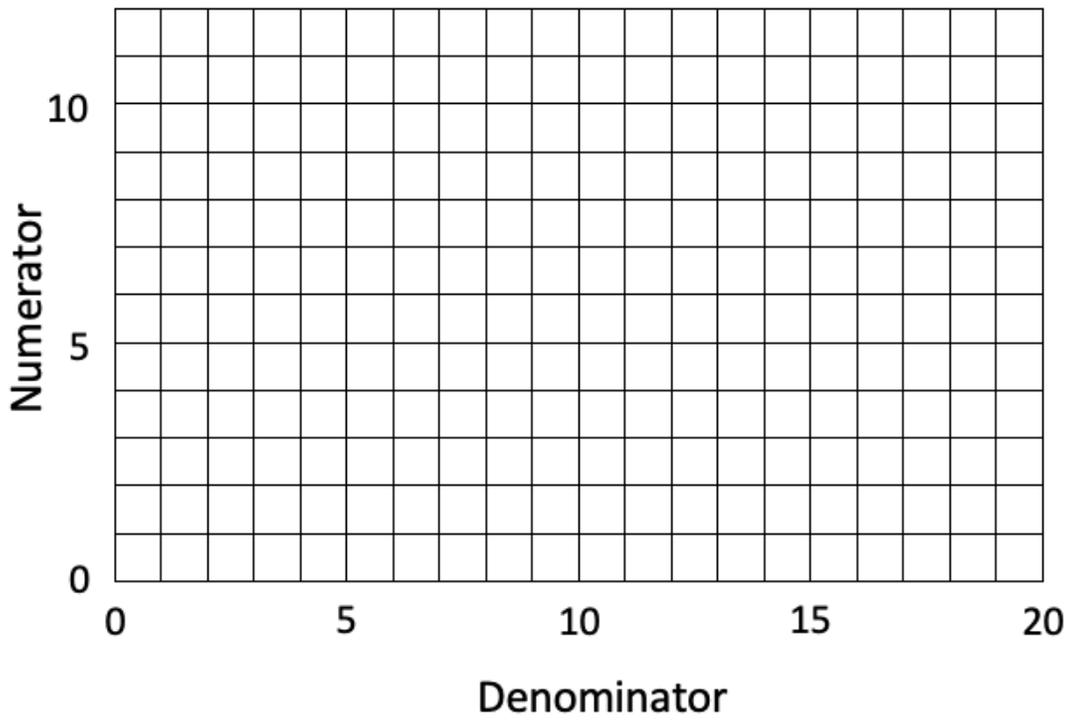
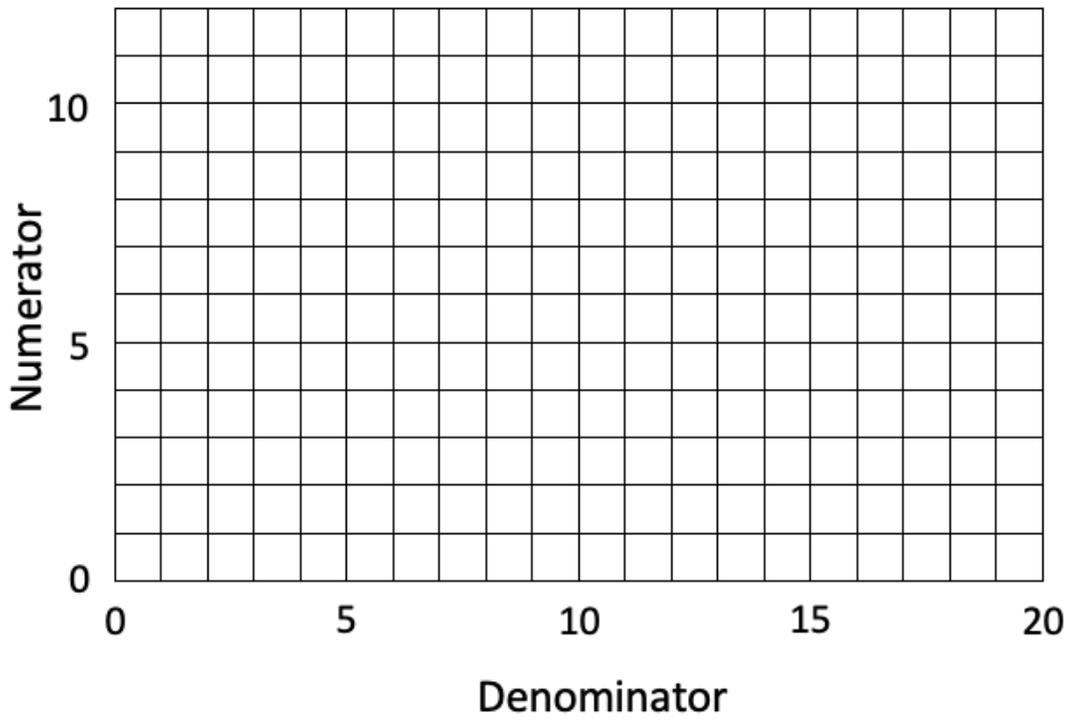
Use a pair of perpendicular number lines, called axes, to define a coordinate system, with the intersection of the lines (the origin) arranged to coincide with the 0 on each line and a given point in the plane located by using an ordered pair of numbers, called its coordinates. Understand that the first number indicates how far to travel from the origin in the direction of one axis, and the second number indicates how far to travel in the direction of the second axis, with the convention that the names of the two axes and the coordinates correspond (e.g., x -axis and x -coordinate, y -axis and y -coordinate).

CCSS.MATH.CONTENT.5.G.A.2

Represent real world and mathematical problems by graphing points in the first quadrant of the coordinate plane, and interpret coordinate values of points in the context of the situation.

Fraction Finder

Name _____



Simplifying Fractions

Name _____

Use the Fraction Finder to simplify each fraction to lowest terms. Spare graphs are on the second page.

$\frac{10}{15}$ _____

$\frac{3}{12}$ _____

$\frac{16}{20}$ _____

$\frac{9}{18}$ _____

$\frac{20}{15}$ _____

$\frac{9}{12}$ _____

$\frac{8}{14}$ _____

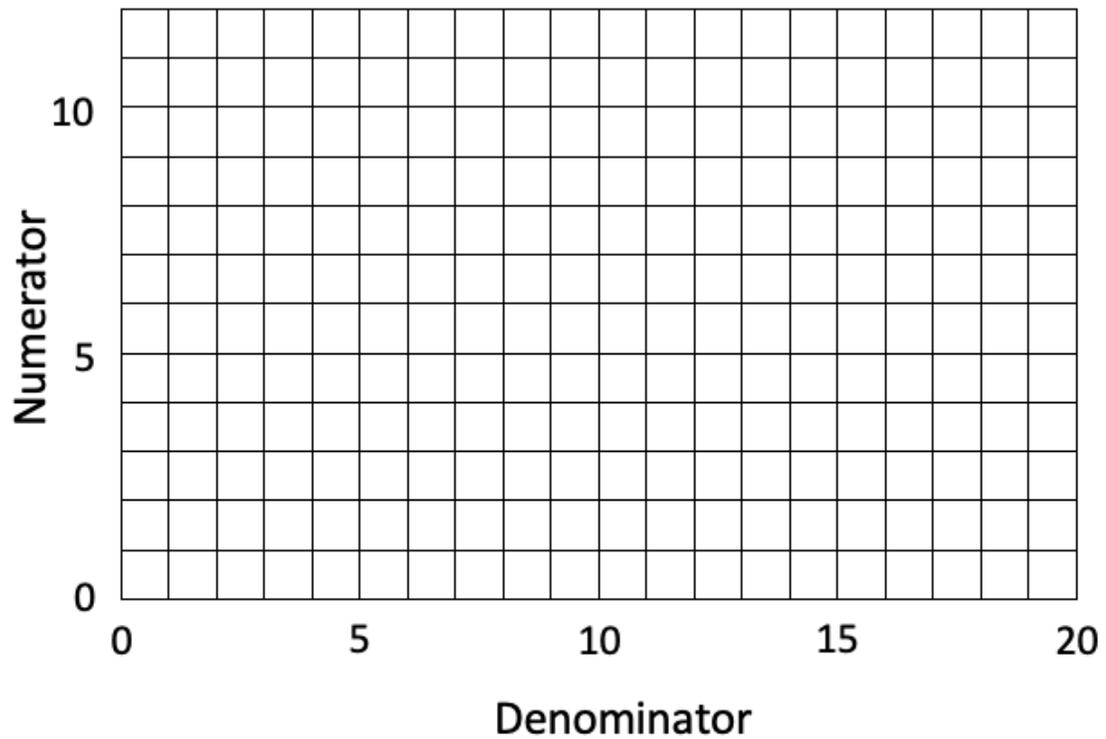
$\frac{4}{12}$ _____

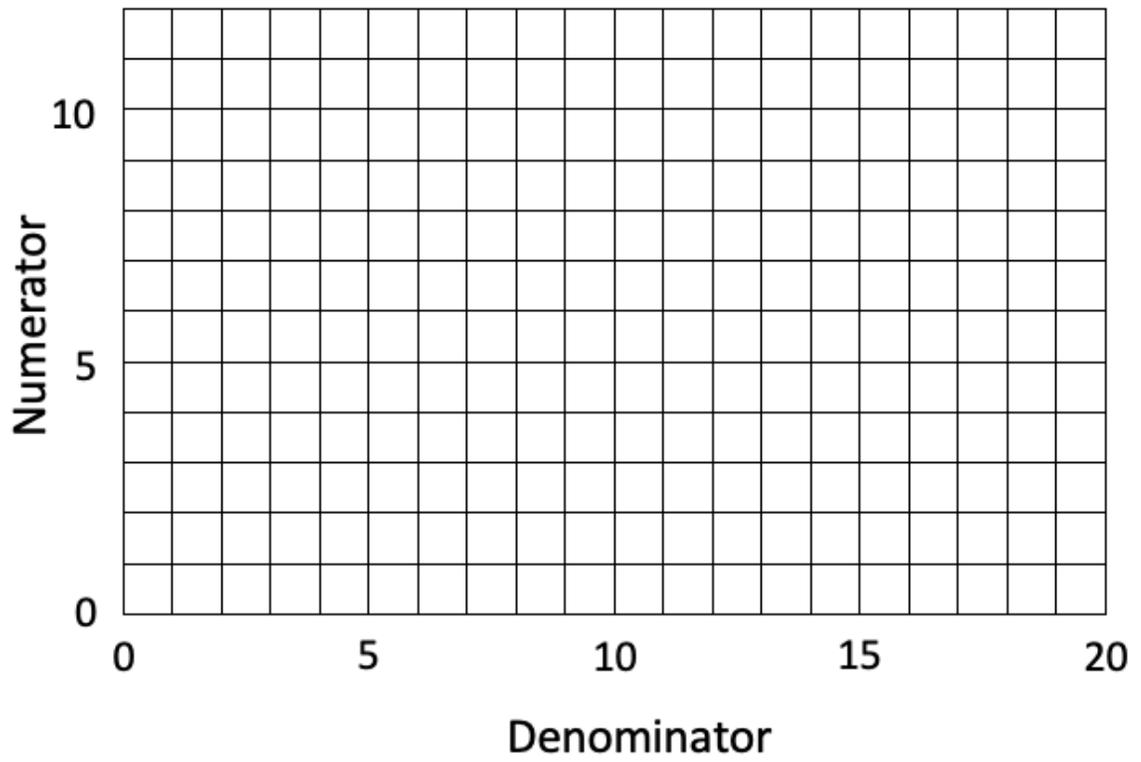
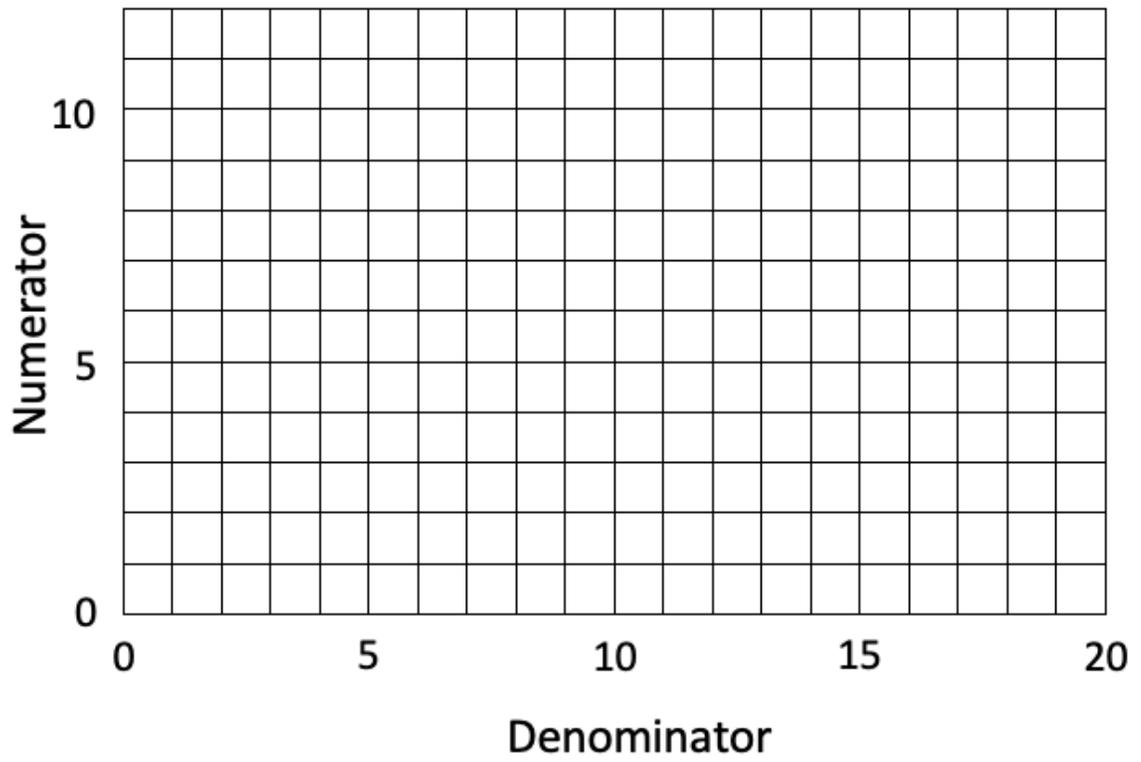
$\frac{15}{10}$ _____

$\frac{20}{20}$ _____

$\frac{14}{35}$ _____

$\frac{12}{28}$ _____





Equivalent Fractions

Name _____

Plot these fractions on the Fraction Finder. Then group them by families that are equivalent by connecting those that are on the same line.

$\frac{1}{3}$ $\frac{2}{4}$ $\frac{8}{20}$ $\frac{2}{6}$ $\frac{6}{9}$ $\frac{6}{15}$ $\frac{4}{10}$ $\frac{5}{10}$ $\frac{10}{15}$ $\frac{3}{9}$ $\frac{4}{8}$ $\frac{8}{12}$

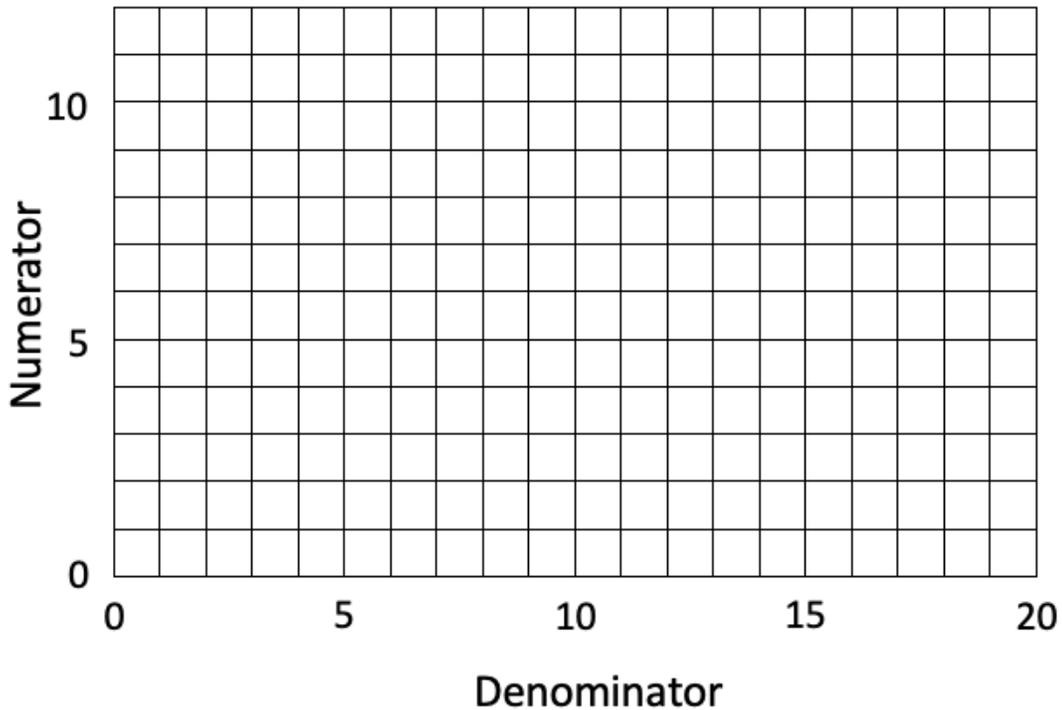
Family 1	_____	_____	_____		_____	_____
Family 2	_____	_____	_____	Now write two	_____	_____
Family 3	_____	_____	_____	new members	_____	_____
Family 4	_____	_____	_____	for each family	_____	_____
				in these blanks.		

For each family, write the fraction that would be in lowest terms.

Family 1 _____ Family 2 _____ Family 3 _____ Family 4 _____

Would this fraction be in any of the families? $\frac{2.5}{5}$ _____

Explain why or why not _____



Comparing Fractions

Name _____

Use the Fraction Finder to compare these fractions. Plot each one on the graph. Then list them in order from least to greatest.

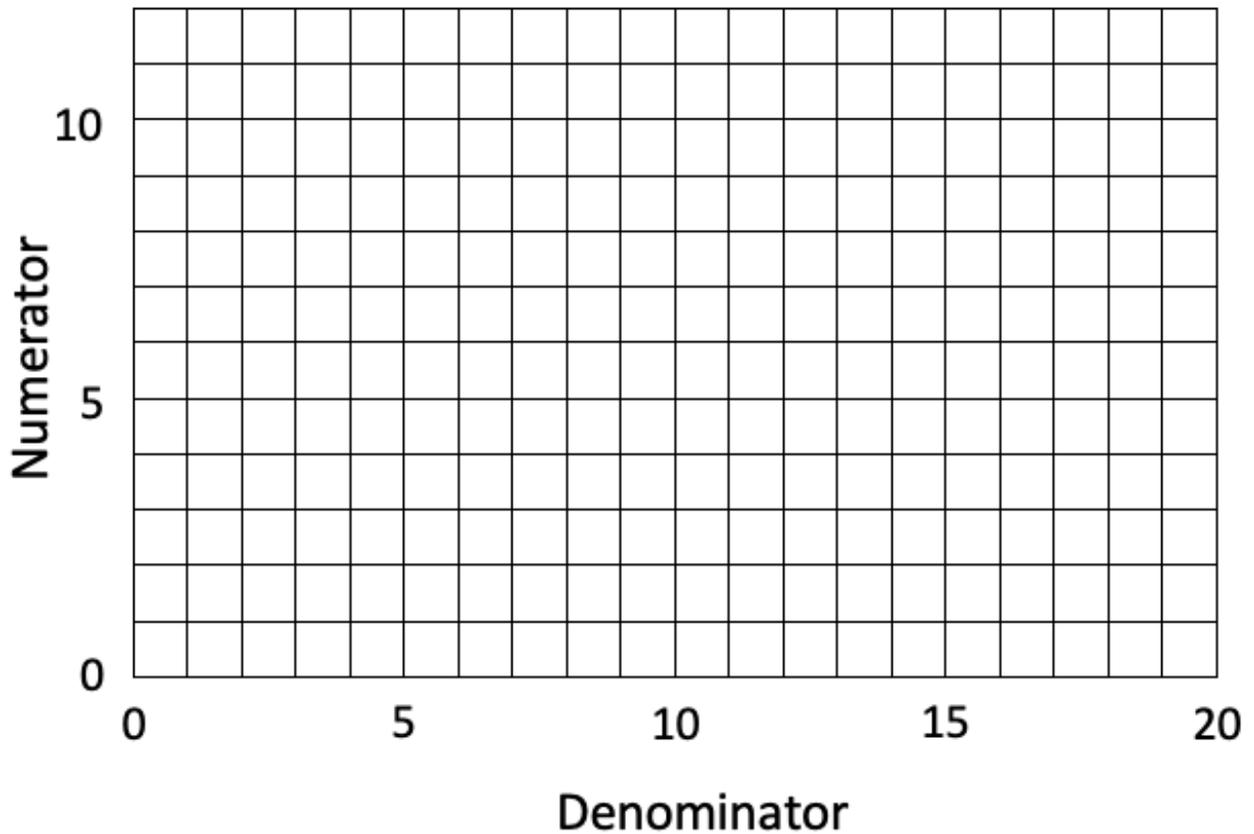
$\frac{1}{3}$ $\frac{3}{4}$ $\frac{2}{5}$ $\frac{5}{6}$ $\frac{2}{3}$ $\frac{4}{5}$ $\frac{4}{4}$ $\frac{4}{3}$ $\frac{1}{6}$ $\frac{7}{9}$ $\frac{1}{5}$ $\frac{8}{5}$

List the fractions here from least to greatest:

_____ least _____ greatest _____

Which fractions are greater than one? _____ and _____

How can you tell? _____

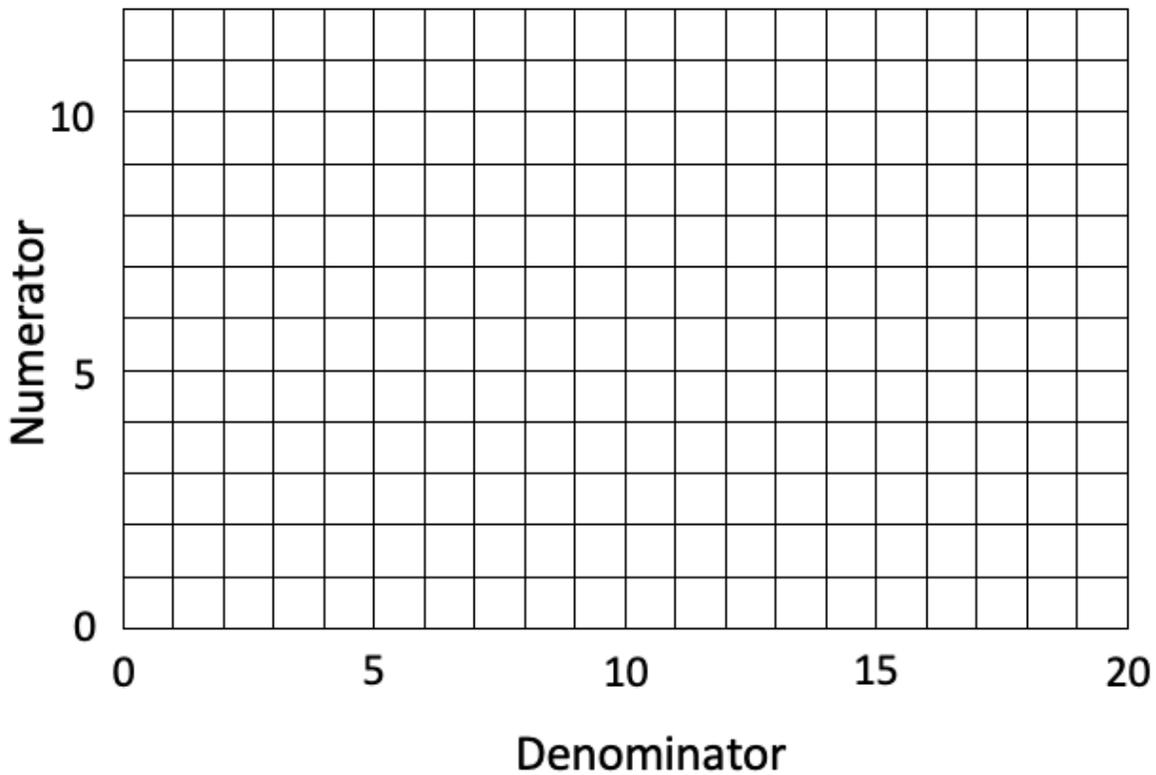


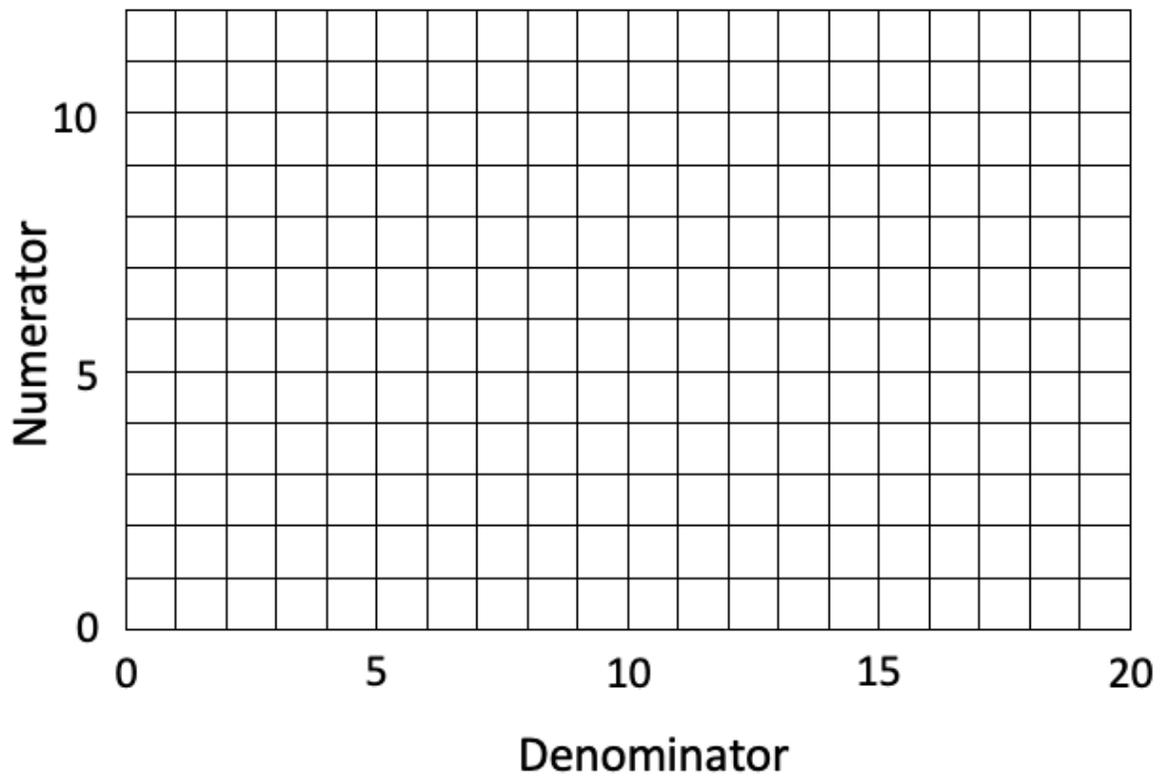
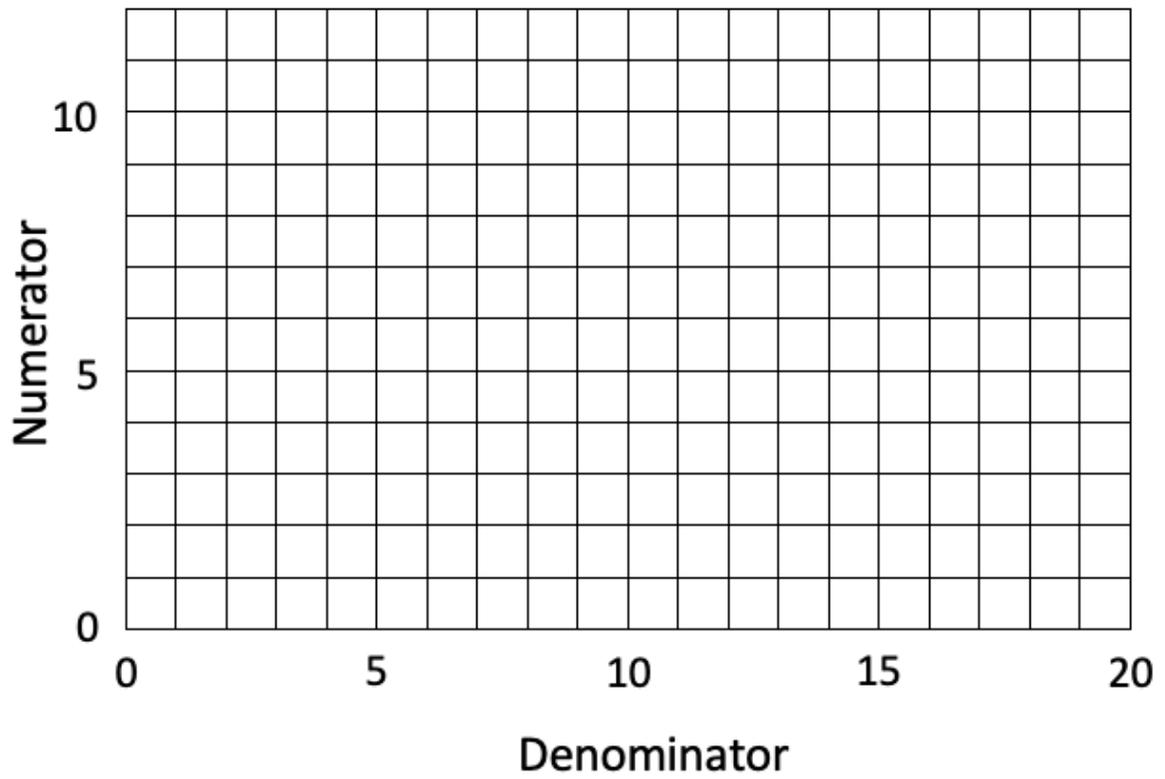
Rounding Fractions

Name _____

Plot each fraction on the Fraction Finder. Then find a simpler fraction that uses smaller numbers but is very close to the line for the original fraction. These simpler fractions will be closer to the origin in the lower left corner. Additional graphs are provided on the following page.

Fraction	Simplified	Fraction	Simplified
$\frac{8}{17}$	_____	$\frac{9}{13}$	_____
$\frac{11}{15}$	_____	$\frac{7}{19}$	_____
$\frac{19}{7}$	_____	$\frac{7}{16}$	_____
$\frac{17}{22}$	_____	$\frac{23}{8}$	_____
$\frac{11}{32}$	_____	$\frac{14}{13}$	_____
$\frac{12}{19}$	_____	$\frac{15}{7}$	_____





If you liked this activity, you might also like some of the other lessons available in my TeachersPayTeachers store. Simply search for "**Teacher to Teacher Press**".

You can also find many free and inexpensive resources on my personal website, www.tttpress.com. **Be sure to subscribe to receive monthly newsletters, blogs, and FREE activities.**

Similar activities include:

- *Number Line: Elementary version* – An engaging strategy to help students develop number sense with fractions, decimals, and percents.
- *Fast Facts and Fractions* – My most popular handout shows how I helped my struggling students master their multiplication facts and all four fraction operations in only 5 minutes a day!
- *Four in a Row* – A fun game that your students will want to play over and over as they practice with whole number, fraction, and decimal multiplication.
- *House Plan Fractions*– Foster conceptual understanding of fraction, decimal, and percent comparisons in this geometry-based model that will intrigue and engage your students.

Feel free to contact me if you have questions or comments or would like to discuss a staff development training or keynote address at your site.

Happy teaching,
Brad