

Rational Numbers, They Sure Are Dense

You already know that fractions extend to infinity in both the positive and the negative directions. You may also know that fractions are a part of the set of Rational Numbers, along with decimals, integers and whole numbers. However, did you know that between any two Rational Numbers there is another Rational Number? For this reason, Rational Numbers are said to be dense. This activity will allow you to explore the idea of density of rational numbers.

You will use the number line application to find fractions between $\frac{1}{4}$ and $\frac{2}{4}$. The number line has 2 sides, Upper and Lower. Use the Upper indicator to find the original fractions. The Lower indicator will be used to find new fractions.

Access the Number Line application by pressing APPS and pressing NUMLINE to select the NUMLINE application. Press ENTER twice to get to the NUM/FRAC LINE menu and select the Fraction Line.

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APPLICATIONS
1:Link...
2:ALG1CH1
3:AreaForm
4:GEOBOARD
5:MathHand
6:NUMLINE
7↓PUZTANKS
    
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NUM/FRAC LINE:
1: Number Line
2: Fraction Line
3: Quit
    
```

Press window and set as shown below:

Min = 0,	Max = 1	Frac
Upper Indicator		
Start 0,	Step $\frac{1}{4}$	Frac
Lower indicator		
Start 0	Step $\frac{1}{8}$	Frac

```

WINDOW
Min=0
Max=1
Dec frac
Upper Indicator
Start=0
Step=1/4
↓Dec frac % Off
    
```

```

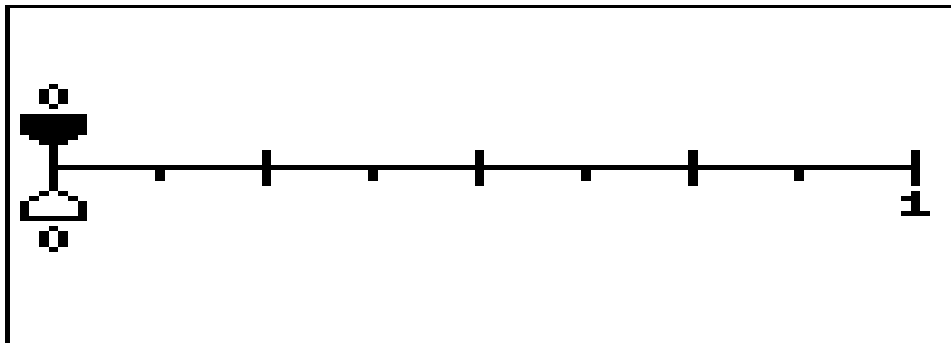
↑WINDOW
Lower Indicator
Start=0
Step= $\frac{1}{8}$ 
Dec frac % Off
    
```

Press graph to see the fraction number line you have created.

A.

1. The step for the upper Indicator is $1/4$. Why do you think $1/8$ was chosen for the Step of the Lower Indicator?

- a. Make sure the top arrow on the number line is shaded, arrow up if necessary.
- b. Press the right arrow to see the fractions on the upper number line. Is the 2nd fraction $2/4$? If not what is it and is it equivalent to $2/4$? _____
- c. How do you know?



NUMBER LINE 1

- d. Label $1/4$ and $1/2$ on the number line above (number line 1).
- e. Arrow down to highlight the Lower Indicator and locate a fraction that falls between $1/4$ and $1/2$.
- f. Label number line 1 with this fraction. Describe the location of this new fraction.

- g. Fill in the blanks with your new fraction to compare it to the original 2 fractions.

$$\frac{\quad}{\quad} > 1/4 \qquad \frac{\quad}{\quad} < 1/2$$

(1st new fraction) (1st new fraction)

- h. Using equivalent fractions show how you know your answers are correct.

- i. Show the math you use to solve this problem.
- j. List the 3 fractions in order from smallest to largest.

_____, _____, _____

Press WINDOW

You will now change the Step for the Lower Indicator

To change settings, place cursor over portion to be changed and enter new fraction. Make sure Frac continues to be highlighted.

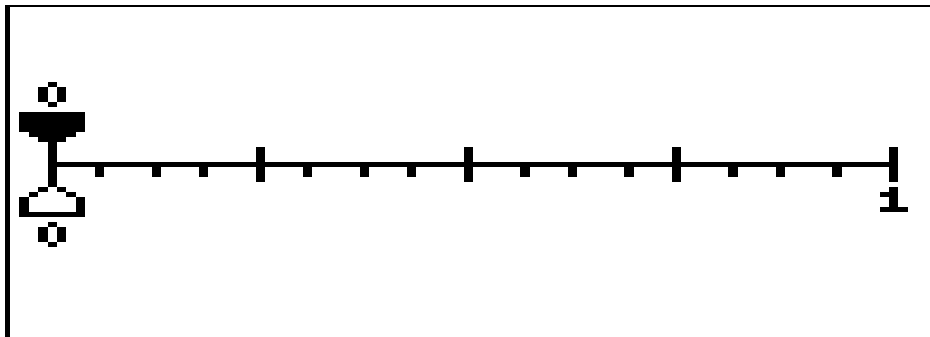
CHANGE ONLY Step in LOWER INDICATOR

Lower indicator

Step 1/16 Frac

```
↑WINDOW
Lower Indicator
Start=■
Step=1/16
Dec FRAC % Off
```

2. Why do you think 1/16 was chosen for the Step of the Lower Indicator?
 - a. 1/16 was chosen as the Step because _____
 - b. Locate and label the 3 fractions from # 1 n above on Number line 2 below.
 - c. Press graph to see number line.
 - d. The Upper Indicator should still show 1/2.



NUMBER LINE 2

- e. Using Lower indicator, find a fraction that falls between the newest fraction and 1/2 on this number line.
- f. Label number line 2 with this new fraction.
- g. Fill in blanks below with the correct fraction.

_____ > 3/8 _____ < 1/2

- h. Using equivalent fractions, show how you know your answers are correct.

- i. List the 4 fractions in order from smallest to largest.

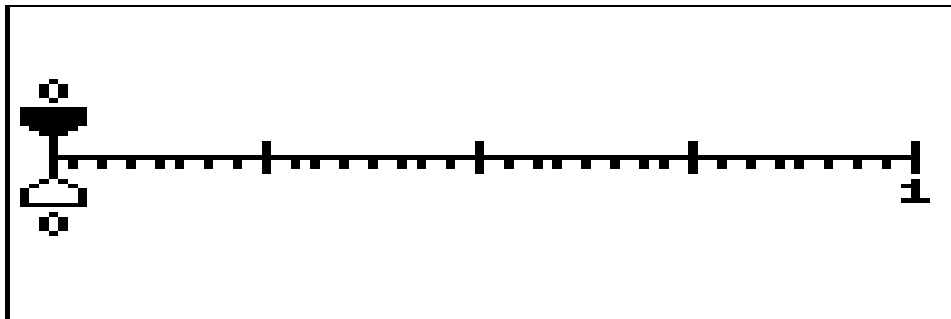
_____, _____, _____, _____

3. What pattern do you notice about the denominators for each of the fractions in the Steps for the Lower Indicators?

4. Complete the table

	Step for Upper Indicator	1/4
1 st New Fraction	Step for Lower Indicator	1/8
2 nd New Fraction	Step for Lower Indicator	
3 rd New Fraction	Step for Lower Indicator	

- a. Change the Step of the Lower Indicator on the TI 73 to show the fraction you entered in the last box of the table.
 b. Locate and label the 4 fractions from # 2i above on student worksheet Number line 3.



NUMBER LINE 3

- c. Using Lower indicator, determine what fraction falls between the newest fraction and 1/2 on this number line.
 d. Label number line 3 with this new fraction.
 e. List the three fractions you found between 1/4 and 1/2

1/4 _____ 1/2

B.

1. You will now repeat steps 1-3 to find fractions between $1/3$ and $2/3$.
 - a. Press the window key and set is as seen below.

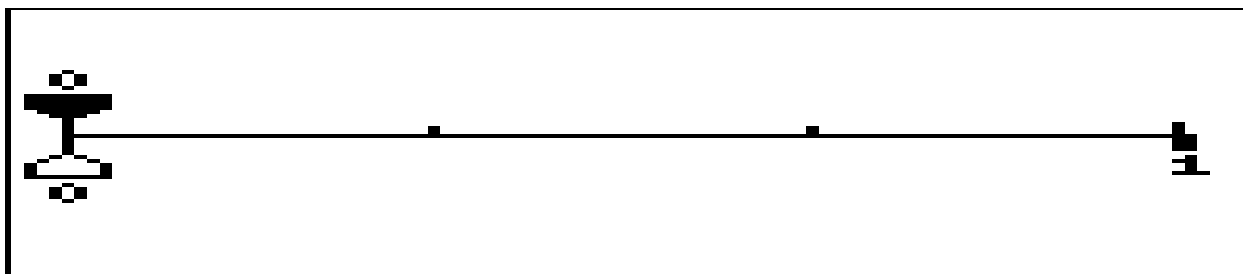
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WINDOW
Min=0
Max=1
Dec F3E2
Upper Indicator
Start=0
Step=1/3
↓Dec F3E2 % Off
  
```

- b. What could the 3 Step numbers (for the Lower Indicator) be to find three fractions between $1/3$ and $2/3$?

c. Why?

- d. Change the Lower Indicator to the first fraction you listed in 1b. above.
 - f. Draw the appropriate divisions on Number Line 4.
 - g. Press graph to see number line.
 - h. Carefully mark the divisions on Numberline 4 below to match those on the TI73 Fraction Line.
 - i. Using Upper Indicator, find $1/3$ and $2/3$ on TI 73.
 - j. Label $1/3$ and $2/3$ on Number line 4 below.



NUMBER LINE 4

- k. Using Lower indicator, find a fraction that falls between $1/3$ and $2/3$.
 - l. Label Number line 4 with this fraction.
 - m. Fill in the blanks below with the new fraction compare it to the original 2 fractions in this section.

$\frac{\text{_____}}{\text{(1st new fraction)}} > 1/3$

 $\frac{\text{_____}}{\text{(1st new fraction)}} < 2/3.$

- n. Using equivalent fractions, show how you know your answers are correct.

- o. List the 3 fractions in order from smallest to largest.

_____, _____, _____

Change the Lower Indicator Setting to the second fraction you listed in B above.

5. Press **graph** to see number line.
 a. Locate and label your 3 fractions from above on Number line 5.



NUMBER LINE 5

- b. Draw the appropriate divisions on Number Line 5.
 c. Using Lower indicator, determine what fraction falls between this new fraction and $2/3$ on this number line.
 d. Label number line 5 with this fraction.
 e. Fill blanks below with the correct fraction.

_____ $> 1/3$ _____ $< 2/3$

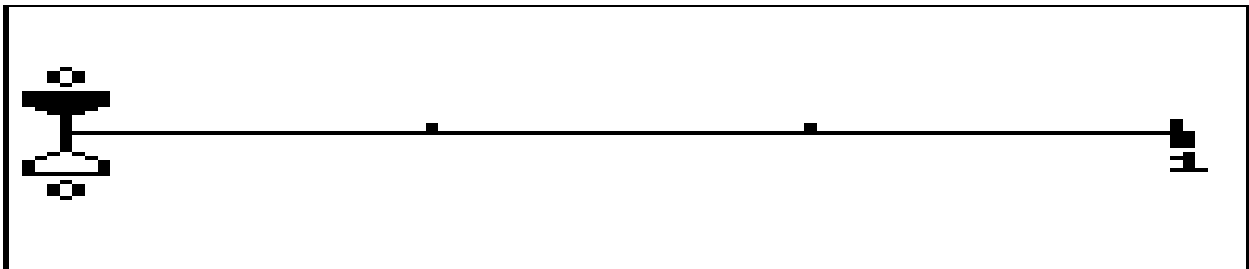
- f. Using equivalent fractions, explain how you know your answers are correct.

- g. Place the 2 fractions you have found so far between $1/3$ and $2/3$ in order from smallest to largest.

$1/3$, _____, _____, $2/3$

Change the Lower Indicator Setting to the third fraction you listed in B above.

6. Press **graph** to see number line
 a. Draw the appropriate divisions on Number Line 6.
 b. Using the TI 73, locate your 4 fractions, label them on Number line 6.



NUMBER LINE 6

- c. Using Lower indicator, determine what fraction falls between your last new fraction and $\frac{2}{3}$ on this number line.
- d. Label number line 6 with this fraction.
- e. Place the three fractions you found between $\frac{1}{3}$ and $\frac{2}{3}$ in order from smallest to largest.

$\frac{1}{3}$ _____ $\frac{2}{3}$

f. Complete the table

	Step for Upper Indicator	$\frac{1}{3}$
1 st New Fraction	Step for Lower Indicator	
2 nd New Fraction	Step for Lower Indicator	
3 rd New Fraction	Step for Lower Indicator	

- 7. Share you findings with a partner.
 - a. Do you have the same answers? _____
 - b. Why or Why Not?

- c. Is it okay if you do not have the same answers? Why or Why Not?

EXTENSIONS

How many fractions can you find between $\frac{1}{5}$ and $\frac{2}{5}$?

