

Grade 3

Number Lines

Purpose:

- To understand relationships between numbers
- To understand the relative magnitude of numbers.

Description:

Students place numbers on a number line. Students use what they know about one number to determine where a second number should be placed. As the types of numbers change and as the scale changes, students must use reasoning skills and their understanding of amounts and quantities to place the numbers.

Materials:

- A large, blank number line easily visible to all students during the routine time
- Attached blackline master of number lines

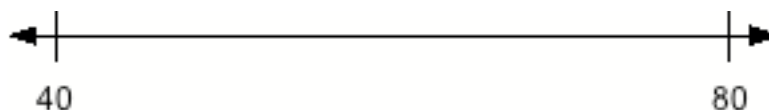
Time: 15 minutes maximum

Caution: Always include arrows on both ends of your number line representations so students realize the number line is infinite; we are only looking at a section of the number line.

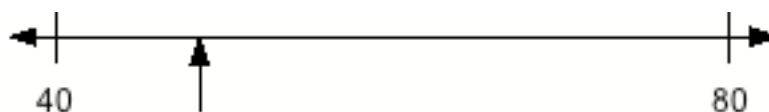
Directions:

VARIATION 1: ESTIMATION

1. Label 2 marks on the number line (e.g., 40 and 80).



2. Place an arrow somewhere between the 2 marks.



- The class suggests reasonable values for the number at the arrow.
The students should give reasons why the numbers they suggest are reasonable (e.g., "It looks like the arrow is about one fourth of the distance between 40 and 80. Since 60 is halfway between 40 and 80 and 50 is halfway between 40 and 60, I think it might be 50.").

Scaffold for Variation 1:

Give the students several numbers to choose from. Students select the number that makes the most sense to them and explain their reasoning. For example:

The arrow is pointing to which of the following numbers? Support your response with a mathematically convincing argument.

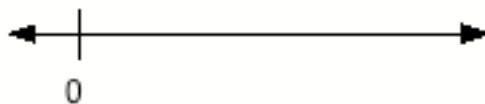
85, 49, 78

Guiding questions for Variation 1:

- Support your placement with a mathematically convincing argument.
- Name a number that is greater than this number.
- How much greater? Prove it on the number line.
- Name a number that is less than this number.
- How much less? Prove it on the number line.

VARIATION 2: ESTIMATION

- Label the mark on the left with a zero.



- Tell the students the arrow is pointing to a particular number (e.g., The arrow is pointing to 42).

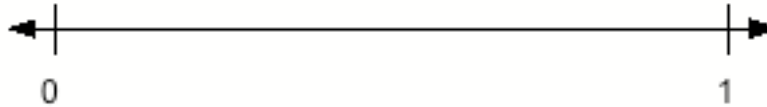


- Ask where other numbers would be. This helps students look at the relative positions of values. For example:
About where would 83 be?
About where would 21 be?
About where would 31 be?

Justify your answers with mathematically convincing arguments.

VARIATION 3: FRACTIONS

1. Label the extremes with “0” and “1.”



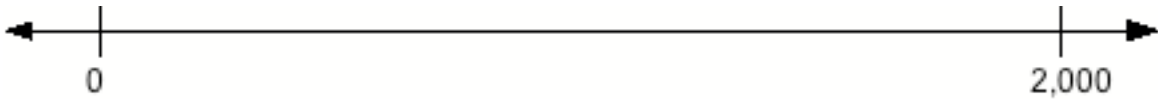
2. Write simple fractions on index cards (e.g., $\frac{1}{2}$, $\frac{1}{4}$, $\frac{1}{8}$, $\frac{1}{3}$, $\frac{2}{3}$, $\frac{3}{4}$, $\frac{7}{8}$, $\frac{8}{8}$, etc.).
3. Choose only 2 or 3 fractions to work with each time you do this routine. Make multiple copies of the same numbers. Give a card to each pair of students. Give them time to discuss where their number would make sense on the number line.
4. Have one pair of students place their card where they think their number belongs on the number line. Students must give a mathematically convincing argument as to why they are placing the number at this location.
5. Students discuss with their partners whether they agree or disagree with the placement of the card and why.
6. Class asks clarifying questions to the pair in the front of the room.
7. Students share other strategies.
8. Lead a conversation about any numbers that students believe might be misplaced. Choose a few numbers whose placement warrants further discussion (e.g., should $\frac{1}{4}$ be placed to the left or to the right of $\frac{1}{8}$? How do you know? 8 is greater than 4. Why would $\frac{1}{8}$ be to the left of $\frac{1}{4}$?)
9. Leave the numbers on the number line from one day to the next so that students can look at the fractions relative to other fractions they have worked with.

Guiding questions for Variation 4:

- Support your placement with a mathematically convincing argument.
- Name a fraction less/greater than yours. Prove it on the number line.
- How do you know your fraction is less/greater than one half?

VARIATION 4: LARGE NUMBERS

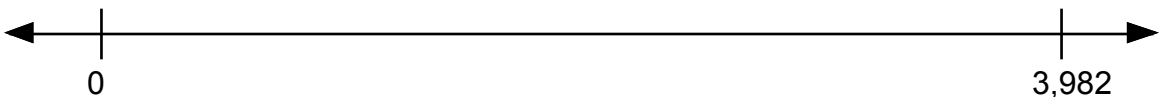
1. Label the extreme to the left with a zero. Label the extreme to the right with 1,000 or 2,000 or 3,000, etc. (a number in the thousands).



2. Write three or four-digit numbers on index cards.
4. Choose only 2 or 3 numbers to work with each time you do this routine. Make multiple copies of the same numbers. Give a card to each pair of students. Give students time to discuss where their number would make sense on the number line.
5. Have one pair of students place their card where they think their number belongs on the number line.
6. Students discuss with their partners whether they agree or disagree with the placement of the card and why.
7. Class asks clarifying questions to the pair in the front of the room.
8. Students share other strategies.
9. Lead a conversation about any numbers that students believe might be misplaced. Choose a few numbers whose placement warrants further discussion (e.g., should 1,001 be placed to the left or to the right of 999? How do you know?)
10. Leave the numbers on the number line from one day to the next so that students can look at the amounts relative to other numbers they have worked with.

Extensions for Variation 4:

- Write zero on the mark to the left. Vary the thousand you write on the mark to the right. Have the class decide on a reasonable value for the mark in the middle.



Change zero to a different value. This increases the rigor of labeling the unknown marks.



- Occasionally give students numbers that **don't** belong between the labeled marks (e.g., if you have labeled the outside marks "0" and "2,750," give students the number 3,000
- to place. This reminds students that they are working with only **part** of the number line.

Guiding questions for Variation 7:

- Support your placement with a mathematically convincing argument.
- Name a number that is greater/less than this number.
- How much greater/less? Prove it on the number line.
- What number is a hundred more/less than your number?
- What number is a thousand more/less than your number?
- What number is ten thousand more/less than your number?

