# THE NUMBER LINE

How much of the number line actually has anything to do with numbers?

TOPICS COVERED: Development of the number line. Rational and irrational numbers and the hierarchy of numbers. Repeating decimals. Attempts to define the reals.

A. GETTING STARTED

In these explorations we've used the counting numbers to count dots, to count piles and to count unit squares of area. Let's now count steps along a straight path with the starting position labeled "0." And to be specific, let's count steps to the right.
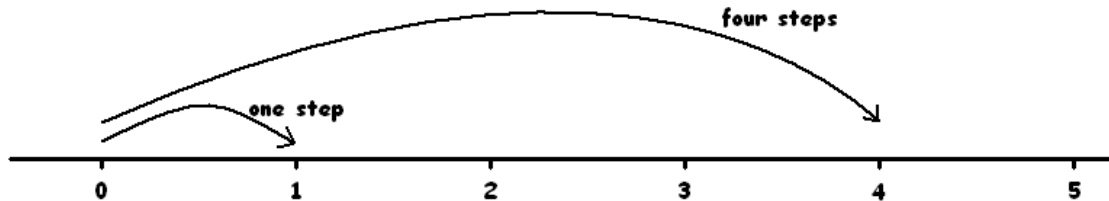
Question 1: If this were your first encounter with the counting numbers, could you "discover" addition with this model? What might $3+5$, for example, mean?

Question 2:
  a) We've drawn a picture of a horizontal line. Need the line be horizontal? Could we draw a vertical line? A diagonal line? Must the steps be going to the right?
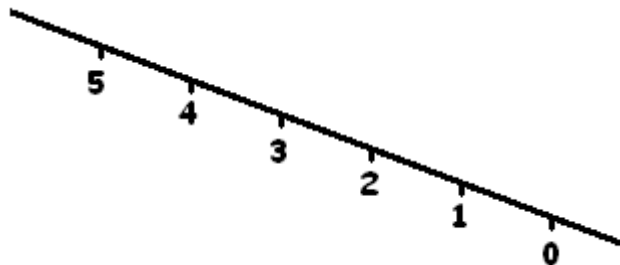
  b) Must the steps on the line be evenly spaced? Is a better question: <u>Should</u> the steps be evenly spaced? What do you think?

It has been become the convention – though not at all necessary for the mathematics – to draw a horizontal line of steps with the (positive) counting numbers heading off to the right. Such a line is called a <u>number line</u>.

At present we have a visual representation of the set of <u>counting numbers</u>:

$$\{0, 1, 2, 3, 4, \ldots\}$$

Question 3: Did we ever decide whether or not zero should be considered a counting number?

But the counting numbers are only part of a larger set of numbers, the <u>integers</u>:

$$\{\ldots, -4, -3, -2, -1, 0, 1, 2, 3, 4, \ldots\}$$

It would be good to include the negative integers on the number line. For these we need "anti-steps" to steps to the right. Might these be steps to the left?

Question 4: In previous explorations we've note that a pile and a hole cancel one another and that a dot and an anti-dot cancel one another (just as $1 + (-1)$ should equal zero.)

Does it seem appropriate to say that a step to the left cancels a step to the right?

Our number line now appears:
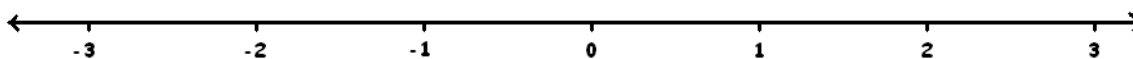
Question 5: How would you use the model of steps to the left and to the right on a number line to explain to a young student why $3 - 4 + 2 + 1 - 5$ is -3?

Next question: Are there numbers between the integers on this number line?

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