5.NF Standing in Line

Alignments to Content Standards

- Alignment: 6.NS.A.1
- Alignment: 5.NF.B.7.c

Tags

• This task is not yet tagged.

Alysha really wants to ride her favorite ride at the amusement park one more time before her parents pick her up at 2:30 pm. There is a very long line at this ride, which Alysha joins at 1:50 pm (point A in the diagram below). Alysha is nervously checking the time as she is moving forward in the line. By 2:03 she has made it to point B in line.

What is your best estimate for how long it will take Alysha to reach the front of the line? If the ride lasts 3 minutes, can she ride one more time before her parents arrive?

front of line

Commentary

The purpose of this task is for students to solve a problem in context that can be solved in different ways, but in particular by dividing a whole number by a unit fraction. To see this as a division problem, we can think about it this way:

If it takes 13 minutes to move $\frac{1}{5}$ of the distance, how long does it take to move the entire distance?

Or more abstractly,

$$13 = \frac{1}{5} \times d$$

However, it is also quite natural to solve the problem by computing 5×13 if we see that there are five equal pieces of the line and each one will take about 13 minutes. Because the task can naturally be solved by multiplication, it can be used to introduce fraction division. It could also be used to see that dividing by a unit fraction is the same as multiplying by its reciprocal. It would also be appropriate as a transition from dividing by a unit fraction (5.NF.B.7) to dividing by any fraction (6.NS.A.1).

This task is a good illustration of MP4, Model with mathematics. This means that it is not just a real world problem, but we also have to make simplifying assumptions to solve the problem. In this case we are

assuming that the line moves in a uniform way, i.e., it takes equal amounts of time to move equal distances.

An extension of the task would be to give non-equally spaced times at different points along the line. Then the students also have to decide if they want to average the numbers, if they want to find a worst case scenario estimate or an optimistic estimate, and come up with a likely range of times it will take to go through the line.

The setup for this problem works in any situation where you are standing in line with a deadline. The context can certainly be changed to create a situation familiar to the students in a teacher's class, from standing in a really slow moving lunch line to standing in line for popular movie tickets or at a sporting event.

With the numbers given in the problem, the conclusion is pretty clearly that there is not enough time for another ride. It would be easy to change the numbers to make the answer less clear. This would provide an opportunity to also include an estimate of the time it takes to go on the ride and to account for the time it takes to meet up with the parents if they aren't meeting t the ride. This set-up would provide a forum for a lively classroom discussion where students have to justify their claims with appropriate assumptions and computations


Solutions

Solution: Dividing

From the diagram we see that it took Alysha 13 minutes to move $\frac{1}{5}$ of the the entire line. If the line continues to move in a similar way, it will take her 5 times as long to move through the entire line. Therefore, we can estimate that it will be a total of

$$5 \times 13 \text{ minutes} = 65 \text{ minutes}$$

to get to the head of the line. Since Alysha is supposed to meet her parents 40 minutes after joining the line, she won't be able to ride one more time.

Solution: Multiplying

From the symmetry of the line we can divide the line into parts we can compare.
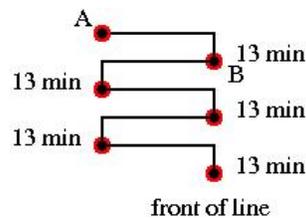
From point A to point B it takes 13 minutes. We can divide the line into 5 parts that have the same distance as from A to B. If we assume that the line moves in a more or less uniform way, it will take approximately

$$5 \times 13 \text{ minutes} = 65 \text{ minutes}$$

to get to the front of the line. Since Alysha is supposed to meet her parents 40 minutes after getting into the line she won't have time to go down the slide one more time.