Guide for Probe: Locating Fractions on the Number Line

I. Correct Answers

    1. B   2. B   3. D

II. Successful Approaches

Here are examples of two successful approaches that students may use.
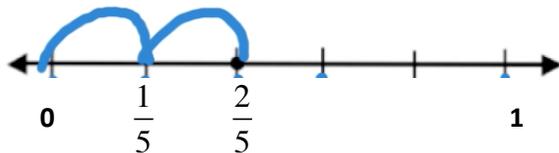
1. Using a Counting Strategy

    A.   Identify the whole unit. It is the distance from 0 to 1 on this number line.

    B.   Check that the whole has been equally partitioned and count the intervals:

    There are 5 equal intervals, so each interval is $\dfrac{1}{5}$.

    C.   Count intervals from 0 to name the point $\dfrac{2}{5}$

2. Using a Benchmark Strategy

Students may use a common benchmark or landmark fractions such as ½, 0 or 1 (or the decimal or percent equivalents) to help locate or identify a point on a number line. The example below shows the correct use of a benchmark strategy:

The student has identified **C** as the benchmark fraction of $\frac{1}{2}$ and used this information to correctly select point **B** as the match to the fraction $\frac{3}{8}$ because "$\frac{3}{8}$ is less than $\frac{1}{2}$ but not by much."

III. Common Student Difficulties and Misconceptions

Students sometimes have difficulty in naming and locating fractions on the number line. Their difficulties may stem from lack of conceptual understanding of fractions and/or difficulty interpreting the number line representation. Here are two common student difficulties that have been identified in the research.

1. Incorrect Use of a Counting Strategy

- **Counting On**: Students with this misconception often apply whole number reasoning by simply using the value of the numerator to count on from the starting point without considering which fractions the hash marks represent or the size of the intervals between them. Student may or may not count the points, instead focusing only on the hash marks.
  a. Counting On: Points and Hash Marks

  b. Counting On: Only Hash Marks

- **Other Incorrect Counting:** Student may also apply other incorrect counting strategies resulting in a different answer pattern.
  - Counting All: include the starting hash mark in their count
  - Counting Back: start with 1 and count backwards

2. Incorrect Use of Benchmarking

Students may apply a variety of incorrect reasoning approaches including:

Incorrectly positioning the fraction in relation to a benchmark, such as $0, \frac{1}{2}$ or 1

For example, a student correctly locates the benchmark ½ and writes that $\frac{3}{8}$ is close to $\frac{1}{2}$. However, he incorrectly chooses a point that is *too close* to $\frac{1}{2}$.

Incorrectly locating a benchmark which leads to incorrect positioning of the fraction

For example, a student correctly writes that $\frac{3}{8}$ is close to the benchmark $\frac{1}{2}$. However, she makes an incorrect assumption that $\frac{1}{2}$ is the middle of a 0–2 number line. This error leads to the student placing $\frac{3}{8}$ in the incorrect position.

Determining the size of a fraction incorrectly based on a benchmark

For example, a student knows that $\frac{3}{8}$ is close to the benchmark $\frac{1}{2}$ but incorrectly thinks that $\frac{3}{8}$ is larger than $\frac{1}{2}$.