# Graphing a Flag Hoist
## Explore the Mathematics

This task provides an opportunity to explore the concept of slope qualitatively — to consider various features of slope without calculating a numerical value. Because no scales are provided on the axes, it is not possible to calculate the slope at a given point. Instead, this task involves thinking about visual features of slope, for example, where a slope appears steeper or less steep, and relating these features to the context of a flag being hoisted.

This task also invites different interpretations of the act of hoisting a flag and different interpretations of how to represent this act graphically. In general, these interpretations are based on the idea that the steeper the graph, the more quickly the flag is being hoisted. With this in mind, we can interpret Graphs (a) – (f) in the following ways:

Graph (a) has a constant slope, meaning that the flag is raised at a constant speed. This graph illustrates a situation in which the boy scout maintains a consistent hoisting rate for the entire time it takes to raise the flag.

Graph (b) starts out rather steeply, but gradually becomes less steep. In this case, the flag is raised quickly at the beginning, and then gradually more slowly. Perhaps, for example, the boy scout works quickly at the beginning, then becomes tired and slows down.

Graph (c) shows an alternating pattern, the slope is steep, then flat, steep, then flat, etc. This suggests that there are short bursts of raising the flag quickly, then pausing, raising quickly again, etc. Perhaps the boy scout uses a hand-over-hand technique to raise the flag, with a brief pause as he switches hands.

Graph (d) is, in a sense, the opposite of Graph (b); the steepness of the slope increases over time as if the flag is raised slowly at first and then more quickly.

In Graph (e), the slope gradually gets steeper, is constant for a bit of some time, and then becomes less steep again at the end. Perhaps it is difficult for the boy scout to raise the flag initially, and then at the end he tires and slows down.

Graph (f) appears to be a vertical line. In comparison to the other graphs Graph (f) does not seem to realistically represent a flag being hoisted under any circumstances. If the boy scout were able to raise the flag quickly, we could imagine a linear graph that was steeper than Graph (a), perhaps much steeper. Still, the graph would not be a vertical line.

*Connecting to Algebra*
This activity allows students to make connections between graphs and physical situations. Students have the opportunity to compare situations represented by linear graphs with situations represented by curves. Students also have the opportunity to interpret steeper and flatter portions of curved graphs in terms of the corresponding physical situation (a flag being hoisted more quickly or more slowly). Because the graphs do not have scales, student may be prompted to view them as holistic objects (Sfard, 1991) rather than as piecewise entities constructed of individual points.

 

Sfard, A.(1991). On the dual nature of mathematical conceptions: reflections on processes and objects as different sides of the same coin. *Educational Studies in Mathematics*, *22*, 1-36

*Connecting to the Common Core Standards*

8.F.5. Describe qualitatively the functional relationship between two quantities by analyzing a graph.

F-IF.4. For a function that models a relationship between two quantities, interpret key features of graphs and tables in terms of the quantities.

S.4. Model with mathematics.