**Goal:** Teaching for coherence by looking backwards: What standards from previous grades describe the prior knowledge my students may have or may have been exposed to that my current target builds on?

**New learning standards (on Pp):**

**Functions:** Interpreting functions: *Interpret functions that arise in applications in terms of the context*.

HS. F.IF.6: Calculate and interpret the average rate of change of a function (presented symbolically or as a table) over a specified interval. Estimate the rate of change from a graph.\*

**Functions**: Linear, Quadratic, and Exponential Models\*: *Construct and compare linear, quadratic, and exponential models and solve problems*

HS.F.LE.1: Distinguish between situations that can be modeled with linear functions and with exponential functions.

1. Prove that linear functions grow by equal differences over equal intervals, and that exponential functions grow by equal factors over equal intervals.
2. Recognize situations in which one quantity changes at a constant rate per unit interval relative to another.

Recognize situations in which a quantity grows or decays by a constant rate per unit interval relative to another.

**Directions:**

Each of the following statements (print on yellow paper –first table below) is a cluster statement from the CCSS in a progression leading to understanding rates of change (from 6th through 8th grade standards). Put these in the middle of the table where everyone can read them, and without looking at the CCSS document, decide which cluster statement belongs to which grade. Order them from 6th through 8th grade.

Distribute the nine standards (print on blue paper, second table below) as evenly distributed as possible, and so that each person in the group has at least one. Choose one person to start. The starting person reads his or her standard aloud and decides which cluster statement the target most likely belongs to, providing rationale. Moving to the left, each other person in the group agrees or disagrees and explains why s/he agrees or disagrees. After all others have contributed, the person reading the standard can change his or her decision. Move to the left around the group with each person reading a standard, determining which cluster they think it belongs to, having each other person in the group agree or disagree and explain why, until all standards are placed with the appropriate cluster statements. As a group, revise the order and grade levels of your clusters if needed.

**Debrief:**

Focus on the changes in **mathematical ideas** at each level, *and* how **learners’** understanding of the concept will change as they progress through the standards.

**Math**:

How do the mathematical ideas differ and build at each grade level?

What other mathematical ideas must be developed and how are they connected to the F-IF standard?

How are the mathematical ideas related to the F-LE standards (linear, exponential, and quadratic functions)?

How are the F-LE standards related to the F-IF standard? (The F-LE standard specifically targets the Growing Rectangles problem, but one focus is comparing three functions (areas), one with a constant rate of change and two with changing rates of change.)

**Learners**:

How do students’ understandings change from one year to the next?

What formative assessment could you use to see where students are along this progression?

If your FA reveals that some students are not ready for this standard, what, specifically, will you do? If your FA reveals that some students have a good understanding of all these standards, what, specifically, will you do?

What experiences might help them build understanding of the F-IF standard from current understandings to where they need to be?

Cluster statements:

|  |  |
| --- | --- |
| ***Understand ratio concepts and use ratio reasoning to solve problems*.** | ***Define, evaluate, and compare functions*.** |
| ***Use functions to model relationships between quantities.*** | ***Understand the connections between proportional relationships, lines, and linear equations.*** |
| ***Analyze proportional relationships and use them to solve real-world and mathematical problems.*** |  |

Standards

|  |  |
| --- | --- |
| Compute unit rates associated with ratios of fractions, including ratios of lengths, areas and other quantities measured in like or different units. For example, if a person walks 1/2 mile in each 1/4 hour, compute the unit rate as the complex fraction 1/2/1/4 miles per hour, equivalently 2 miles per hour. | Use similar triangles to explain why the slope m is the same between any two distinct points on a non-vertical line in the coordinate plane; derive the equation y = mx for a line through the origin and the equation y = mx + b for a line intercepting the vertical axis at b. |
| Understand the concept of a ratio and use ratio language to describe a ratio relationship between two quantities. For example, “The ratio of wings to beaks in the bird house at the zoo was 2:1, because for every 2 wings there was 1 beak.” “For every vote candidate A received, candidate C received nearly three votes.” | Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions). For example, given a linear function represented by a table of values and a linear function represented by an algebraic expression, determine which function has the greater rate of change. |
| Understand the concept of a unit rate a/b associated with a ratio a:b with b ≠ 0, and use rate language in the context of a ratio relationship. For example, “This recipe has a ratio of 3 cups of flour to 4 cups of sugar, so there is 3/4 cup of flour for each cup of sugar.” “We paid $75 for 15 hamburgers, which is a rate of $5 per hamburger.” | Use ratio and rate reasoning to solve real-world and mathematical problems, e.g., by reasoning about tables of equivalent ratios, tape diagrams, double number line diagrams, or equations. |
| Graph proportional relationships, interpreting the unit rate as the slope of the graph. Compare two different proportional relationships represented in different ways. For example, compare a distance-time graph to a distance-time equation to determine which of two moving objects has greater speed. | Recognize and represent proportional relationships between quantities. Decide whether two quantities are in a proportional relationship, e.g., by testing for equivalent ratios in a table or graphing on a coordinate plane and observing whether the graph is a straight line through the origin. |
| Identify the constant of proportionality (unit rate) in tables, graphs, equations, diagrams, and verbal descriptions of proportional relationships. | Represent proportional relationships by equations. For example, if total cost t is proportional to the number n of items purchased at a constant price p, the relationship between the total cost and the number of items can be expressed as t=pn. |
| Explain what a point (x, y) on the graph of a proportional relationship means in terms of the situation, with special attention to the points (0, 0) and (1, r) where r is the unit rate. |  |