6.RP Riding at a Constant Speed, Assessment Variation

Alignments to Content Standards: 6.RP.A.2 6.RP.A.3

Task

Lin rode a bike 20 miles in 150 minutes. If she rode at a constant speed,

a. How far did she ride in 15 minutes?

b. How long did it take her to ride 6 miles?

c. How fast did she ride in miles per hour?

d. What was her pace in minutes per mile?

IM Commentary

This task is part of a joint project between Student Achievement Partners and Illustrative Mathematics to develop prototype machine-scorable assessment items that test a range of mathematical knowledge and skills described in the CCSSM and begin to signal the focus and coherence of the standards.

Task Purpose

This task is part of a set of three assessment tasks that address various aspects of 6.RP domain and help distinguish between 6th and 7th grade expectations. While simply constructed, 6.RP The Escalator addresses aspects of both 6.RP.1 "Understand the concept of a ratio" and 6.RP.2 "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." The simple extension of a traditional multiple choice item to a "choose all that apply" allows us to ask questions about the same context from the different perspectives afforded by the different RP standards in 6th grade. 6.RP Riding at a Constant Speed addresses aspects of 6.RP.2 "Understand the concept of a unit rate a/b associated with a ratio a:b" and 6.RP.3 "Use ratio and rate reasoning to solve real-world and mathematical problems." The numbers are chosen so that it would be easy to implement this task as a fill-in-the-blank item. On the other hand, 7.RP Molly's Run is meant to contrast directly with "6.RP Riding at a Constant Speed" as it is the natural extension of the work that students do related to 6.RP.2. In sixth grade, the standards are clear that ratios need to have whole numbers for a and b. With the introduction of rational number arithmetic in 7.NS, the standards place an emphasis on ratios that have fractions within a given ratio; 7.RP.1 requires students to "compute unit rates associated with ratios of fractions."

Cognitive Complexity

Mathematical Content

The mathematics in "6.RP The Escalator" is more complex than it appears. The distractors are placed in a particular order. Students might choose (c) after (correctly) choosing (a) because they look similar. The three correct answers are purposefully interrupted by an incorrect choice, and (e) is included for students who subtract rather than divide. "6.RP Riding at a Constant Speed" requires students to attend to both ratios (20:150) and (150:20) and both associated unit rates $\frac{20}{150}$ and $\frac{150}{20}$ that are implicit in the given context. Thus, this task is complex for 6th grade. "7.RP Molly's Run" is a straight-forward extension of the work that students do in 6th grade. The only difference is that students now work with ratios defined by fractions rather than just whole numbers. Thus, this task is not mathematically complex except for students who are still struggling with fractions.

Linguistic Demand

The linguistic demand for all three tasks is low.

Stimulus Material

The stimulus material for all three tasks is not complex.

Response Mode

The response mode for all three tasks is not complex.

The Standards for Mathematical Practice focus on the nature of the learning

experiences by attending to the thinking processes and habits of mind that students need to develop in order to attain a deep and flexible understanding of mathematics. Certain tasks lend themselves to the demonstration of specific practices by students. The practices that are observable during exploration of a task depend on how instruction unfolds in the classroom. While it is possible that tasks may be connected to several practices, the commentary will spotlight one practice connection in depth. Possible secondary practice connections may be discussed but not in the same degree of detail.

The first two tasks in this set engage students in MP.6, Attend to precision. Students must understand and derive a unit rate associated with a ratio. This understanding requires reasoning about ratios and rates and the ability to calculate a unit rate with precision. This further supports students' ability to communicate succinctly to others including the use of clear definitions in discussions.

One element of precision that needs to be attended to in the task includes keeping track of units and identifying which unit rate has been calculated (was that miles per minute or minutes per mile). Students must also attend to precision as they move between units, changing from minutes to hours or back.

Solutions

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Solution: 1

	A	B	C	D	E	F
Number of Minutes	150	15	7.5	30	45	60
Number of Miles	20	2	1	4	6	8

The values in column B were found by dividing both values in column A by 10. The values in column C were found by dividing both values in column B by 2. The other columns contain multiples of the values in column B.

a. If we look in column B, we can see that she could ride 2 miles in 15 minutes.

b. If we look in column E, we can see that it would take her 45 minutes to ride 6 miles.

c. If we look in column F, we can see that she is riding 8 miles every 60 minutes (which is 1 hour), so she is riding her bike at a rate of 8 miles per hour.

d. If we look in column C, we can see that her pace is 7.5 minutes per mile.

This is a four-point item.

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Solution: 2

a. She could ride 1 mile in 7.5 minutes and 2 miles (1 + 1) in 15 minutes (7.5 + 7.5).

b. She rides 150/20 minutes per mile which is 7.5 minutes per mile. So it would take her 45 minutes to ride 6 miles because $6 \times 7.5 = 45$.

c. If she rides 2 miles in 15 minutes, then she can ride 4 miles in 30 minutes and 8 miles per hour.

d. She rides 7.5 minutes per mile.