

High School / Case Study 2

➔ MATH * SMARTER BALANCED PERFORMANCE TASK

ENGLISH LEARNER

Item 1

Candles A and B are lit at the same time. What will be the height, in cm, of each candle after 3 hours of burning?

Student
Response
to Item 1

Candle Type A:

8

Candle Type B:

7

Analysis of
Response
to Item 1

This response receives a full score of 1 point. The student correctly determined the height of both candles after three hours of burning.

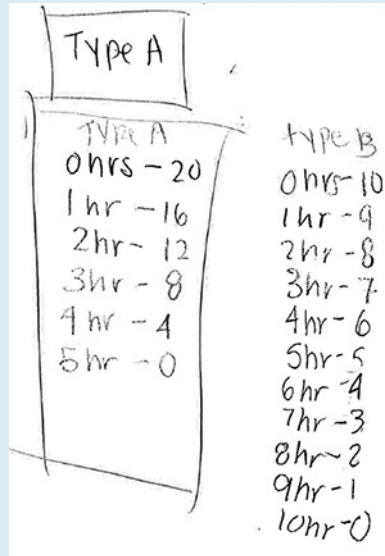
Item 2

Candles of each type were lit at the same time. Abbie thinks that since Candle Type A burns more quickly than Candle Type B, that it will burn out (have a height of 0 cm) first.

Julie thinks that since Candle Type B starts out much shorter than Candle Type A, it will be the candle to burn out first.

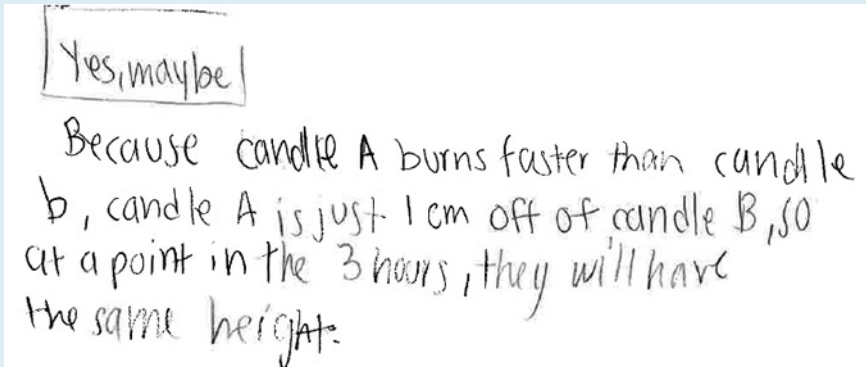
Which candle will burn out first? Give a mathematical explanation to convince Abbie and Julie of your solution. Clearly identify the quantities involved.

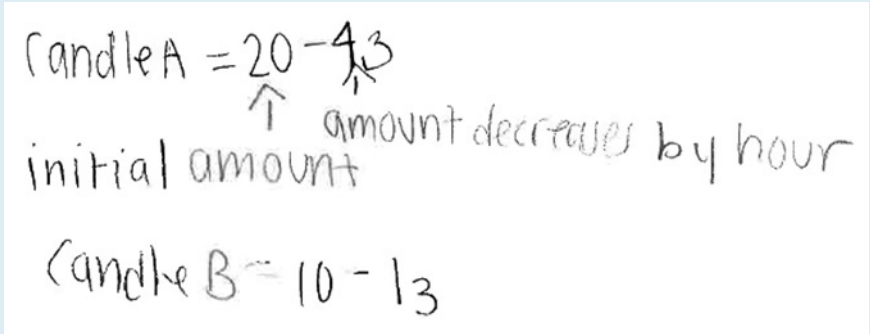
Student Response to Item 2



Analysis of Response to Item 2

This response receives a partial score of 1 point. In the response, the student represented the relationship between the values for the two quantities involved in the situation. The student labeled the values for time, but did not clearly identify the height, which is a requirement to earn full credit.

<p>Item 3</p>	<p>Abbie has 3 hours left to film. She lights a new Candle Type A and Candle Type B and then starts filming.</p> <p>In the 3 hours she has left, will Abbie capture the moment when the candles are exactly the same height?</p> <p>Explain to Abbie how you can determine the answer.</p>
<p>Student Response to Item 3</p>	
<p>Analysis of Response to Item 3</p>	<p>Although the student provided a written response and justified his/her reasoning, the student did not provide mathematically valid evidence to justify his/her claim that the candles will be the same height within the three-hour period of filming. This response receives a score of 0 points.</p>

<p>Item 4</p>	<p>You have decided to use functions to help Abbie think about the candles.</p> <p>You show her how to represent the height of a candle, h, as a function of time, t, using this equation:</p> $h = k + nt$ <p>First, explain to Abbie what k and n represent in order to model the different candles. Be specific in your explanation.</p>
<p>Student Response to Item 4</p>	 <p>Candle A = 20 - 4t ↑ initial amount ↑ amount decreases by hour</p> <p>Candle B = 10 - 1t</p>
<p>Analysis of Response to Item 4</p>	<p>This response receives a full score of 2 points. The student used the structure from item 2 to show what each variable represents.</p>

Item 5

Now, choose either Candle A or Candle B to create an equation that will tell Abbie the height of the candle at t hours after it is lit.

Determine what the numerical values for k and n should be for the candle you chose.

Using these k and n values, write an equation that tells Abbie the height h of the candle, in cm, at t hours after it is lit.

Student Response to Item 5

$$20 = 8 + 43$$

Analysis of Response to Item 5

This response receives a score of 0 points. The equation is inconsistent with an equation expressing the height, h , in centimeters, of either candle in terms of time, t , in hours.

Item 6

For her next film, Abbie wants candles that will burn for exactly 8 hours. You want to give her a choice by designing two different candles (Type C and Type D).

Using the equation $h = k + nt$, determine two different pairs of values for k and n that will meet the requirement to burn down to a height of 0 cm in exactly 8 hours.

Complete the table to show two possible sets of values for k and n for your new candle designs.

	k	n
Candle Type C		
Candle Type D		

Student Response to Item 6

	k	n
Candle Type C	5	4
Candle Type D	2	6

Analysis of Response to Item 6

This response receives a score of 0 points. It appears that the student may have guessed the values of k and n for Candle C and Candle D.

Overview of Student's Performance

This student, an emerging bilingual student, has a partial understanding of the mathematical content and practices that are assessed in this task. The student's work in item #2 shows a productive approach to making sense of the quantities involved in the task. Although s/he created a two-column representation of time, t , and height, h , of each candle, the student did not label the height, in centimeters, in the table of values. However, the student used the structure of his/her answer in item #2 to identify what each of the variables in the equation $h = k + nt$ represents. The student would benefit from instruction on accessing previous answers to make sense of later items, which is a skill that can be nurtured. There is evidence that the student tried to decode the text by relating it to previous displays of information. However, in items 5 and 6, the student did not apply this structure when writing an equation relating h to t , or in finding new values of k and n to describe Candle C and Candle D.

For item 3, the student's response did not indicate whether or not Candle A and Candle B will be the same height within the three-hour time frame. The student had an idea for how to proceed with the task, stating that Candle A burns faster than Candle B, and had the idea that at some point they will be the same height. However, the student did not provide a valid mathematical reason to justify his/her claim. The student would benefit from instruction on building on ideas to express mathematical reasoning.

Next Steps

This student would benefit from opportunities that provide multiple means of engagement (UDL Principle 1) and opportunities to provide multiple means of representation (UDL Principle 2). In addition, opportunities to engage in Standards for Mathematical Practice (MP) 1, 2, 4, 6, and 8 will support his/her use of the abilities and concepts assessed in this task. The student's approaches to item 1 and item 2 indicate that s/he has an emerging understanding of what s/he is asked to do. With this, s/he would benefit from some instructional strategies that serve to deepen his/her understanding, such as being provided with sets of questions that help him/her make sense of the problem (MP 1) and that s/he can use as a guide for how to proceed to label quantities and check the reasonableness of answers (MP 2). The student would also benefit from purposeful feedback that allows him/her to modify or revise work to include a meaningful approach or steps to correct an answer. In addition, the student would benefit from I suggest optimizing his/her experience with real-world applications of mathematics (UDL Principle 1, MP 4), developing his/her own experience of self-regulation, and sustaining his/her effort and interest in doing mathematics.

To support the student's access to the language of mathematics, vocabulary development tools such as interactive word walls, concept maps, math webs, and sentence frames and starters would facilitate comprehension and strengthen the writing of explanations to justify his/her thinking (MP 6). A claim-evidence-reasoning (C-E-R) graphic organizer would provide structure for how to construct a valid explanation that supports a claim. The use of evidence is emphasized in this strategy, which would serve well as a guide to enhance the student's mathematics writing.

To facilitate the development of MP 8 (look for and make use of structure), the student can be supported with strategies such as layering, use of multiple representations, and extending procedures and emphasizing structures. Layering can be done with a simple task in which a variable or an expression is added to increase the complexity of the task. The layer may or may not use the same procedure as the original task, but could assess the same skill(s) or concept(s). The student could then experience an entry point to a problem that pushes him/her to gain understanding by applying the same skill(s) to respond to the next layer(s). Use of multiple representations will deepen the student's conceptual understanding of a concept. The use of symbolic, graphical, and numerical representations will help expand his/her previous understandings by allowing the student to link visual images to symbolic representations. Efforts should also be invested in classroom instruction to create a solid base for the student to develop structural conceptions of algebra.