

Focus  
Standards  
and Claim

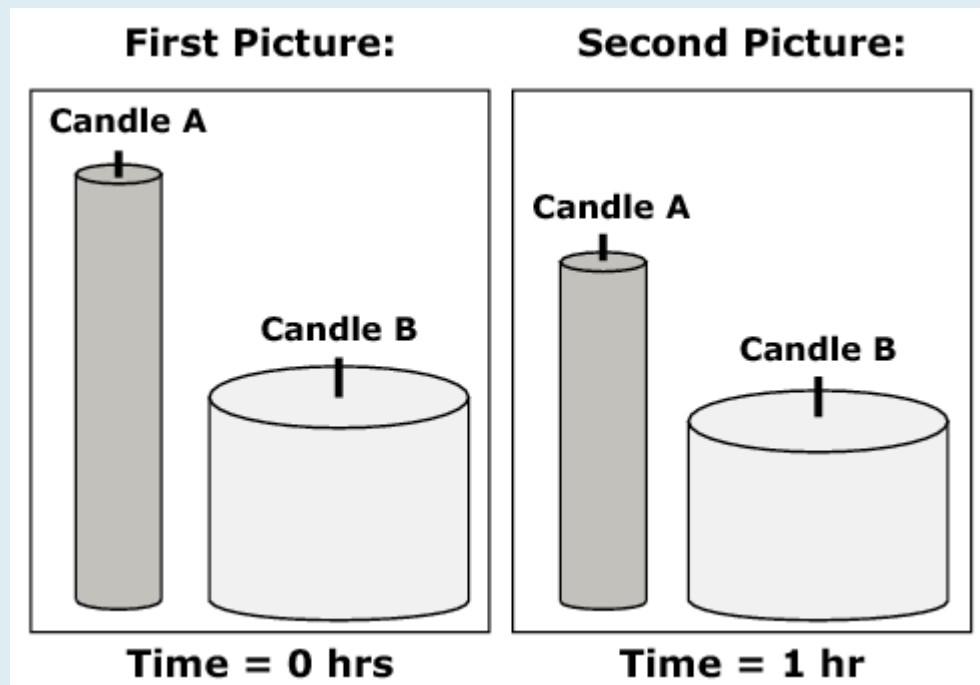
Claim 2  
FLE.B.5

Stimulus

### Lights, Candles, Action!

Your friend Abbie is making a movie. She is filming a fancy dinner scene and she has two types of candles on the table. She wants to determine how long the candles will last.

She takes a picture, lights the candles, and then lets them burn for 1 hour. She then takes a second picture. You can assume that each candle burns at its own constant rate.



Candle Type A initial height = 20 cm

Candle Type B initial height = 10 cm

Candle Type A height after burning for 1 hour = 16 cm

Candle Type B height after burning for 1 hour = 9 cm

You will use this information to help Abbie think about the candles she might use for her film.

<h3>Item Prompt</h3>	<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, <math>h</math>, as a function of time, <math>t</math>, using this equation:</p> $h = k + nt$ <p>First, explain to Abbie what <math>k</math> and <math>n</math> represent in order to model the different candles. Be specific in your explanation.</p>
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## Scoring Guide

SCORE	2 POINTS	1 POINT	0 POINTS
	<p>The student correctly identifies that “k” represents the initial height of the candle and “n” represents the burn rate of the candle.</p> <p><b>Note:</b> It is necessary for the student to identify “k” as the initial or original height in order to receive full credit, because the height of the candle changes as it burns and is represented by “h” in the equation.</p>	<p>The student is only able to correctly identify one of the parameters, not both.</p>	<p>All other responses.</p>

## Sample Responses

### Student Sample A



For candle A:

$k = 20$ , original height of candle

$n = -4$ , rate at it burns/hr

For candle B:

$k = 10$ , original height of candle

$n = -1$ , rate at it burns/hr

$k =$  original height of candle

$n =$  rate at which candle burns cm/hr

#### SCORE RATIONALE

The student correctly identified what  $k$  and  $n$  represent in the context of the problem.

### Student Sample B



$k =$  initial height

$n =$  constant rate of the candle burning

Candle A:  $h = 20 - (4)t$

Candle B:  $h = 10 - (1)t$

#### SCORE RATIONALE

The student correctly determined what  $k$  and  $n$  stand for, and further used appropriate values to specify the function for the height of each candle at time  $t$ , in hours after it is lit.

### Student Sample C



$k$  is the starting height, while  $n$  is the rate at which the height is decreasing.

#### SCORE RATIONALE

The student correctly identified the meaning of  $k$  and  $n$  in the context of the problem.

## Student Sample D



Candle A =  $20 - 4\text{cm}(t)$

Initial amount =  $20 = k$

Amount decreases by hour =  $4\text{cm} = n$

Candle B =  $10 - 1\text{cm}$

Initial amount =  $10 = k$

Amount decreases by hour =  $1\text{cm} = n$

**SCORE RATIONALE**

The student wrote the function for the height of each candle after burning  $t$  hours, and correctly identified both the values and meanings of  $k$  and  $n$  for each candle.

## Student Sample E



$k$  is the original height of Candle Type A and Candle Type B before they began to burn.

$n$  is negative. It's the difference of height after candle Type A & Candle Type B's 1 hour of burning.

**SCORE RATIONALE**

The student identified the meaning of  $k$  correctly, and provided two correct statements about what  $n$  represents. The first of these statements, " $n$  is negative," is about the value of  $n$ , not about what it represents, but together with the second statement, the response reflects a mathematically accurate interpretation of  $n$  that is connected to the context. Although the response does not mention burn rate or constant rate explicitly, the final statement reflects the essential idea of a constant rate: the difference in height after 1 hour of burning. If the student had written "each hour" or "per hour," this response would have been more clearly deserving of full credit. This one squeaks by.

## Student Sample F



$k$  = initial height

$n$  = number of cm dropped

$$20 = 20 + 0(0)$$

$$20 = 20$$

**SCORE RATIONALE**

The student correctly identified  $k$ , but not  $n$ . If the student had included the number of cm dropped per hour, or each hour, this could have earned full credit, but as written the response earns partial credit of 1 point.

## Student Sample G



$k$  represents the height after burning the candle for a specific amount of time.

$n$  represents the height of how much is burned off during the time

for example:

$$k = 16 \text{ cm} \quad n = 4 \text{ cm}$$

$$h = k + nt$$

$$h = 16 + 4(1) = h = 16 + 4$$

$$h = 20 \text{ cm}$$

**SCORE RATIONALE**

The student identified  $n$  partially correctly, but the given interpretation of  $k$  is incorrect. The response includes an attempt to use equations to support the stated meaning of each of the parameters, and provides evidence of some valid sense-making about the relationships among the quantities. This response earns 1 point.

## Student Sample H



$h$  = height

$t$  = time

$n$  will be the amount of hours

$k$  will be the height of the candle from the beginning

**SCORE RATIONALE**

The student correctly identified what  $k$  means in the context of the problem, but not  $n$ . The response earns 1 point.

## Student Sample I



$k$  = is how much the candle burns in one hour

$$y = -1x + 10$$

(burns 1 cm in an hour)

$$y = -4x + 20$$

(burns 4cm in an hour)

$n$  = the height of the candle originally

**SCORE RATIONALE**

The student switched the meaning of  $k$  and  $n$  in the context of the problem. Although the equations and their notations provide clear evidence of a solid understanding of the relationships among the quantities, the statements about  $n$  and  $k$  are both incorrect, and this response earns 0 points.

## Student Sample J



The “ $h$ ” is the height of the candle, as the function of time is “ $t$ .” The letter “ $k$ ” symbolizes to be the subtraction of both candles in every hour. And “ $n$ ” is the missing value that needs to solve.

**SCORE RATIONALE**

Although there is evidence of a lot of interpretive work in this response, the student did not provide the correct meaning of  $k$  and  $n$  in the equation  $h = k + nt$ . The response earns 0 points.

## Student Sample K



$k$  is the rate of change and  $n$  is

$$2n - 1 = 8$$

$$2n = 9$$

$$n = 9/2$$

$$8 = -1 + 2(9/2)$$

**SCORE RATIONALE**

The student provided an incomplete answer and did not include the correct meaning of either  $k$  or  $n$ . The response earns 0 points