

Burning the Candle

Purpose:

Participants will gather data on the length of a candle as it varies over specific burn lengths. This data will serve as the basis for creation of a table, graph, and linear function.

Overview:

In small groups, participants will gather data on the length of a candle as it varies over specific burn lengths. They will have the option of using multiple representations for exploration including graphical, tabular and functional.

TEExES Mathematics Competencies. The beginning teacher:

- II.04.A Uses inductive reasoning to identify, extend, and create patterns using concrete models, figures, numbers, and algebraic expressions.
- II.04.B Formulates implicit and explicit rules to describe and construct sequences verbally, numerically, graphically, and symbolically.
- II.04.D Gives appropriate justification of the manipulation of algebraic expressions.

TEKS Mathematics Objectives. The student is expected to:

- 5.06.A Describe relationships mathematically. The student is expected to select from and use diagrams and number sentences to represent real-life situations.
- 6.05 Formulate an equation from a problem situation.
- 6.8.B Select and use appropriate units, tools, or formulas to measure and to solve problems involving length (including perimeter and circumference), area, time, temperature, capacity, and weight.

Terms.

Outlier, linear function, graph, data point, length

Materials.

For each small group of participants:

- Transparency
- Activity Sheet for each participant
- Candle
- Lighter
- Clay for making candle holder
- Stop Watch (optional)

Transparency.

- *Burning the Candle*

Activity Sheet(s).

- *Burning the Candle*

Procedure:

Steps	Questions/Math Notes
<p>1. Read aloud the <i>Burning the Candle</i> two times. Allow participants to ask questions about the steps outlined on the transparency.</p> <p>Ask participants to work in groups of 4 as they gather their data. Encourage safety and discuss precautions when using this activity.</p>	<p>To stimulate reflection, ask participants to build a table showing the number length of the candle for each of the burning periods.</p>
<p>2. Circulate among the groups as they gather their data. When the groups graph their data be sure to discuss the outlier data points.</p>	<p>What would have caused the first burning to result in an outlier data point?</p> <p>Examine an unburned candle for clues if necessary.</p>
<p>3. Select several small groups to present their findings and graphs.</p>	<p><i>How does your graph compare with other groups? Is there a general pattern?</i></p> <p><i>What is the exception to the pattern? How can you explain this?</i></p>

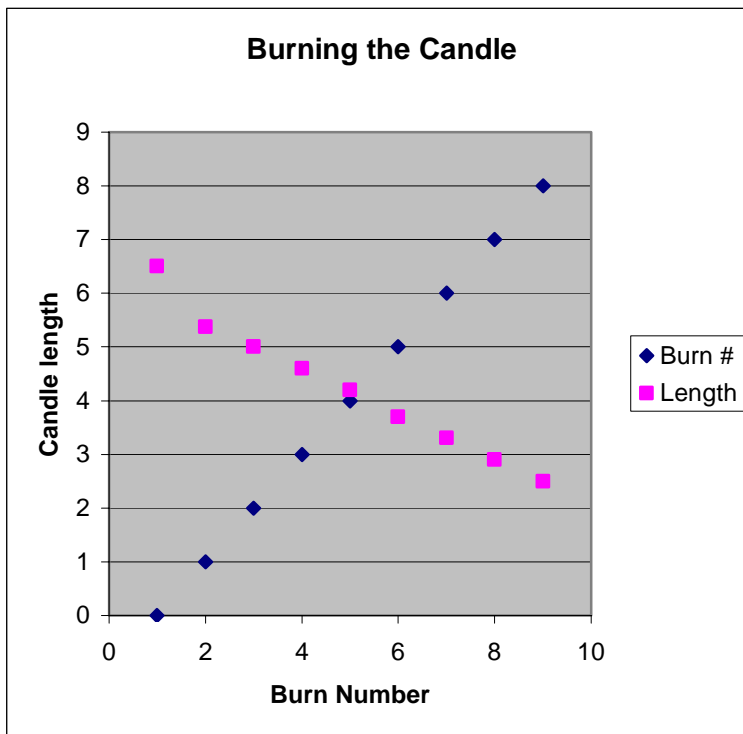
Burning the Candle Solution and Discussion:

This activity provides an opportunity to gather data which lends itself to the creation of a linear function. It also allows for a discussion to be held concerning factors influencing the application of a function to actual events.

The following spreadsheet shows the results of a typical set of observations

Burn #	Length	Total Time Burned
0	6.5	0
1	5.375	30
2	5	60
3	4.6	90
4	4.2	120
5	3.7	150
6	3.3	180
7	2.9	210
8	2.5	240

When these results are plotted it is easy to see that with the exception of the first burn, the candle's length very closely follows a straight line. Notice that although we could have plotted the **Total Time Burned** the difference in size between these two units would have made comparison difficult.



This example also plots **Burn Number**, which also gives rise to a linear function. However, this line is purely mathematical in nature ($F(x) = X+1$) whereas the candle length line is due to collected data. The differences between these two types of functions are well worth discussing, and this activity provides the opportunity to do so.

For example, as this chart clearly shows, the first burn showed a markedly faster rate of length decrease than any subsequent burn. A close examination of the candle provides the reason why. A birthday candle, of the type used in this exercise, is not the same shape throughout. Rather, the end of the candle to be lit comes to a point making a cone.



This means that the first burn will go much faster than those which follow. This provides an excellent opportunity to observe not only an outlier data point, but the reasons why care must be taken in the entry and interpretation of data.