

# Day 1

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## *Essential Question*

How do we use math to find the height of things that are difficult to measure?

## *Lesson Objective*

Students will understand a proportional relationship between two variables.

## *Standards*

G-SRT.1. Verify experimentally the properties of dilations given by a center and a scale factor.

MP.8. Look for and express regularity in repeated reasoning.

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## *Activities*

### 1. *Introduce the Essential Question.*

Slideshow	Teacher sets the scene for this unit of study. Teacher will have slides of images of things whose height might be interesting to measure.
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2. *Establish Classroom Norms.* Discussion around norms for working together and doing math. (ie. how to have a discussion, how to justify answers, etc.)

3. *Simpsons Sunblocker.* The purpose of this activity is to give students an opportunity to explore the concept of geometric proportionality. Since students will be working in teams, this activity helps to establish group norms.

Launch	<p>Teacher will show the Simpson's clip of Mr. Burns blocking the sun with a circular disk. Teacher will give the goal of the day: "Our goal is to help Mr. Burns understand where to place a circular disk in order to block the sun over the town of Springfield."</p> <ul style="list-style-type: none"><li>• Teacher will show the contents of the sunblocker kit: a flashlight, the cut-out sun blockers, a ruler, and the map of the city of San Jose.</li><li>• Teacher will call up several students to help him demonstrate the data collection. One student holds the flashlight, another holds a blocker, and another measures. The fourth records. The teacher will point out that students need to keep the flashlight in the same position at all times, as much as possible, just like the sun is.</li><li>• Teacher will explicitly call attention to what each member of the group is doing.</li><li>• Teacher will distribute the Simpsons Sunblocker worksheet.</li></ul>
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## Activities

### 3. Simpsons Sunblocker

Group Work	<p>In groups of four, students will repeat the experiment for all the sunblockers in their kit. Students will create an in-out table with the following variables: diameter of the blocking disk and distance from light source.</p> <p>Teacher will make the assessment explicit. “At the end of all this, I’m going to give you a disc that you don’t have. You’ll have to tell me where to put it to block out the sun over San Jose and you’ll only have one shot to get it as right as possible.”</p> <p>Teacher Talking Points:</p> <ul style="list-style-type: none"><li>• <i>Precision.</i> Teacher will encourage students to be as precise as possible in their measurements and in holding the flashlight.</li><li>• <i>Noticing.</i> Teacher will ask students to share their informal observations about what they’re noticing.</li></ul> <p>Student Challenges &amp; Misconceptions:</p> <ul style="list-style-type: none"><li>• <i>Organization.</i> Students might not experiment systematically. They might measure the discs in an order that doesn’t highlight patterns as well as ascending or descending would have. If they struggle to see patterns, the teacher can encourage students to reorganize their data.</li></ul>
Formative Assessment	<p>When students have completed the table, teacher will pass out the next prompt on a card: “We’ve created a disc that is 15 cm in diameter. Where should it go? Everybody in your group should be able to explain your reasoning.”</p> <p>Student Conceptions:</p> <ul style="list-style-type: none"><li>• <i>Estimation — Direction.</i> “I know the blocker is going to be farther away from the light because the disk is bigger.”</li><li>• <i>Estimation — Constant Difference.</i> “I know the blocker is going to be farther away and I used the pattern to count up to where I thought it would be.”</li></ul>

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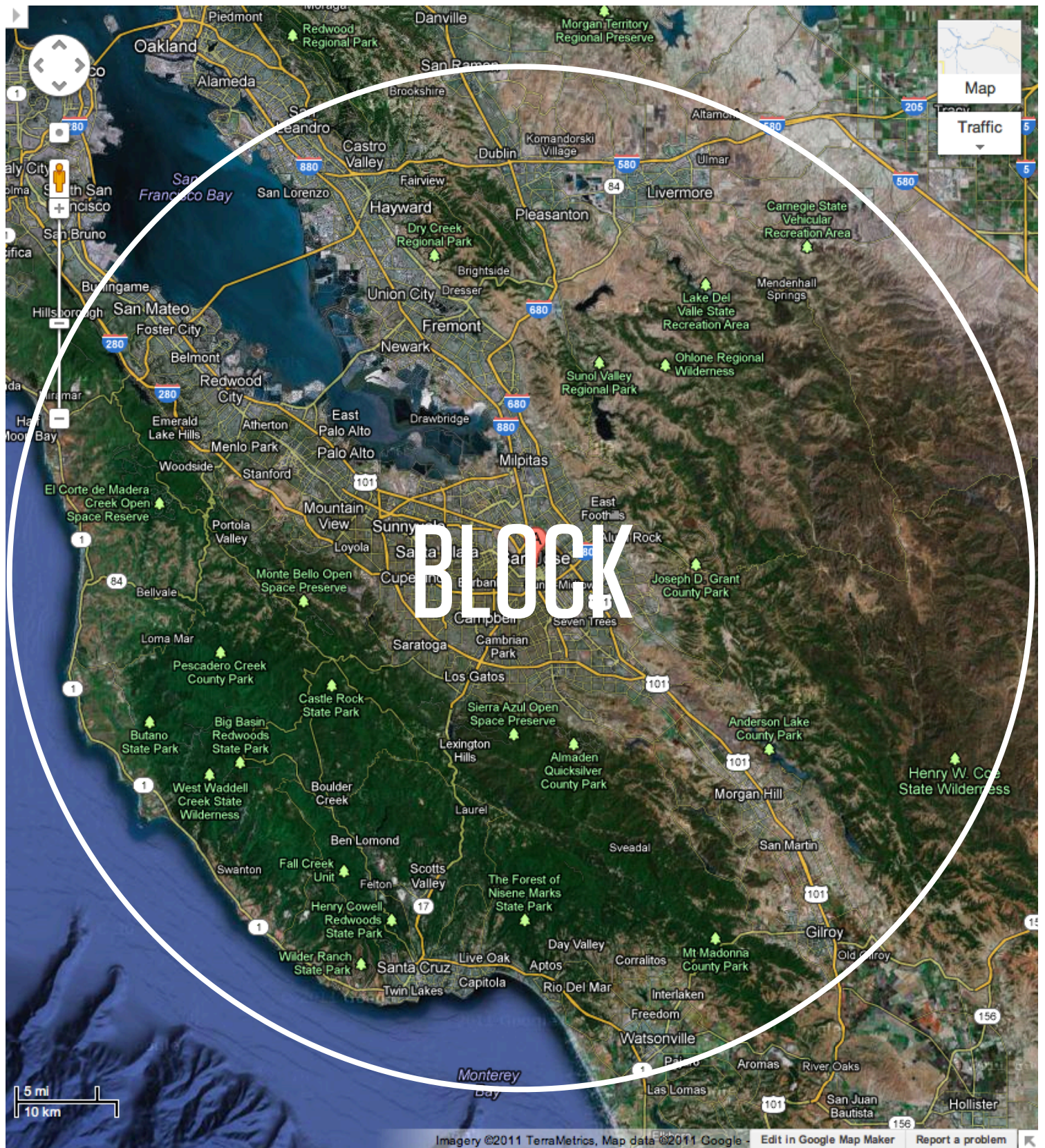
## Activities

### 3. Simpsons Sunblocker

Formative Assessment	<ul style="list-style-type: none"><li>• <i>Estimation – Interpolation.</i> “San Jose is 18.5 centimeters. The largest disk is 9.4. This new disk is 15 centimeters so it’s going to be really far away from the light source.”</li><li>• <i>Calculation.</i> The student calculates the constant of proportionality and uses it to find the new height.</li></ul>
Group Work	<p>As groups find their estimates, the teacher asks a random member for her answer and her reasoning. (The answer should be more sophisticated than <i>Estimation – Direction.</i>)</p> <p>Teacher passes out the two graphs. The first is to be used for a sketch. The second is to be used for a more accurate graph. Every student in the group should make a sketch of the data (rough, no units, to get a sense of trends) and a graph of the data (precise, using grid paper) and compare with each other. They will explain to each other in words why they drew it the way they did.</p> <p>Teacher Talking Points:</p> <ul style="list-style-type: none"><li>• <i>Methods.</i> Teacher will ask students how they’ll use their graph to determine the height of the final sun blocker. Teacher can ask students, “Can you show me where the final sun blocker is on your graph?”</li></ul> <p>Once students have their answer — both estimated and now tested by graphing — the teacher will test their answer by giving them the final sunblocker and letting them use it. Each group will record how close their answer was from the actual best placement of the final disk.</p> <p>(Note: every group may have a different, correct answer, depending on where they hold the flashlight.)</p> <p>Teacher will offer extensions as the groups finish. Every group needs to enter their data in a Google Form so the teacher can pose questions about the class data set the next day.</p>
Class Debrief	<p><i>Headlining.</i> Each group decides on a single “headline,” a major takeaway or big idea from today. (eg. “Use little data to make conclusions about big data.”) They write it down and then share each out to the entire class.</p>

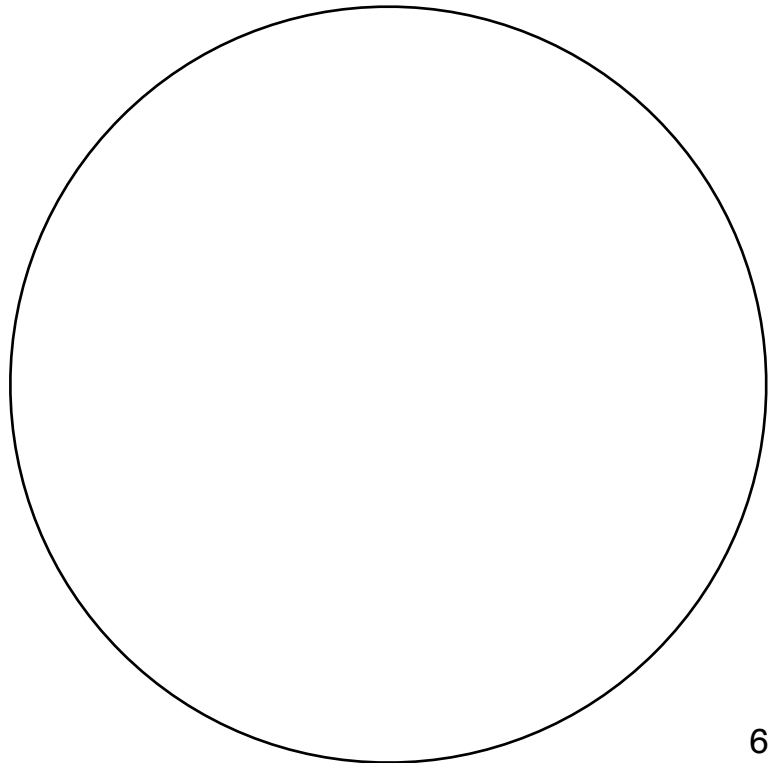
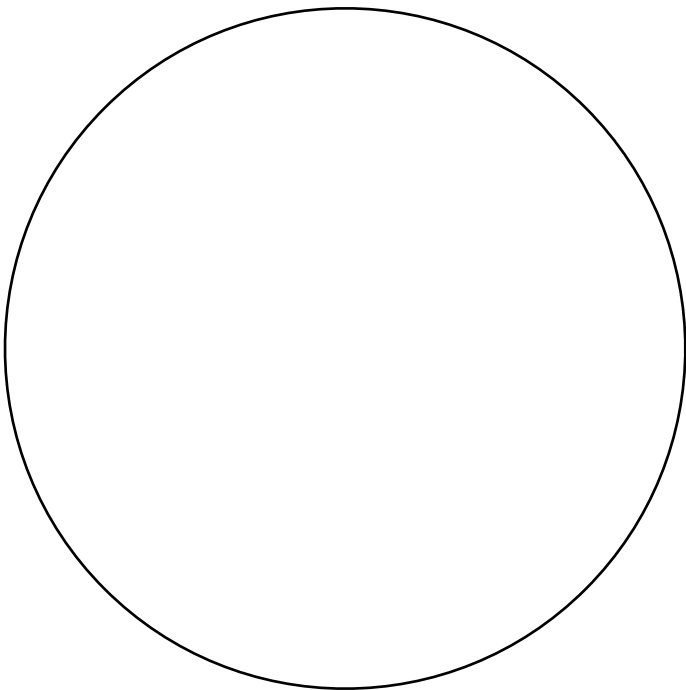
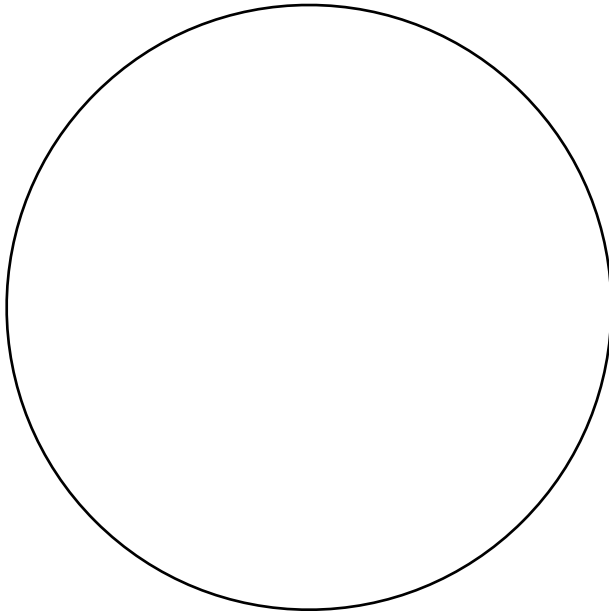
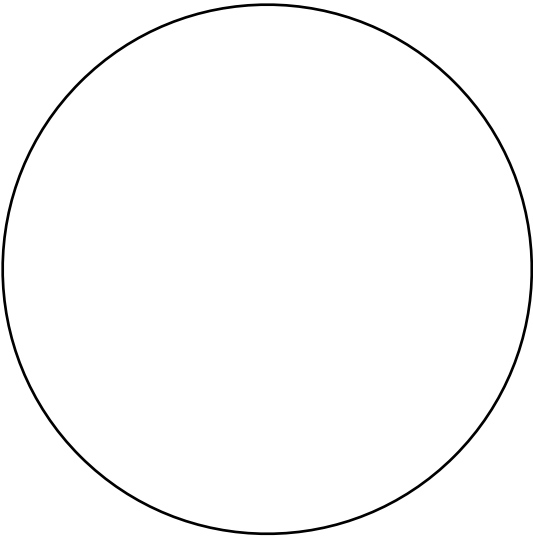
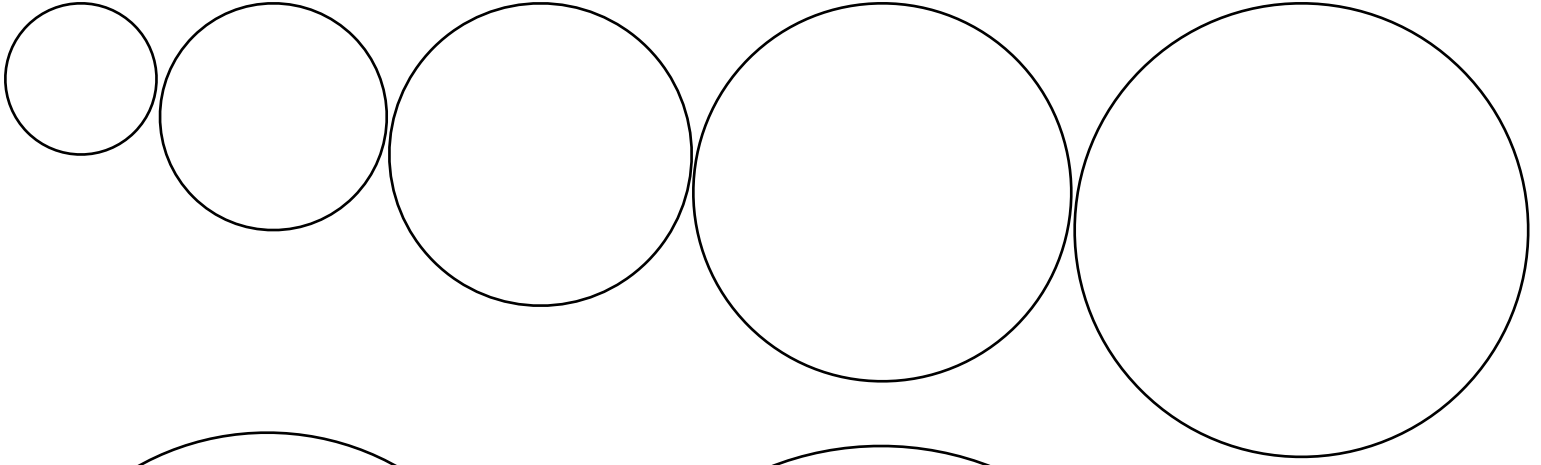


# Sun Blocker



# Sun Blocker

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# Sun Blocker

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<b>d</b>	<b>h</b>
<i>diameter of blocker</i>	<i>distance from blocker to light</i>

