

## Supplementary and Vertical Angles



The interactive white board DreamBox Teacher Tool for this lesson is available on our website under Resources or using [www.dreambox.com/teachertools](http://www.dreambox.com/teachertools).

Students use this interactive tool to reason deductively about supplementary, vertical, and adjacent angles as they make rotations, aim for targets, and determine angle measurements.

### Sample Lesson

**Objective:** Students find unknown angles using supplementary, adjacent, and vertical angle relationships.

**Background:** Prior to completing this lesson, students should understand that angles are a measurement of rotation, know that one full rotation measures  $360^\circ$ , and recognize angle measure as additive.

### Lesson:

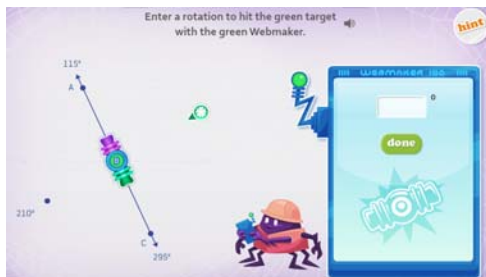
1. Bring up the DreamBox interactive white board lesson.



2. Begin by stating, "We need to rotate the Webmaker so that the purple laser will hit the purple target." Ask, "How could we figure this out? Take a moment to draw this problem on your scrap paper. Record the lines and locations of the given point and purple target. Then solve the problem and record your strategy for finding the number to enter into the Webmaker and share with your partner." Once students have discussed their strategies with their partners, ask a volunteer to provide a solution.

Possible responses:

- "We know that the measure of the opposite point across from the purple target is  $295^\circ$ . That point is  $65^\circ$  from  $0^\circ$  because  $295 + 65 = 360$ . That means the purple target is  $65^\circ$  less than  $180^\circ$ .  $180 - 65 = 115$ , so  $115^\circ$ ."
- " $295^\circ$  is  $115^\circ$  more than  $180^\circ$ . So we need to rotate  $115^\circ$  to the purple target."
- "We know that  $295^\circ$  is  $25^\circ$  more than  $270^\circ$ , and  $270^\circ$  is directly across from  $90^\circ$ . So we can add  $25^\circ$  to  $90^\circ$  and rotate  $115^\circ$ . This is our answer."
- " $65^\circ$  is the answer because  $360 - 295 = 65$ . That's how many degrees the laser is from the  $180^\circ$  line." (If students provide this answer, allow them to plug in that number. Discuss the reference angles,  $0^\circ$ ,  $90^\circ$ , and  $180^\circ$  and ask them how  $65^\circ$  can help them with finding the full measure.)



3. Ask, "In this problem, our answer was  $115^\circ$ . Many of you used  $65^\circ$  to help find the answer. This pair of angles -  $115^\circ$  and  $65^\circ$  - is an example of a special pair of angles called "Supplementary Angles." What is special enough about  $115^\circ$  and  $65^\circ$  that we would give pairs like this one and others a special name?"

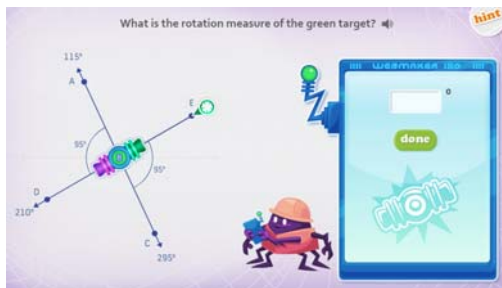
Possible responses:

- When you rotate  $115^\circ$  and then  $65^\circ$ , you've rotated one half of the circle. Supplementary angles must be two angles that combine to make one half.
- $115^\circ + 65^\circ = 180^\circ$ . A pair angles is supplementary if they add up to  $180^\circ$ .

4. State, "Now we need to determine how far the green laser needs to rotate to hit the green target. Are there any supplementary angle relationships that can help us hit the target?"

Possible responses:

- "The opposite point from the green target is  $210^\circ$  which is  $30^\circ$  more than  $180^\circ$ . That means that the target is at  $30^\circ$ .  $210 - 30$  makes  $180$ , so they are supplementary." (Allow the students to plug in that angle. Discuss where the laser landed. It only traveled  $30^\circ$  from  $295^\circ$  so it landed at  $325^\circ$ . What other information do we need to move it to the target? Why aren't  $210$  and  $30$  supplementary?)
- " $210 - 115 = 95$ . So rotate  $95^\circ$  to hit the green target. The supplementary angle for  $95^\circ$  is  $85^\circ$ , but it's easier to use the  $95^\circ$  in this situation.
- " $360 - 295 = 65$  and  $210 - 180 = 30$ . If we add  $65^\circ$  and  $30^\circ$ , we get  $95^\circ$ . That's the rotation to hit the target."



5. "Now we see how those two  $95^\circ$  measures are labeled and are across from each other where the two lines intersect. Those congruent angles are called Vertical Angles. The problem now asks about the rotation measure of the angle for the green target. Point A is at  $115^\circ$ , Point D is at  $210^\circ$ , and point C is at  $295^\circ$ . Where is point E?"

Possible responses:

- "We know  $360 - 295 = 65$ , so  $95 - 65 = 30^\circ$ . That's how far the green target is from  $0^\circ$ ."
- " $210 - 180 = 30$ . That's the measure of the vertical angle across from point E and  $0^\circ$ . So  $30^\circ$  is the answer."
- "We know  $180 - 115 = 65$ .  $95 - 65 = 30$ . So it's at  $30^\circ$ ."

6. One extension problem would be to ask about the measure of the non-labeled vertical angles in the problem. Here,  $95^\circ$  is labeled, and the other pair of vertical angles both measure  $85^\circ$ . Discuss how  $2(95^\circ) + 2(85^\circ) = 360^\circ$ . Repeat the questions above with future problems.