**Exploring Gears and Gear Ratios**

**Learning Goals**

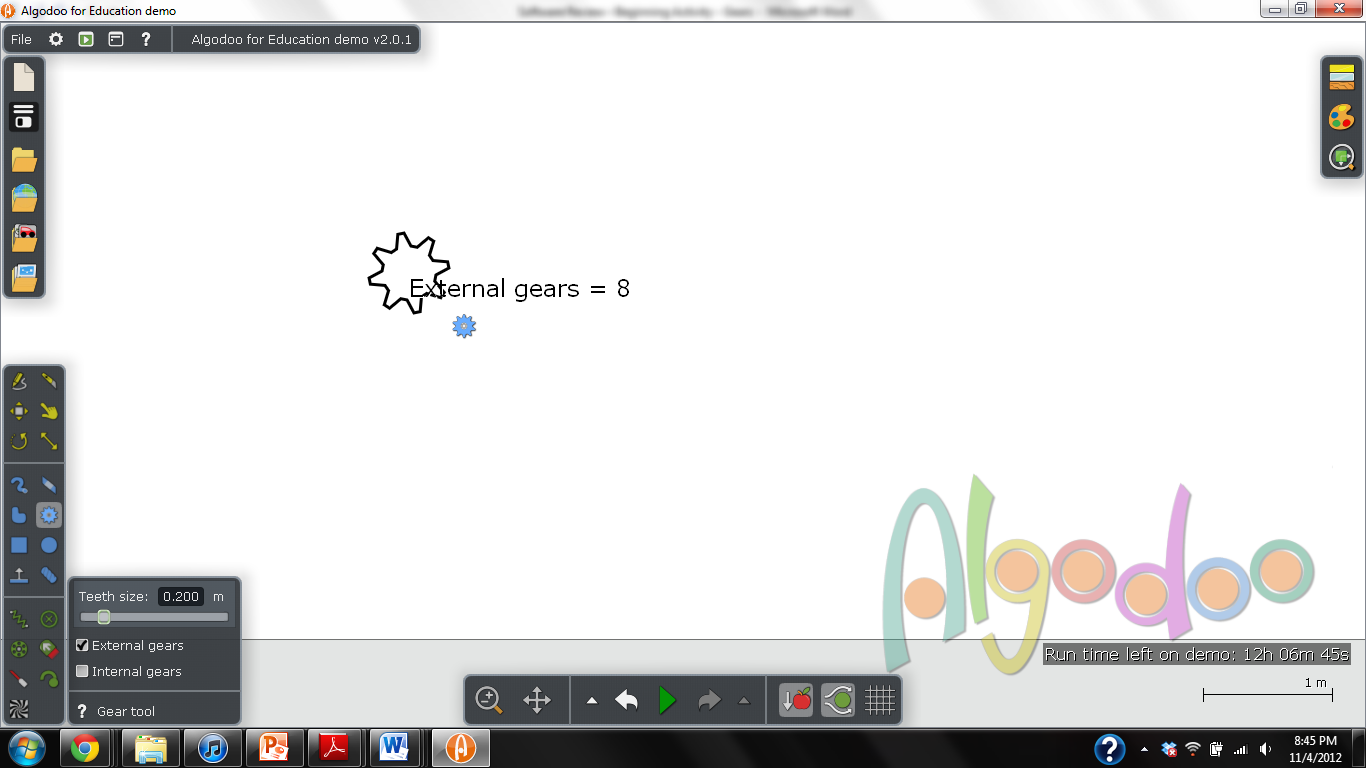
* Understand how gears can be fit together
* Learn how different diameters and number of teeth drive the number of relative turns of each gear
* Understand how gears can be used to alter the speed of the driving force and the speed of the parts

**Terms to Know**

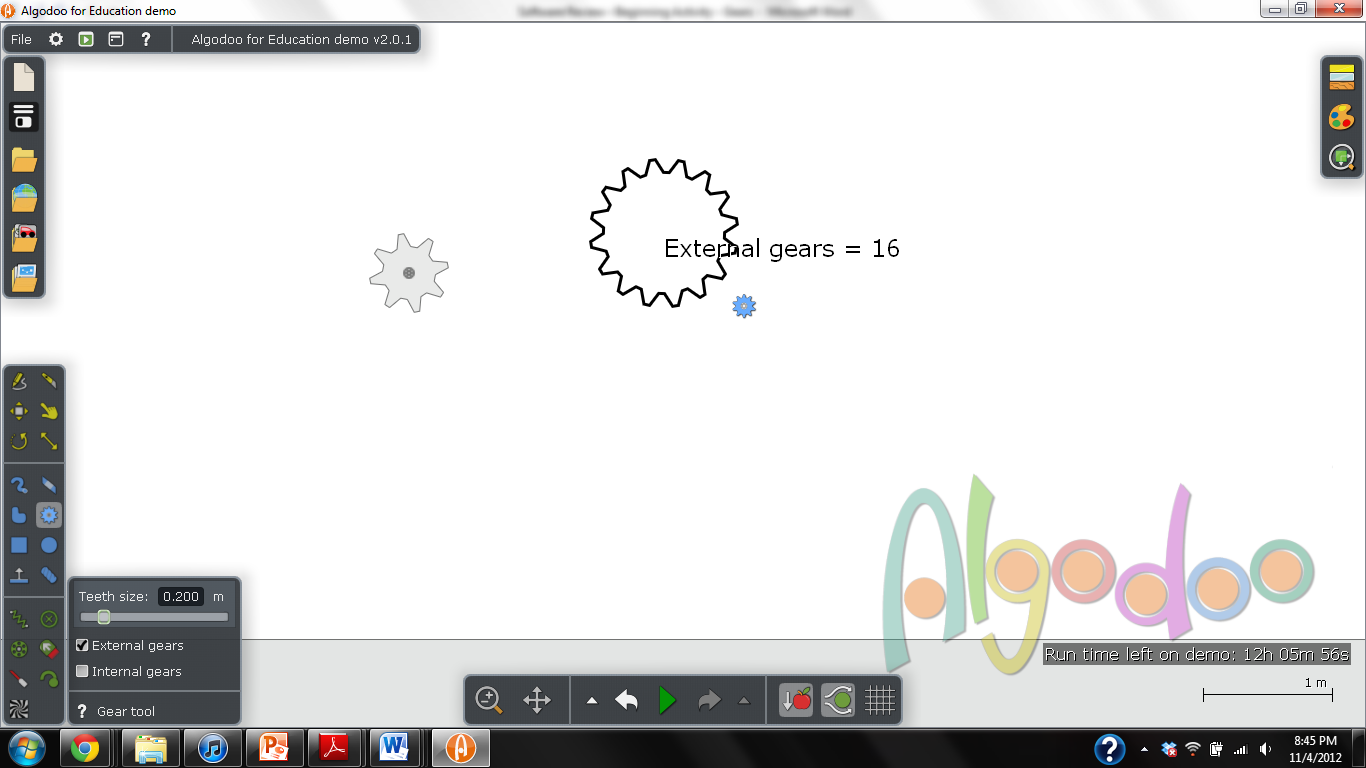
*Gear –* A toothed wheel

*Driver –* The gear being acted upon

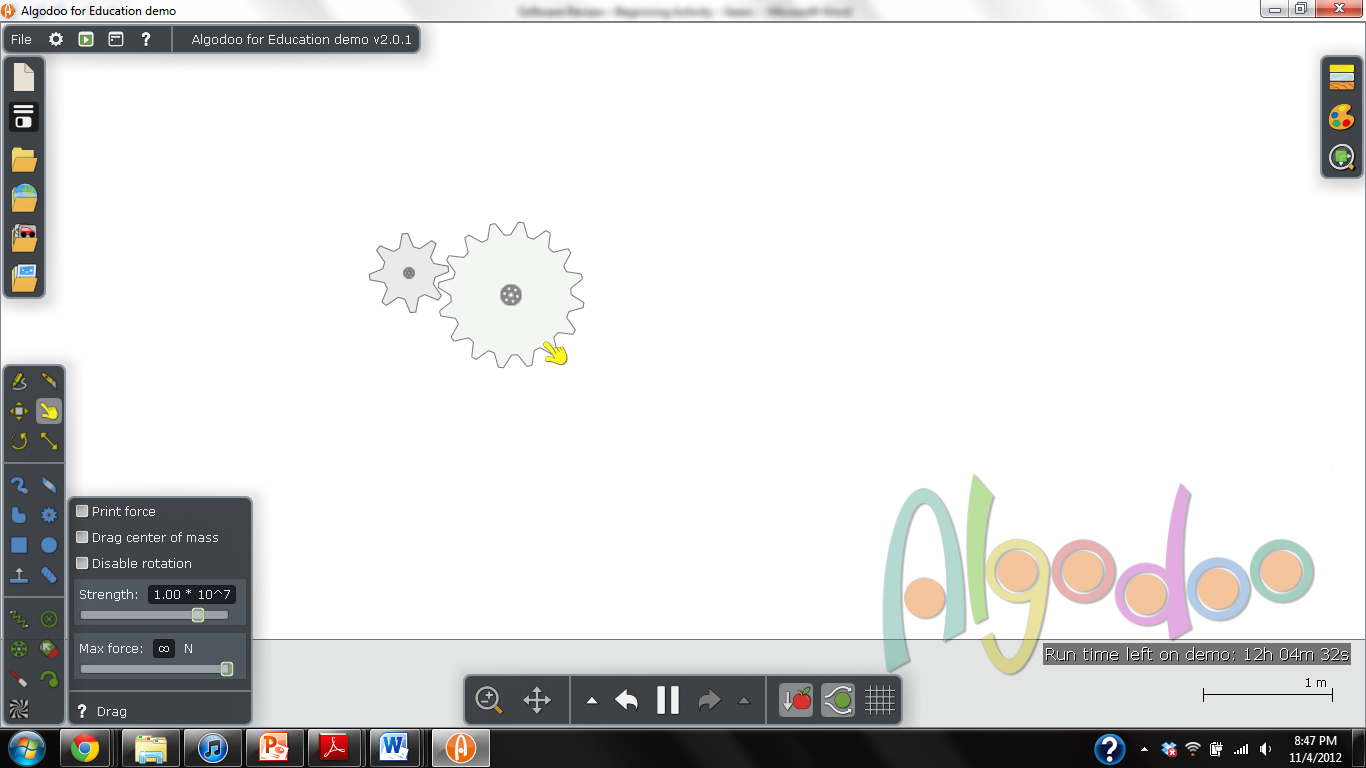
*Follower –* The gear that moves because of direct action of the driver gear

*Gear Ratio –* The number of teeth of the driver to the number of teeth of the follower (related to the diameter of the gears - the larger the gear, the more teeth it has)

**Getting Started**

1. Open Algodoo and create a new file
2. Create a gear with 8 teeth
3. Create a gear with 16 teeth
4. Move the gears together
5. Play the simulation and click on the Force (yellow finger) tool
6. Use the tool to move one of the gears around
7. As you make one full rotation of the Driver gear, have a partner

track one of the teeth of the Follower gear

1. Count the number of full revolutions the Follower has to turn so that

the Driver gear and the Follower gear can both end up in their same

starting locations

1. Record your data in the chart below
2. Play around with the number of teeth each gear has and the number of

revolutions it takes for each to get to their starting positions at the same time

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Driver Gear # of Teeth** | **Follower Gear # of Teeth** | **#teeth of Driver / #teeth of Follower** | **# of revolutions of Driver Gear** | **# of revolutions of Follower Gear** | **#rev of Driver / #rev of Follower** |
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What do you notice about the fractions in the 3rd and 6th columns? This is your **Gear Ratio.**

Now run the experiment again but make the smaller gear your Driver gear.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Driver Gear # of Teeth** | **Follower Gear # of Teeth** | **#teeth of Driver / #teeth of Follower** | **# of revolutions of Driver Gear** | **# of revolutions of Follower Gear** | **#rev of Driver / #rev of Follower** |
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If you want a gear to turn more slowly than the input you are giving it, which size gear should be the Driver and which should be the Follower? Why?

**Extension: Gears in the Physical World**

Materials: 2 hoops – one 1-foot diameter and 1 2-foot diameter

Activity: 1) have 4 students stand evenly spaced around the smaller hoop with their right hand out to the side and gripping the hoop and their left hand extended on their other side. Have 8 students stand around the larger hoop similarly but with hands reversed.

2) Have the 2 circles stand side by side so that one person from the smaller hoop and one person from the larger hoop have their palms pressed together

3) Assign one of the groups to be the driver gear. This group will step slowly around the circle of their hoop – for every person that reaches the point where the 2 gears meet, a new person from each hoop should be there to give a “high five”

4) Do this until the driver group has made one complete revolution around their hoop.

5) Discuss what happened with the students.