**Geometry: Using Geogebra to determine the volume of a 3D figure**

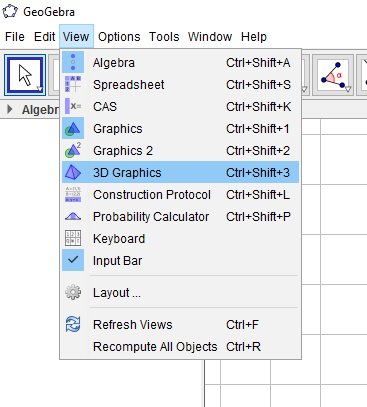
**Grades: 7-10**

Important Vocabulary:

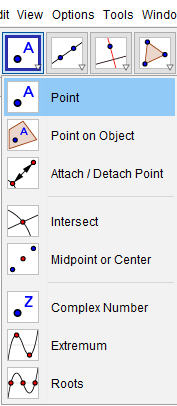
* **Volume** – The measure of the amount of space inside a solid figure
* **Radius** – The distance from the center of the circle and any point on the circle.

Important Formula:

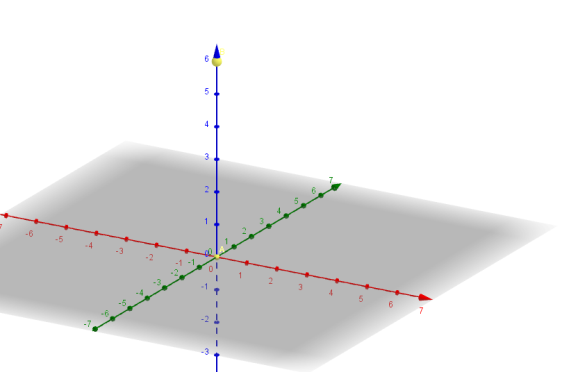
1. In Geogebra, click the view drop down tab at the top of the document and select 3D Graphics.



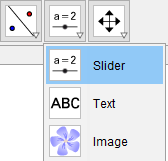
1. Click on **POINT**, locatedunder the picture of a point and the letter A**:**



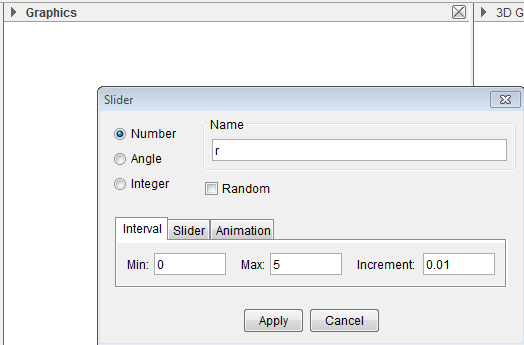
* 1. Create two points on the z-axis by clicking the graph in the location the point is to be located, one at z = 0 and one at z = 6.



1. Click on **CREATE SLIDERS** under the slider tab, and then click anywhere under the section titled Graphics.

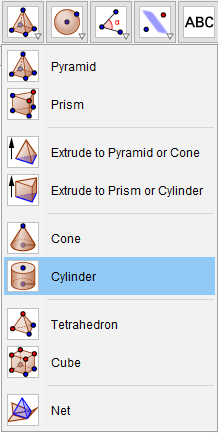


1. Organize the sliders:

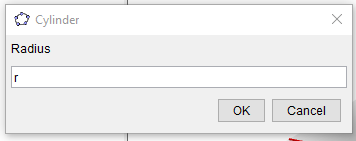


* 1. In the Name section, label the slider **r.**
  2. Change the interval to say there is a Min: 0 Max: 5 and Increment: 0.01

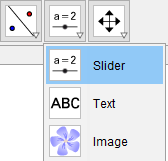
1. Using the two points, A and B, create a cylinder with a radius of r**.**
   1. Click on the **pyramid tab**, located at the top left of the screen, and select **CYLINDER**.



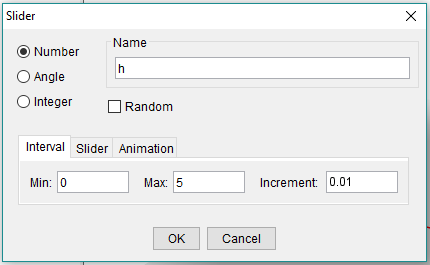
* 1. Draw a cylinder connecting points A and B.
  2. When prompted, insert r for the radius of the cylinder.



1. Click on **CREATE SLIDERS** under the slider tab, and then click anywhere under the section titled Graphics.

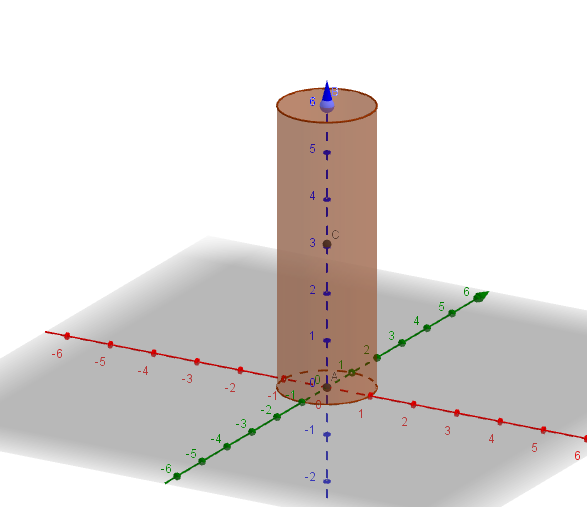


1. Organize the sliders:

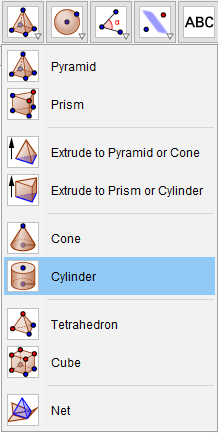


* 1. In the Name section, label the slider **h**.
  2. Change the interval to say there is a Min: 0 Max: 5 and Increment: 0.01

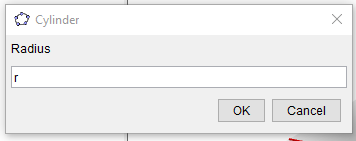
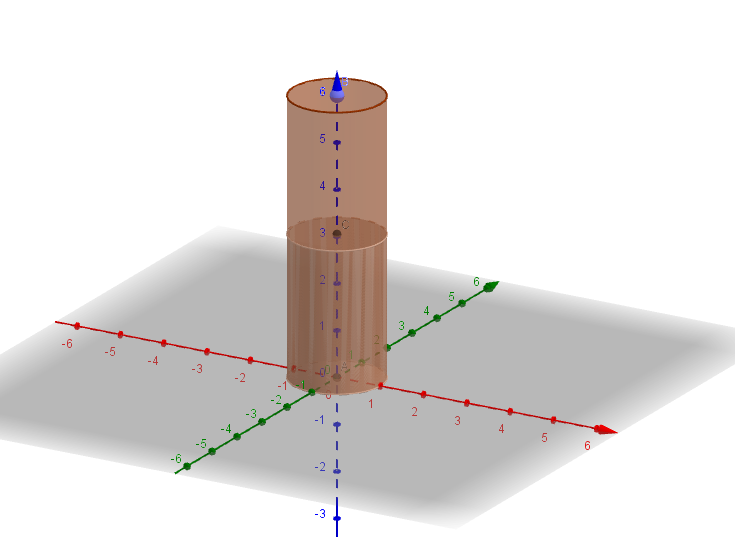
1. Insert the point **C=(0,0,h)** into the **INPUT** line.

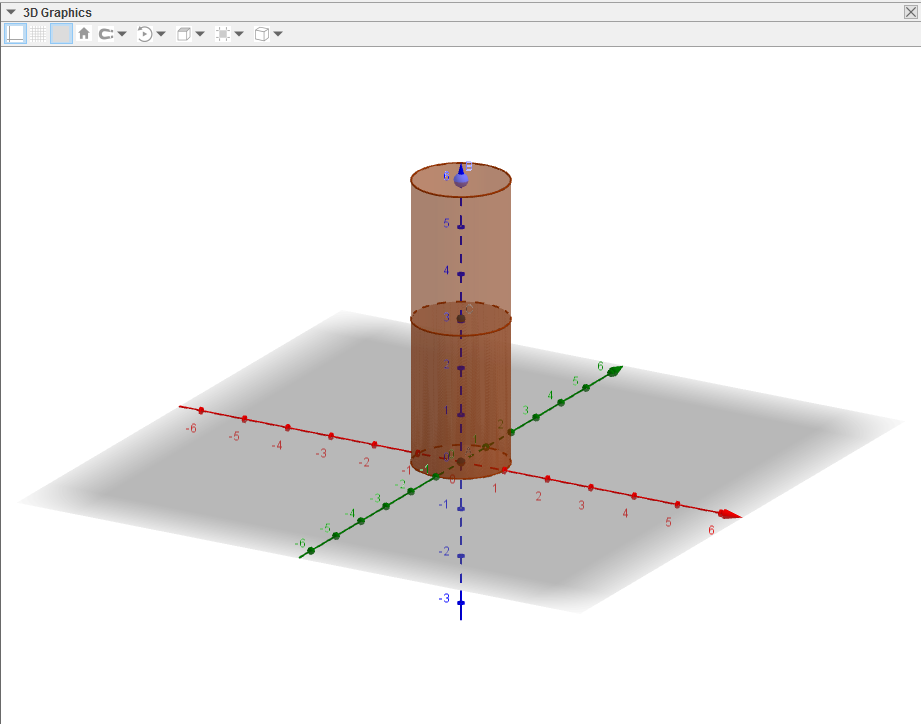
1. Using the points A and C, create a cylinder with a radius of r**.**
   1. Click on the **pyramid tab**, located at the top left of the screen, and select **CYLINDER**.



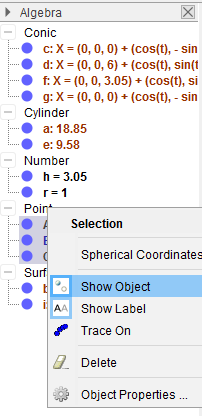
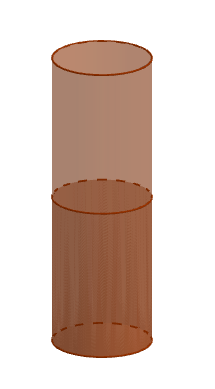
* 1. Draw a cylinder connecting points A and C.
  2. When prompted, insert r for the radius of the cylinder.

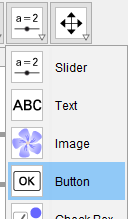
1. Under the section titled 3D Graphics, turn off the **plane and axis**, by selecting the highlighted boxes.



1. Under the section titled Algebra, right click on the category points and click on **SHOW OBJECT**.

** **

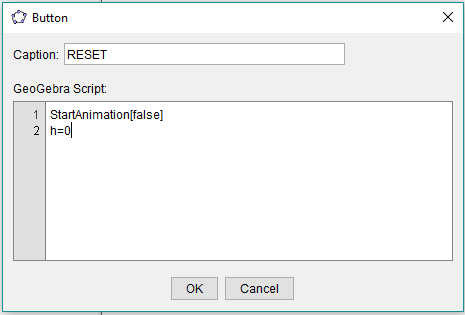
1. Add Animation
   1. Click the **slider tab** at the top of the page, select **BUTTON**, and then click anywhere under the section titled Graphics [You will repeat this step TWO times].



* 1. **START** button
     1. Type **START** in the box labeled **Caption**
     2. Insert **StartAnimation[h]** into the section labeled GeoGebra Script, this provides the information required to have the height of the shape change.



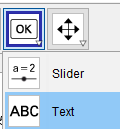
* 1. **RESET** button
     1. Type **START** in the box labeled **Caption**
     2. Insert **StartAnimation[false]** into the section labeled GeoGebra Script, this negates the information that the START button provides.
     3. Press enter and insert **h=0** into the section labeled GeoGebra Script.



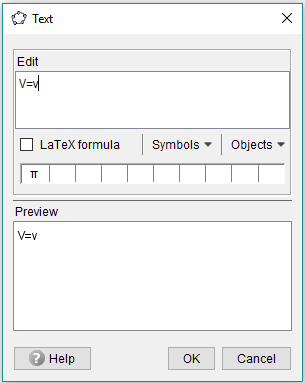
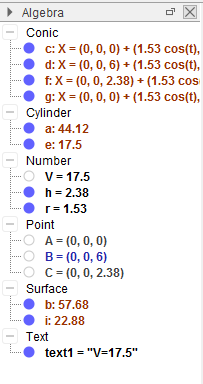
1. Insert the formula **V=r^(2)\*pi\*h** into the **INPUT** line.



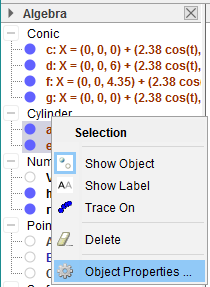
1. Click the **button tab** at the top of the page, select **TEXT**, and then click anywhere under the section titled 3D Graphics.



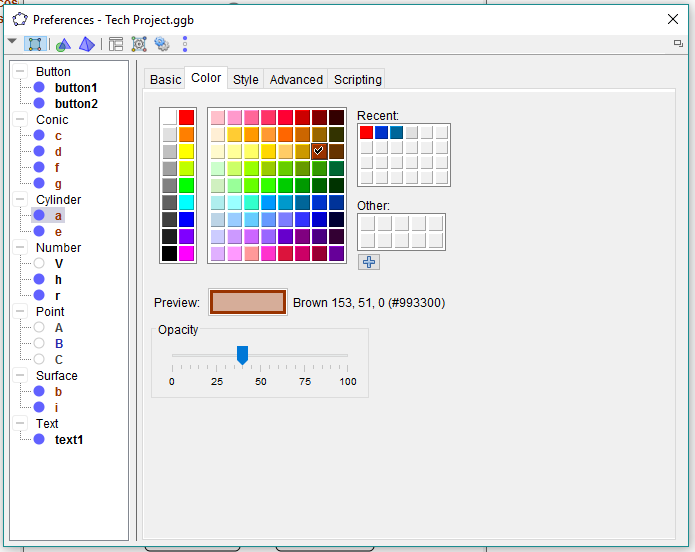
* 1. Use the text boxes to insert the volume of the figure into the 3D Graphics section.
     1. Volume is represented by the letter V
     2. Start by typing **V=** in thesection titled **Edit**, then select the number represented by **V** under Algebra, Numbers

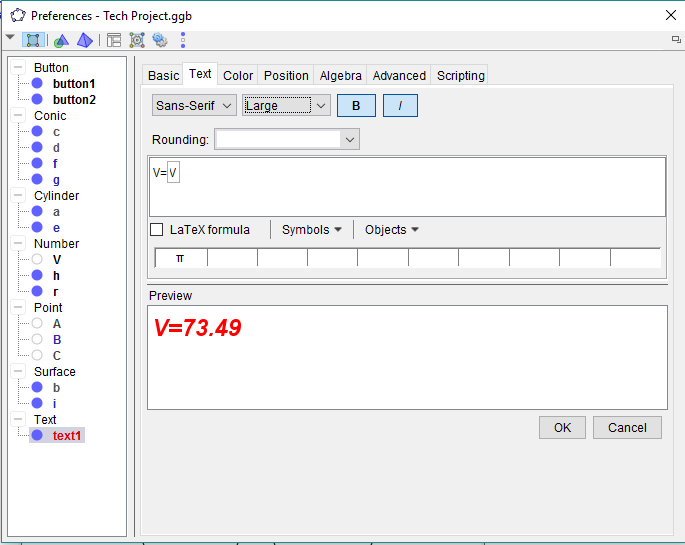
1. We want to adjust the colors and fonts so that they can be seen clearly.
   1. Under the Algebra section, right click on the cylinder and select **Object Properties.**



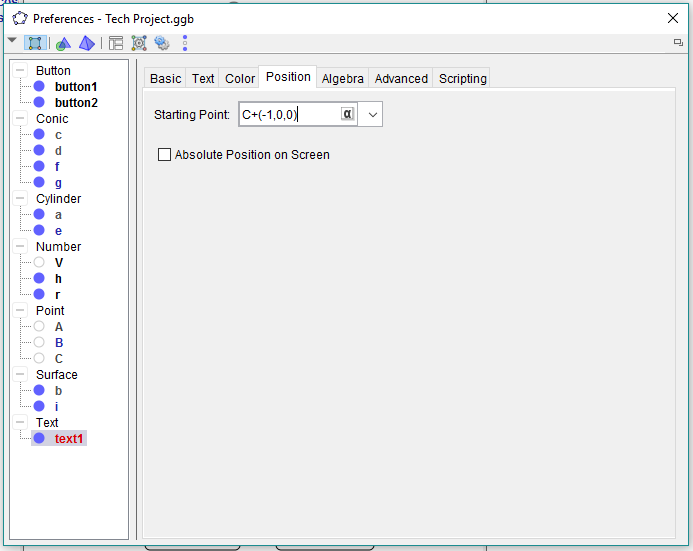
* 1. Fix the color of the two cylinders and the text (Make sure that the cylinder AB is lighter in color than cylinder AC), using the **COLOR** tab.
     1. Cylinder AB is represented by the variable a
     2. Cylinder AC is represented by the variable e
     3. The Text V=V is represented by text1

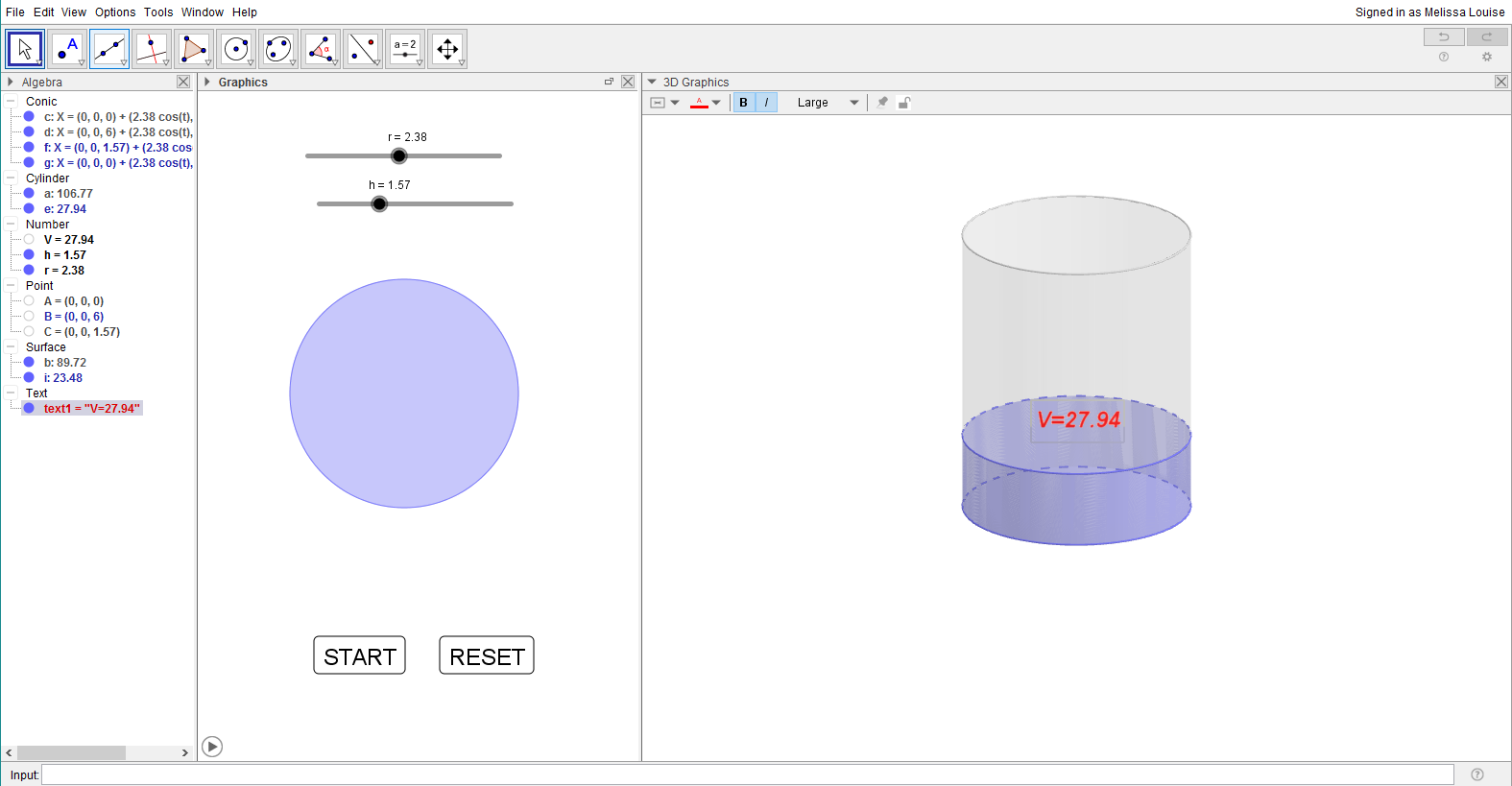


* 1. Fix the font of the text using the **TEXT** tab.



1. We want to reposition the **TEXT** box, so that the text changes positions as cylinder AC moves.
   1. Under the Algebra section, right click on text1and select **Object Properties.**
   2. Under the **POSITION** tab, unselect the *“Absolute position on screen”* box. After unselecting the box, insert the boundary C+(-1,0,0) for the starting point and press **ENTER**.





Questions

1. When h remains constant, explain how changing the value of r affect the volume of the cylinder.
2. When r remains constant, explain how changing the value of h affect the volume of the cylinder.
3. State the volume of a cylinder, based on the following restriction.
   1. r = 30 , h=5.01
   2. r = 25 , h=1.26
   3. r = 45 , h=2.6
   4. r = 15 , h=3.1
   5. r = 28 , h=5.6
   6. r = 6 , h=90

**Extension Activity**

1. We learned about two other formulas relating to the volume of a solid, including a prism and a cone. Following the steps that we used to find the volume of a cylinder in Geogebra, design and demonstrate how to create an animation representing the volume of either a prism or a cone.

Resources

[Svijet Matematike]. (2016, June 14). *Volume of a cylinder (animated) in Geogebra [tutorial]*. [Video File]. Retrieved from https://www.youtube.com/watch?v=wEKAGGB4Mng&t=97s