

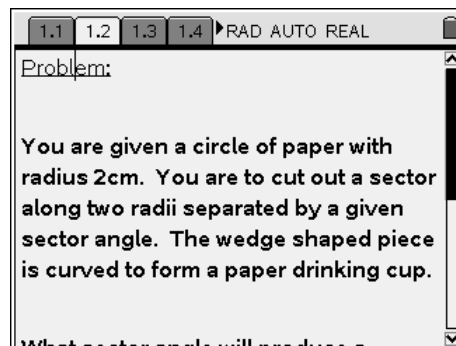
In this activity you and a partner will explore what sector angle actually maximizes the cone's volume. The geometric construction will calculate the cone radius and height for a given sector angle. You will collect data for a variety of angles, make a scatter plot and determine the maximum value from your scatter plot.

Turn on the Nspire CAS unit.

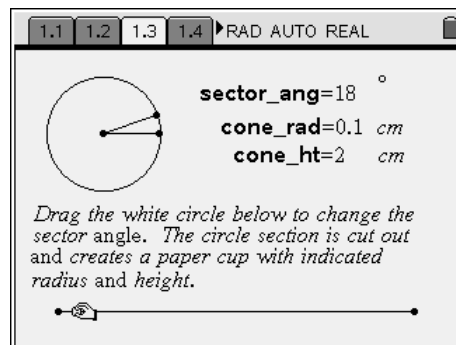
From the **Home** screen choose **My Documents** and open the file: *Max Cone Vol – Student.tns*

Name	Size
CAS Intro	39K
Cone Volume	5K
Max Cone Vol – Student.tns	5K
Examples	33K
Fast Track	108K
Nspire Training	15K
Open Topped Box	10K
Presentations	16K
Quad Form	4K


Review the instructions on page 1.2. Be sure you understand the problem before you begin. Ask your partner or your teacher for assistance

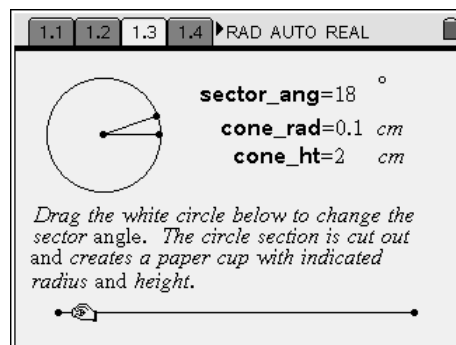


Move to page 1.3. The construction allows you to choose any sector angle from  $0^\circ$  to  $360^\circ$ . The slider at bottom controls the sector angle.



Move the cursor until it is over the white dot on the slider. The cursor will become an open hand as shown in the diagram on the right.

To move the slider you must grasp the white dot by pressing and holding  until the hand closes as shown on the screen on the right.

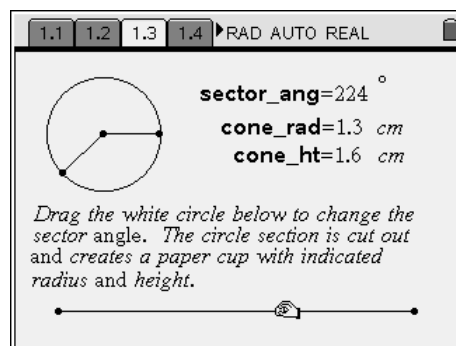


Using the **NavPad** move the slider left and right. As you move the slider the sector angle will change. The radius and height of the cone formed from the net are also calculated.

To get enough data to create a complete scatter plot we will need all the possible sector angles from 0° to 360°.

As you move the slider you will see the circle diagram change and values for **sector\_ang**, **cone\_rad** and **cone\_ht** updated.

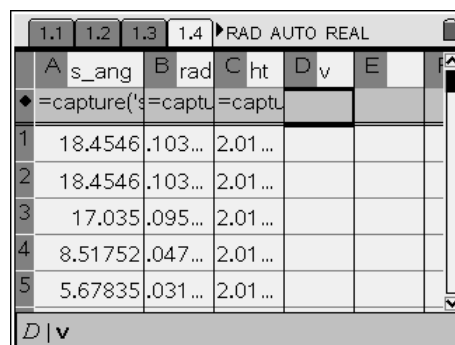
By pressing the **NavPad** left and right buttons you will change the sector angle and collect the angle, cone radius and height for all the possible nets.



Move to page 1.4. Each time you moved the slider control the values for the variables were stored as rows in this spreadsheet.

Use the **NavPad** to examine the data.

Move the cursor to the cell in column D below the label **V**.



	A s_ang	B rad	C ht	D v	E
◆	=capture('s	=captu	=captu		
1	18.4546	,103...	2.01...		
2	18.4546	,103...	2.01...		
3	17.035	,095...	2.01...		
4	8.51752	,047...	2.01...		
5	5.67835	,031...	2.01...		
	D   v				

We need to calculate the cone volume for each of the nets in the rows.

Recall the formula for a cone is  $V = \frac{1}{3} \pi r^2 h$

We have to enter this formula into the spreadsheet. Like Excel formulas begin with =

Type = 1  $\frac{1}{3}$  3  $\pi$  rad 2 ht

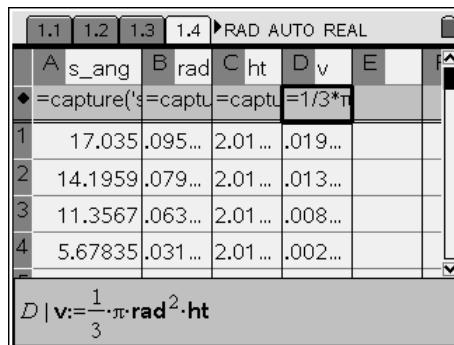
The formula you entered will show on the bottom of the screen and all the volumes will be calculated in column D

Move to 1.5. We will make a scatter plot of the angles and the volumes.

Press  $\text{menu}$  3 3 to change the screen to a scatter plot.

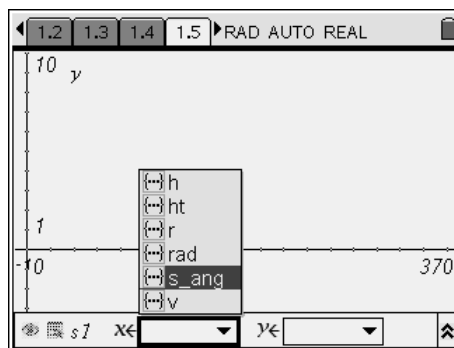
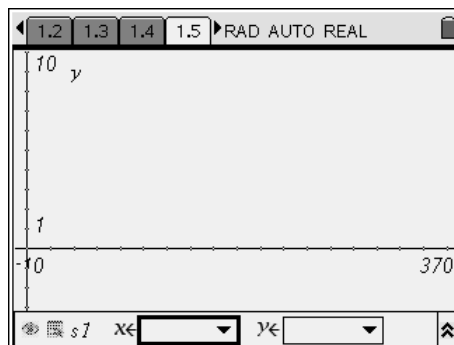
Press  $\text{enter}$  and choose **s\_ang** from the list using the **NavPad** and press  $\text{enter}$ .




This selects the independent variable.



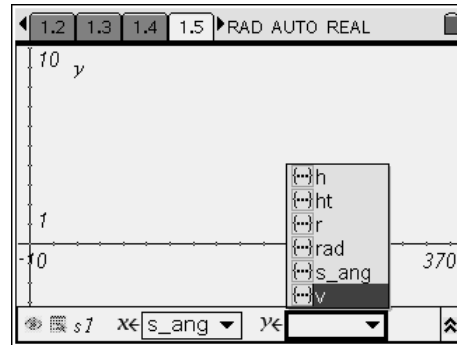
	A s_ang	B rad	C ht	D v	E
1	17.035	.095...	2.01...	.019...	
2	14.1959	.079...	2.01...	.013...	
3	11.3567	.063...	2.01...	.008...	
4	5.67835	.031...	2.01...	.002...	

D | v: =  $\frac{1}{3} \cdot \pi \cdot \text{rad}^2 \cdot \text{ht}$

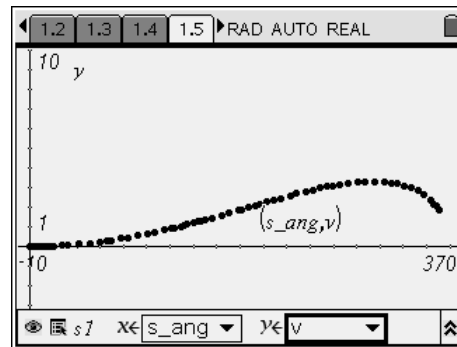


Press   and choose **v** from the list using the **NavPad** and press .

This selects the dependent variable.

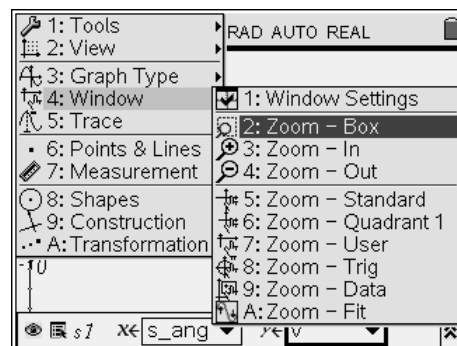


A scatter plot of sector angle versus volume of the cone appears. The relation is non-linear but appears to have a maximum value on the right side.




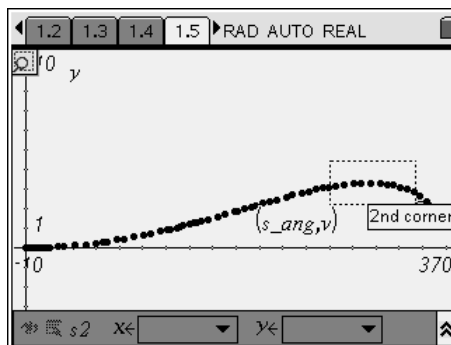
To examine the section of the plot near the maximum in detail use the **Zoom Box** feature.

Press  **4 2**





A magnifying cursor appears asking for the **1<sup>st</sup> corner**. You need to mark diagonal corners of a rectangle for the section of the graph you will to examine.

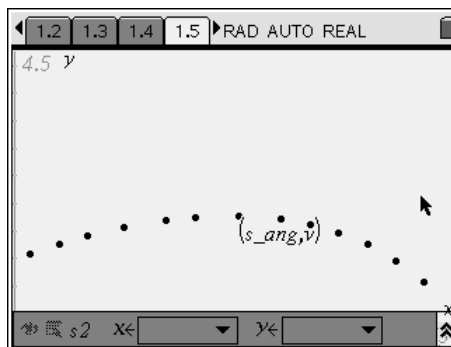
Using the **NavPad** and the  button to mark two diagonal corners near the maximum.




Press  to exit the **Zoom Box** mode.

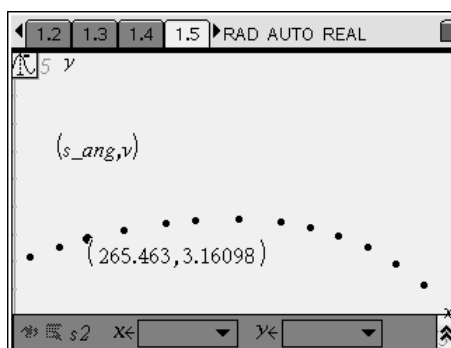
We will now **Trace** over the dots to find the angle that has the maximum volume.

Move the label **(s\_ang,v)** by grasping it with the , move it and drop it using .



Press  **5 1** to enter **Trace** mode. When the cursor is on a dot the coordinates will be displayed. Using the **NavPad** move from dot to dot until you find the point with maximum volume

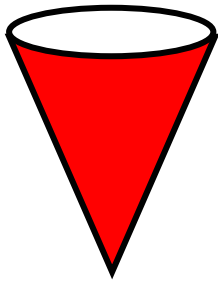
Compare your answer with your partner.



**Reflection:**

What sector angle creates the net for a cone with maximum volume? State reasons for your answer

If a circle of paper with a larger radius was used to create the net for the cone, would the sector angle for the net that maximizes the cone's volume be different? Justify your choice



A company makes cone-shaped drinking cups from circular pieces of paper. Since several different sizes of cones can be made from the same circular piece of paper, you must decide which one the company will produce. You will determine the sector angle to cut a net for the cone with maximum volume.

