Maximizing a Paper Cone's Volume
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Activity overview
The net for a conical paper cup is formed by cutting a sector from a circular piece of paper. What sector angle creates a net that maximizes the cone's volume? In this activity students will build concrete models, measure the dimensions and calculate the volume. Next, students will use a construction to gather data, make a scatter plot and determine the sector angle that maximizes the volume.

Concepts
Calculating the volume of a cone
Creating a scatter plot
Linear and non-linear relations
Determining the maximum value

Teacher preparation
  o *Students need prior knowledge on constructing cones from nets and calculating volumes of cones*

Classroom management tips
Have students work in pairs to facilitate communication and the comparison of solutions.

TI-Nspire Applications
Max Cone Vol – Student.tns
Max Cone Vol – Teacher.tns

Step-by-step directions
  o Copy *Max Cone Vol – Student.tns* to Nspire handheld units
  o Make copies of student sheets *Max Cone Vol – Student.pdf*
  o Students require scissors, tape and a ruler to construct and measure nets
  o Distribute page 6 of the student BLM that contains a circle with radii at 45° intervals. Assign each student one of the possible nets from 45° to 315°. Students cut the cone net with their assigned angle. Students form a cone form the net and measure its height and radius and calculate its volume.
  o Lead a class discussion on which cone model has the maximum volume. Students should give reasons for their choice. Pose the question: How can we be certain that this is the cone that maximizes the volume?
  o Distribute copies of pages 1 to 5 of the student activity and Nspire handhelds. Students work in pairs on the investigation
  o Consolidate student understanding with a discussion afterwards.

Assessment and evaluation
* *During the activity assess students on their use of the mathematical processes **representing** and **reasoning and proving***
* *This activity could be used as a summative evaluation*

Activity extensions

- *Older students can algebraically determine the formulas for the radius of the cone based on the sector angle and the height of the cone based on the circle's radius and radius of the cone.*
- *Calculus students could determine the optimal angle using calculus methods.*