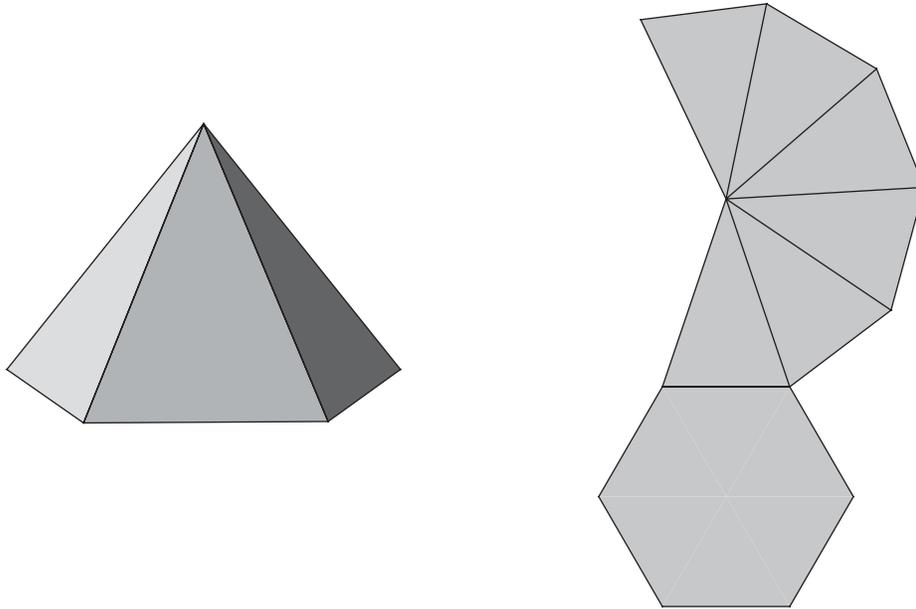


# Pyramid Dissection

In this activity you'll create a regular pyramid with your choice of the height, the number of sides, and the size of the base. Then you'll calculate its surface area.



## EXPLORE



1. Open **Pyramid Dissection.gsp** and go to page "Pyramid." Use *spin*, *pitch*, and *roll* to change your view of the regular pyramid.
2. Change the number of sides ( $N$ ), the size of the base ( $R$ ), and the slant height ( $L$ ). View the pyramid from different angles.
3. Adjust the controls to look at the pyramid from directly above. Which control did you use to do this? What does the pyramid look like in this position? What does the *spin* control do now?
4. Explore the shape of the net for various pyramids. How small can you make the slant height? What do the pyramid and the net look like then? What happens if you make the slant height large and the radius small?

To find the surface area, you must find the area of the base and of the lateral faces.

## Base Area

5. Go to page "Base." Change the size of the base and change the number of sides. Measure the distance from  $R$  to the midpoint of the thick red side. Label the measurement  $r$ .
6. Measure one side of the base and have Sketchpad calculate the perimeter. Write down your calculation and result.
7. Find the area of the base. Imagine dividing the regular polygon into simpler shapes and do some measurements and calculations. (If you're stuck, press *Show Hint* to get some ideas.) Write down your calculation and result.
8. Change the number of sides and the size of the base, and make sure that your perimeter and area calculations seem reasonable. If not, fix them so that they work correctly for any base.
9. Increase the number of sides to more than 50. Divide the perimeter by  $r$  and divide the area by  $r^2$ . Have you seen these two numbers before? Why do you think you get these values?

## Face Area

10. On page "Faces," drag  $L$ ,  $R$ , and  $N$  to change the slant height, the size of the base, and the number of sides. Measure the distance  $r$  and side length  $s$  as you did in steps 5 and 6. Measure the slant height of the pyramid and label it  $l$ .

# Pyramid Dissection

continued



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11. Find the total area of the lateral faces. Calculate a value that will be correct for any value of  $n$ . Write down the calculation and the result.
  12. What is this value when the number of faces is at least 50? Why?

## Total Area

13. On page “Area,” do the necessary constructions, measurements, and calculations to find the total surface area of the regular pyramid, including the base and the lateral faces. Write down your calculation and result.

## EXPLORE MORE

14. On page “Net,” set  $L$ ,  $R$ , and  $N$  to match the pyramid you made on page “Area.” Choose **File | Print Preview** and make sure the net fits on one page. If necessary, click *Scale To Fit Page*, and then click **Print**. Label the base and each face with the area you calculated based on the measurements. Cut out the net, fold along the lines, and glue or tape your three-dimensional pyramid together.
15. What does the pyramid look like when the number of lateral faces is large? How could you calculate the surface area of this shape without using the value of  $n$ ? (Your answers to steps 9 and 12 may be useful.)
16. The *height* ( $h$ ) of a pyramid is defined as the vertical distance from the base to the *vertex*. In step 10, you measured the slant height  $l$  (the height of one of the lateral faces). How can you find the vertical height of the pyramid if you know  $l$  and  $r$ ? (For instance, if  $l = 15$  cm and  $r = 9$  cm, what is  $h$ ?) How could you find  $l$  if you know  $h$  and  $r$ ? (For instance, if  $h = 5$  cm and  $r = 12$  cm, what is  $l$ ?)
17. On page “Explore More,” you can experiment with the advanced controls that affect the look of this three-dimensional model.