

Pocket Protractor

Measure angles with a tool you can make yourself.

Materials

- square sheet of paper (you can trim a sheet of 8.5" × 11" paper into a square; 8.5" × 8.5" would be fine)
Alternative: square origami paper, perhaps 6" × 6"
- pencil
- ruler (optional)
- scissors (optional)

Group Size

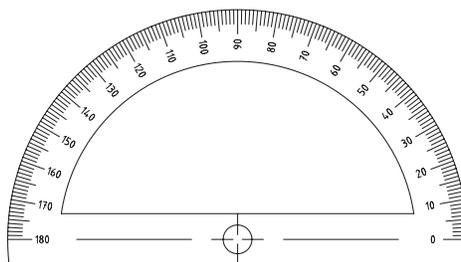
individuals

Related Activities

- [Playground Patterns of Cracks](#) 
- [Angle Hunting](#) 

Background

Geometry enthusiasts use a standard tool called a protractor to measure angles. But you can make your own angle-measuring device out of a piece of paper!



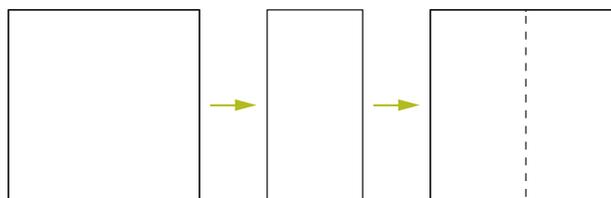
Standard Protractor



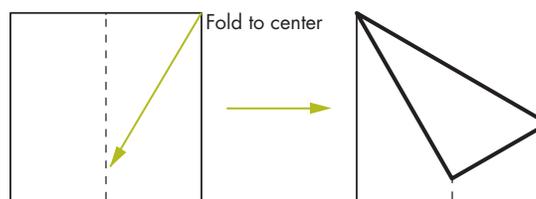
Pocket Protractor

Try This

1. Fold the paper in half and then unfold it:



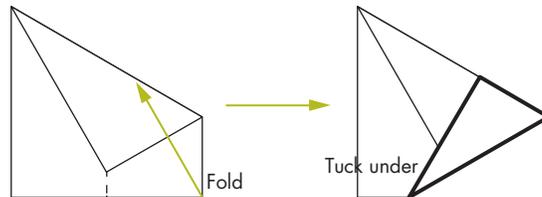
2. Fold the upper right corner (a 90° angle) to a point low on the center fold you created in step 1, making sure that this fold creates a triangle at the upper left:



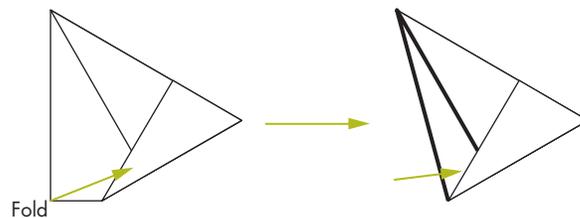
The triangle shown in bold above is called a 30-60-90 triangle, meaning that the angles are 30°, 60°, and 90°.

Pocket Protractor (continued)

- Now fold the lower right corner over the 30-60-90 triangle, creating another 30-60-90 triangle as shown in bold:

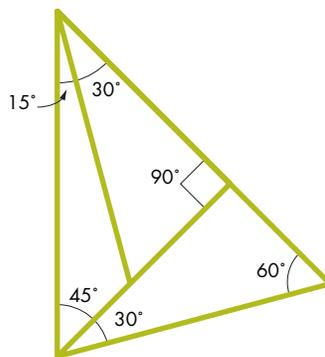


- Fold the lower left corner to meet the edge of the first 30-60-90 triangle you created. Tuck the 90° angle under the last triangle you formed:



Now you have a Pocket Protractor!

- Let's identify the angles:



Write the angles on your protractor.

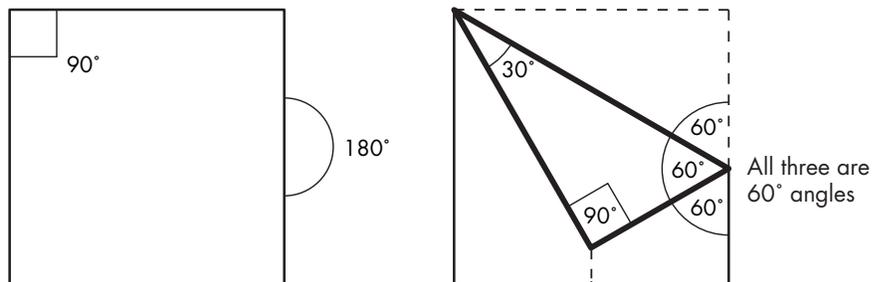
Another angle you can find is 75° because $45^\circ + 30^\circ = 75^\circ$. And if you unfold your 60° angle you double it, which gives you a 120° angle.

- You can put your Pocket Protractor to work by doing one or both of the Related Activities.

Pocket Protractor (continued)

What's Going On?

Folding is a natural way to divide an angle into smaller equal angles. We started with a square, which has four 90° angles. When we created our first 30-60-90 triangle, we got the 30° angle by dividing the upper left corner (90°) into three equal angles and we got the 60° angle by dividing the straight side (180°) into three equal angles (see diagram below). You can probably identify the 90° angle just by looking at it. But here's another way to determine the number of degrees of an angle: The sum of the interior angles of any triangle is 180° , so if you know the number of degrees of two angles, you can know the third by subtracting the sum of the first two from 180° . If you add 30° and 60° , you get 90° . Subtract 90° from 180° and you get 90° —the number of degrees of the third angle.



Extension

Team up with some other members of your group. Work together to try to show why each angle on the Pocket Protractor is, in fact, the number of degrees the label says it is.

Activity adapted from Unfolding Mathematics with Unit Origami, Key Curriculum Press, 1150 65th Street, Emeryville, CA 94608, 1-800-995-MATH, www.keypress.com.