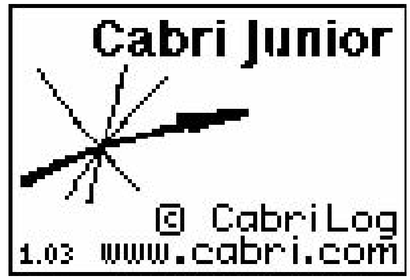
Triangle Side-Angle Inequality Theorems

First, turn on your TI-84 and press the APPS key. Arrow down until you see Cabri Jr and press ENTER. You should now see this introduction screen.

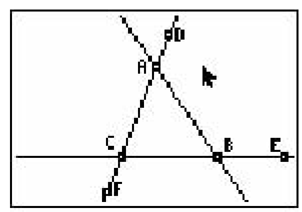



To begin the program, press any key. If a drawing comes up on the screen, press the key (note the F1 above and to the right of the key – this program uses F1, F2, F3, F4, F5 names instead of the regular key names) and arrow down to NEW. It will ask you if you would like to save the changes. Press the key and then enter to not save the changes.

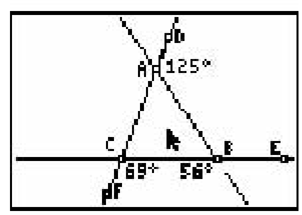
We are now ready to begin.

There are several theorems that make statements about the relationships between the lengths of sides and the degree measures of opposite angles in triangles. In this activity, we will look at two of these theorems. Remember that the interactive constructions demonstrate these theorems, but are not sufficient for proofs of the theorems. However, we can investigate the properties provided in the theorems.

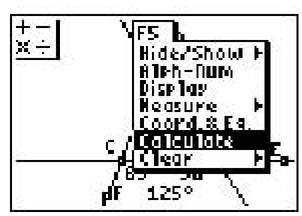
Exterior Angle Inequality – The degree measure of an exterior angle is greater than the measure of the corresponding remote interior angles.




Start by constructing three intersecting lines to form a triangle and its external angles. Label the vertices of the triangle A, B and C and label the points outside the triangle D, E and F.

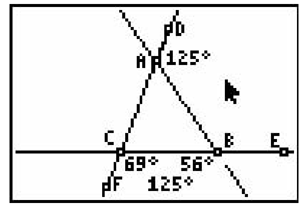



Measure any one of the three external angles. In the diagram, the external angle DAB has been measured. Measure the remote interior angles at C and B. Obviously, the external angle is larger than either of the remote interior angles.

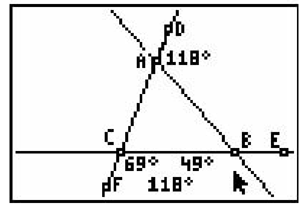



Exterior Angle Theorem can also be verified at the same time. This theorem states that the external angle is equal to the sum of the two remote interior angles. Do show this, press and select the Calculate feature.

To use this feature, move to one of the angle measures for the interior angles. As the cursor moves close to it, the measurement will be underlined. Press to select it. Press the key and move to the second angle measurement. When it is underlined, press to select it. The total will appear with a hand. You can then move it to any location on the screen.

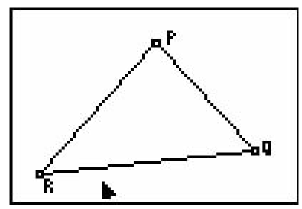



Test the results by dragging one of the vertices of the triangle to other locations. Is the exterior angle always greater than either of the remote interior angles and equal to their sum?

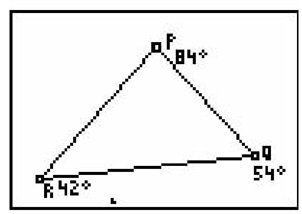



Would the same property hold if one of the other exterior angles was used? Does it make any difference which one you select? Another theorem that we can investigate states that the longest side of a triangle is always opposite the angle of greatest degree measure and the shortest side of the triangle is always opposite the angle of least degree measure.

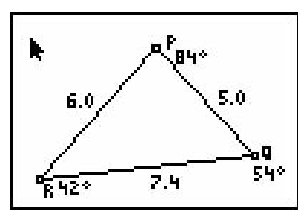
To explore this, construct any triangle PQR. Be sure that the triangle is not equilateral or isosceles.



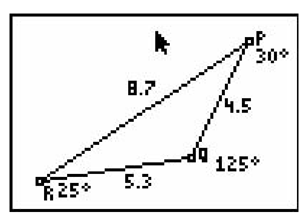

Measure the angles in the triangle and identify the angles that are the greatest and least.




Measure the three sides of the triangle. Compare the largest side to the largest angle. In this diagram, angle P is the largest and is opposite side RQ, which is the longest side. The shortest side, PQ is opposite the smallest angle at R.




To test this property, drag any of the vertices of the triangle to a new location on the screen. Even though the longest side may change, will it still be opposite the largest angle? Will the shortest side still be opposite the smallest angle?




When you get to the study of trigonometry, you will find there is convention in naming sides in relation to the angles. In the diagram, we often refer to angle PQR as just angle

Q. Notice that we always use upper case letters to identify the vertices. The side opposite angle Q would be referred to use the lower case letter q. Thus, side PR is labeled as “q”. Which side corresponds to angle P? Which side corresponds to angle R?