

Investigating the Triangle Sum Conjecture

Aim: To explore this conjecture by gathering data.

Assumptions: Previous experience using *Geometer's Sketchpad*, specifically:

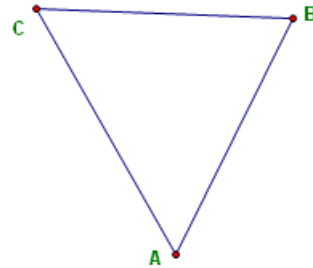
- Drawing a triangle
- Measuring and labeling angles
- Saving and printing GSP files

FIRST:

1. Open GSP, and
2. Draw a triangle (*sketch* with segment tool; do not *construct*), then
3. Measure all of its interior angles (leave them in a list for convenience).

Your finished triangle should look like the one at right.

$m\angle ACB = 58^\circ$
 $m\angle ABC = 66^\circ$
 $m\angle BAC = 56^\circ$



TIP:

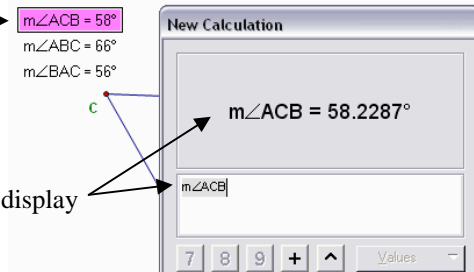
The triangle with measurements should cover an area no larger than 1/9 of the screen. This will leave room for other parts of this activity.

SECOND:

Use GSP's calculator to calculate the sum of the three angles, as follows:

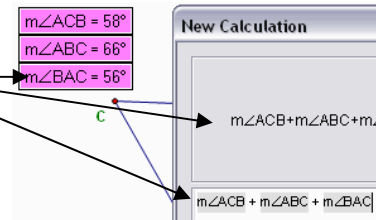
1. In the menu bar, click Measure > Calculate
2. Position the cursor over the colored bar at the top of the calculator, and drag it out of the way of your diagram (so you can at least see the measurements)
3. Click right on the measurement for one angle — you will see some wording appear in the calculator display.
4. Click the calculator's "+" key.
5. Click the second angle.
6. Click the calculator's "+" key.
7. Click the third angle, then "OK" (means "=") — the calculator will disappear.
8. You will see an equation showing the sum of the three interior angles.
9. Drag this so it doesn't cover anything else, then de-select.

Click this; do not type in any numbers



See the calculator display change

Appearance after 6th step (clicked third angle; have not clicked "OK")

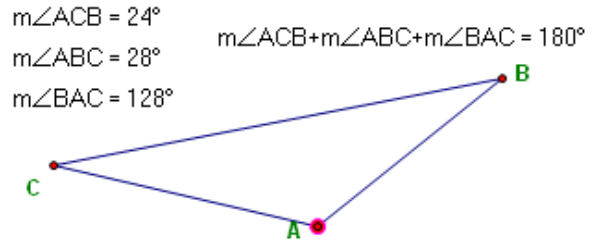


$m\angle ACB = 58^\circ$
 $m\angle ABC = 66^\circ$
 $m\angle BAC = 56^\circ$

$m\angle ACB + m\angle ABC + m\angle BAC = 180^\circ$

THIRD:

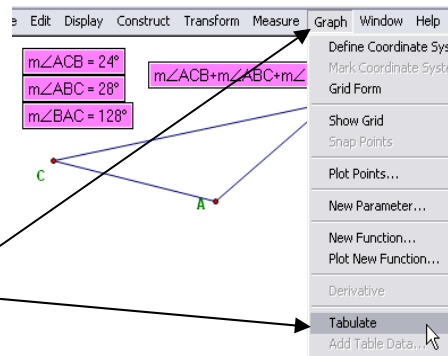
1. Investigate the conjecture by clicking and dragging on any one of your triangle's vertices.
2. **What happens to:**
 - The measure of **each angle**?
 - **The sum** of the three angles?



FOURTH:

Make a table to record your observations. GSP will make the table AND fill in the data. Do these steps:

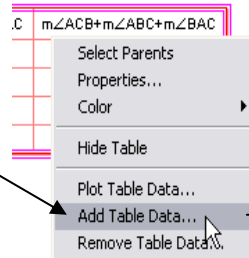
1. **Highlight the three angle measurements , then the equation** showing the sum (this equation must be the fourth thing highlighted)
2. On the menu bar, click **Graph > Tabulate**
3. You will get a table with 4 columns: the first three show the angles, and the fourth (right-hand) column shows the sum. Drag the table out of the way of your triangle and its measurements.
4. **Double-click** on the **sum**.
5. This will make a duplicate of the row containing the measurements and sum of the triangle presently on your screen. Notice it is lighter in color.
6. Go to **any vertex** of your triangle, and **drag** it to change the angles of your triangle. Watch the effect this has on the table. When your second row has different measurements than the first, stop moving the vertex.
7. **Repeat steps 4, 5, and 6 two more times.** You will end up with a table with four rows of measurements, and some evidence to show the conjecture about triangle angles.
8. **RIGHT-click** on the **table**, then click **"Add Table Data"** in the pop-up menu.
9. Click the second radio button, and fill in a number from 10 to 25 in the first box. Leave the other box at 1.0.
10. Click **"OK"**.
11. **Repeat step 6, and keep the vertex** you clicked **moving constantly**. Watch how the table automatically gets a new row every 1.0 seconds.



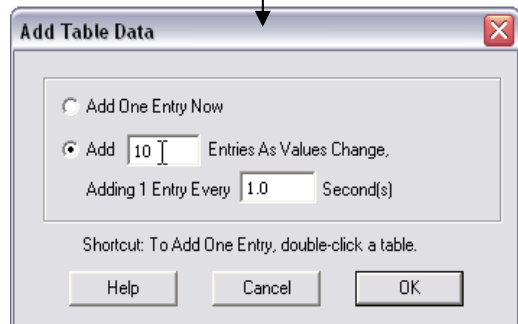
m∠ACB	m∠ABC	m∠BAC	m∠ACB+m∠ABC+m∠BAC
24°	28°	128°	180°

24°	28°	128°	180°
24°	28°	128°	180°

24°	28°	128°	180°
12°	104°	64°	180°
9°	68°	103°	180°
130°	21°	29°	180°



Double-click the bottom row to add a new row below it.



After you have finished the fourth part, you see this:

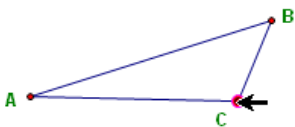
If you feel you need more data, repeat steps 8 through 11.

= 111°

= 50°

= 19°

$m\angle ACB + m\angle ABC + m\angle BAC = 180^\circ$



$m\angle ACB$	$m\angle ABC$	$m\angle BAC$	$m\angle ACB + m\angle ABC + m\angle BAC$
24°	28°	128°	180°
12°	104°	64°	180°
9°	68°	103°	180°
130°	21°	29°	180°
101°	23°	56°	180°
90°	17°	74°	180°
43°	19°	118°	180°
9°	4°	167°	180°
146°	10°	24°	180°
115°	47°	18°	180°
132°	37°	11°	180°
111°	50°	19°	180°

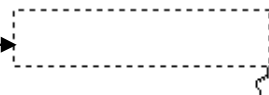
FIFTH:

Write about that you have learned about the conjecture:

1. Click the **text tool**.
2. Move the mouse into an open part of your screen, and **drag the "pointy hand"** you have. This will make a text box.
3. **Type your report** in the text box. Be careful — **GSP does not have a spell checker.**
4. Type in **your name**, too.
5. **TIP:**

You should **"type first, then pretty later."** Type your report and name, **then highlight** text you want to format (change), **then make changes** to the highlighted parts. GSP has a rather simple text editor, so this method works best for it.

6. **De-select** after typing and formatting.



I have discovered that the three angles of a triangle tota
By Billy, 6L

Finally,

- **Save**, then
- **Print** your work



For further exploration:

Use this method to explore the conjecture that can be made about the sum of the interior angles of a:

- Quadrilateral
- Pentagon
- Hexagon
- n-gon (polyon of any number of sides)

When two lines cross, creating vertical angles, there is a relationship between opposite angles. Use a method similar to this one to check out the conjecture.

There are about **20 common conjectures in geometry**. For more, go to the following website (working as of 2005-03-24): <http://www.geom.uiuc.edu/~dwiggins/mainpage.html>