The Cosine Rule

Teacher Answers

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TI-Nspire CAS | Investigation | Student | 30min

Aim

The aim of this investigation is to confirm the Cosine Rule.

Equipment

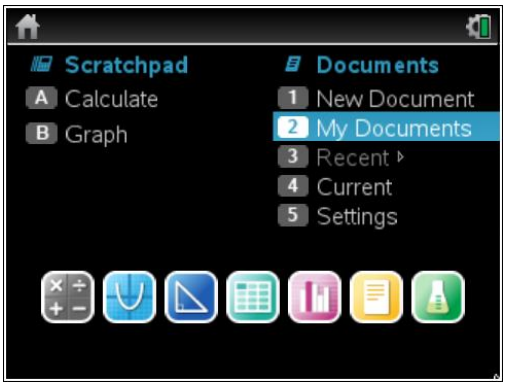
For this activity you will need:

- TI-Nspire CAS (or TI-Nspire)
- TI-Nspire file – Cosine Rule

Introduction – Setting up the calculations

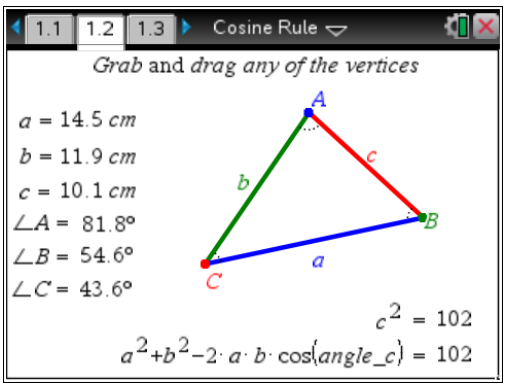
This activity requires access to the "Cosine Rule" TI-Nspire file. This file should be loaded on your device before proceeding.

Once the file is on your handheld, press **home** and select **My Documents**. Locate the "Cosine Rule" file and press **enter** to open.



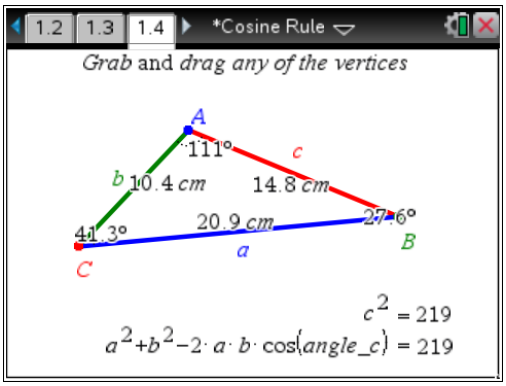
The Cosine Rule is $c^2 = a^2 + b^2 - 2 \cdot a \cdot b \cdot \cos(C)$

Navigate to page 1.2, then grab and drag any of the vertices of the triangle. Observe that even though the measurements change, the Cosine Rule remains true.

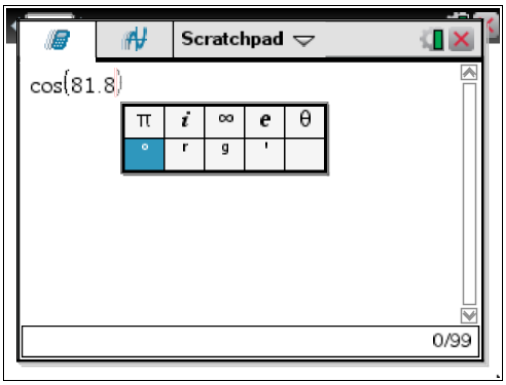


Author: Neale Woods

Navigate to page 1.4, then grab and drag any of the vertices of the triangle. Again, observe that even though the measurements change, the Cosine Rule ratios remain equal.



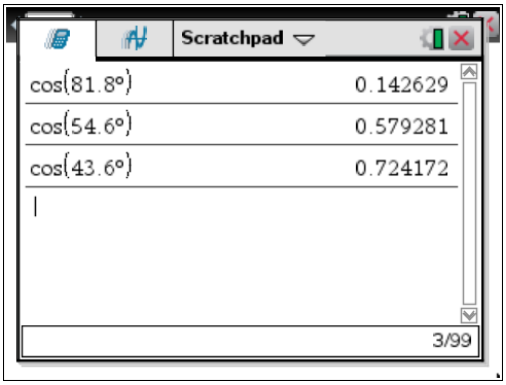
Part of in this investigation requires calculations to be performed. The Scratchpad is a place where calculations can be computed and then discarded. To access the Scratchpad press **home** and select **Scratchpad** (or press **A**). Alternatively, press the [ ] key (this key is not available on a Clickpad).



Change the document setting to **Degree** or use the degree symbol (°). This can be found in the symbol palette or by pressing [ ] or [ ] to access one of the mini-palettes. On a Clickpad, press ctrl + ⏱.

Calculate some of the cosine values from page 1.2.

Because you are inputting decimal values, you will get decimal answers. If you happen to get an exact answer, press **ctrl + enter** for the decimal answer.



To return to the current document, press **esc**. If you are on the **home** page, select **Current** (or press **4**).

1. Alter the triangle on page 1.2 then complete the table below using a new set of values. Compare these to your own calculations using the Scratchpad.

   Several values are possible for the following table.

Side/Angle	Value	Cosine Rule	Page 1.2	Scratchpad
a	14.5	c^2	102	102.01
b	11.9			
c	10.1			
∠A	81.8°	$a^2+b^2-2\times a\times b\times\cos(C°)$	102	101.948
∠B	54.6°			
∠C	43.6°			

2. Are the results on page 1.2 and the Scratchpad the same? In not, why do you think they are different?

   Any discrepancies will be due to rounding errors. The values shown on page 1.2 are rounded values. Consequently, the Scratchpad results may vary.

3. The other two forms of the Cosine Rule are:

   $$a^2=b^2+c^2-2\cdot b\cdot c\cdot\cos(A) \text{ and}$$

   $$b^2=a^2+c^2-2\cdot a\cdot c\cdot\cos(B)$$

   Using the values from the table in question 1, copy and complete this table to verify these two forms of the Cosine Rule. Use the Scratchpad for your calculations.

   Several values are possible for the following table.

a^2	210.25
$b^2+c^2-2\times b\times c\times\cos(A°)$	209.335
b^2	141.61
$a^2+c^2-2\times a\times c\times\cos(B°)$	142.589

4. Do you believe your answers verify the Cosine Rule? Why or why not?

   Yes, although this is not a proof. The results verify the Cosine Rule as these results are very close. Any discrepancies will be due to rounding errors.