

Cabri Jr. Activity: Construction of a Rectangle and Investigating its Properties

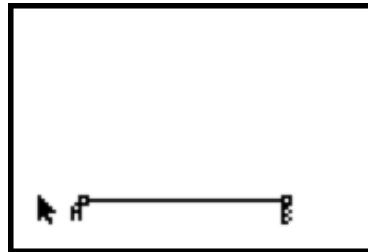
First Turn on your TI-84 Plus and press the APPS key. Arrow down until you see Cabri Jr and press ENTER. You should now see this introduction screen.



To begin the program, press any key. If a drawing comes up on the screen, press the Y= 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 changes. Press the 2nd key and then enter to not save the changes.

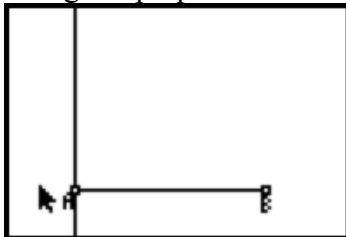
We are now ready to begin.

A rectangle is a special type of parallelogram where all four angles are congruent. So, it is equiangular, but not regular. Can you explain the difference? Is a rectangle ever a regular polygon? If so, what conditions must apply for this to occur?

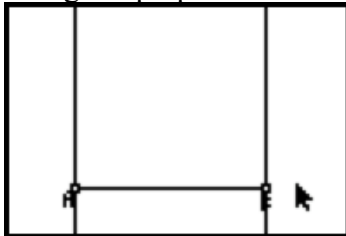


To construct a rectangle, begin with a line segment AB.

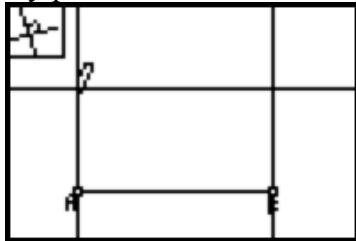
Using the perpendicular tool construct a line perpendicular to AB through point A.



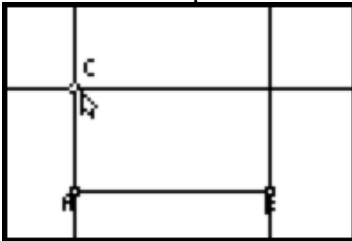
Using the perpendicular tool construct a line perpendicular to AB through point B.



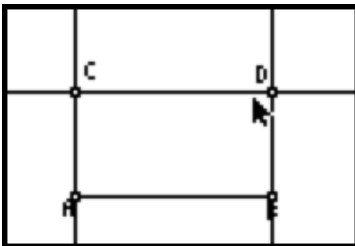
Using the perpendicular tool construct a line perpendicular to the first perpendicular line through any point that is not A.



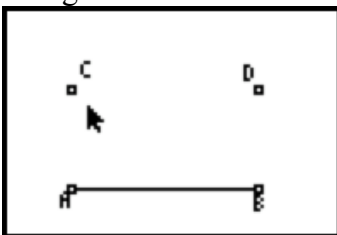
Label the new point C.



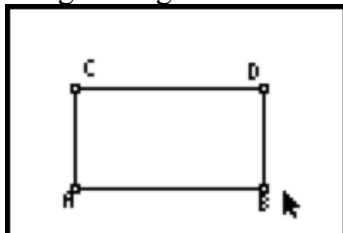
Using the point on intersection tool construct the point where the other two perpendicular lines meet. Label it D.



Using the hide/show tool. Hide the three perpendicular lines.

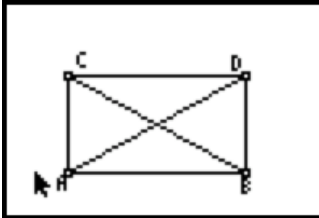


Using the segment tool draw segments AC, CD, and BD.

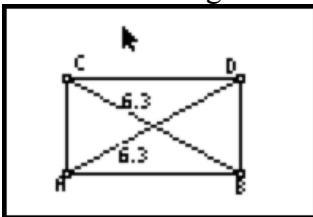


If you drag either point A, B, or C the figure will change, but the right angles will remain the same. Can you explain why? Why can't you drag point D?

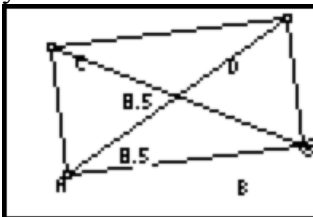
Since this is a special type of parallelogram, it has the same properties as a parallelogram. However, it also displays one unique property. To begin investigating this property, construct the diagonals AD and BC using the segment tool.



Measure the lengths of AD and BC using the measure tool and selecting distance & length.

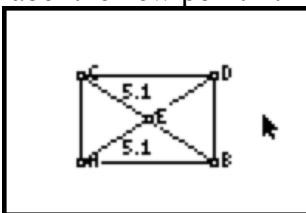


What do you notice about the lengths? Drag point B around to change the rectangle. What do you observe about the lengths as the rectangle changes?

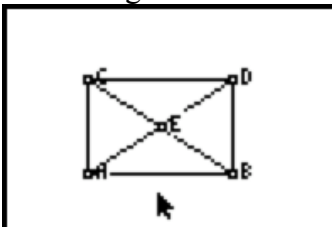


You should discover the property of a rectangle that the diagonals are congruent.

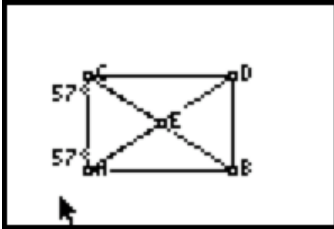
Using the point on intersection tool construct the point where the two diagonals intersect. Then label the new point E.



Next using the hide/show tool hide the lengths of the diagonals.

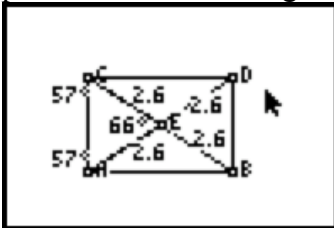


Now we can explore the properties of the triangles formed by the diagonals of the rectangle. First using the measure angle tool measure $\angle CAE$ and $\angle ACE$. What do you notice about their measures? What do you think will be the measure of $\angle AEC$? Measure $\angle AEC$ to test your conjecture.



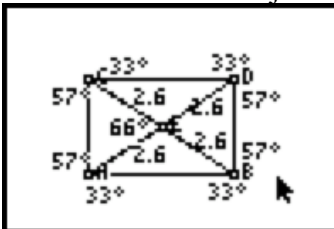
Based on your angle measures what type of triangle is $\triangle AEC$? Let us test the lengths of AE , and CE to verify the conjecture.

Now using the measure distance and length tool measure segments AE , CE , BE , and DE . Since the diagonals were congruent, what do you notice about each of these segments? What does point E do to each diagonal?



You should notice that point E is the midpoint of the diagonals AD and BC .

Since $\triangle AEC$ is an isosceles triangle, how do you think you can classify $\triangle BED$, $\triangle AEB$, and $\triangle CED$? Using the measure angles tool measure $\angle DBE$ and $\angle BDE$ to the conjecture for $\triangle BED$, then measure $\angle ABE$ and $\angle BAE$ to test the conjecture for $\triangle AEB$ and finally measure $\angle DCE$ and $\angle CDE$ to test the conjecture for $\triangle CED$.



So the diagonals of a rectangle split the rectangle into four isosceles triangles. What is the relationship between $\triangle AEB$ and $\triangle CED$? What is the relationship between $\triangle AEC$ and $\triangle BED$?

Since $ABCD$ is a rectangle, remember $\angle CAE$ and $\angle BAE$ are complementary angles. Likewise, $\angle ACE$ and $\angle DCE$ are complements, $\angle CDE$ and $\angle BDE$ are complements, and $\angle ABE$ and $\angle DBE$ are complements.

Do the properties of a rectangle apply to a square as well? What would be the relationship between the four triangles created by a square's diagonals?