

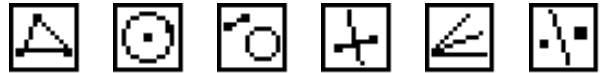
Activity 12

Constructing Triangles

Objectives

- To learn how to construct all types of triangles using the Cabri® Jr. application
- To reinforce the difference between a construction and a drawing

Cabri® Jr. Tools








Introduction

The difference between a construction and a drawing is a very important one in the dynamic geometry environment (see A General Interactive Geometry Issue, page v). This activity focuses on various ways to construct the different types of triangles including isosceles, equilateral, right, and right isosceles. In the first part of the activity, you will make constructions based on a minimal definition of the shape. Then you will construct shapes using a variety of techniques rather than one “correct” method.


Part I: Constructing Triangles from Minimal Definitions

Construction

Construct the following (each as a separate Cabri Jr. figure) using the given minimal definitions.

-  Triangle – a three-sided polygon
-  Isosceles Triangle – a triangle with at least two congruent sides
-  Equilateral Triangle – a triangle with three congruent sides
-  Right Triangle – a triangle with one right angle
-  Isosceles Right Triangle – a right triangle with two congruent sides

Exploration

-  Drag the vertices and sides of the triangles you have constructed to ensure the minimal definitions are retained.

Note: In some constructions, not all vertices or sides are independent objects that will drag.






Questions and Conjectures

Write the steps you used to construct each of the triangles. Be prepared to demonstrate that your construction supports the minimal definition.


Part II: Constructing Triangles using Other Properties

Construction

Construct the following again using a different method (each as a separate Cabri® Jr. figure) taking advantage of other properties of the triangle.

-  Triangle
-  Isosceles Triangle
-  Equilateral Triangle
-  Right Triangle
-  Isosceles Right Triangle

Exploration

-  Drag the vertices and sides of the triangles you have constructed to ensure the constructions are valid.

Questions and Conjectures

Write the steps you used to construct each of the triangles. Explain why each construction is valid even though it does not use the properties of the minimal definitions of each figure. Be prepared to demonstrate.

Teacher Notes



Activity 12

Constructing Triangles

Additional Information

For this activity, you may want to demonstrate one construction for the class so they understand what to do.

The Cabri Jr. tools listed are offered as suggestions to the students of tools that they might consider using. Students are not required to use every one of these tools nor are they limited to only these tools.

Part I: Constructing Triangles from Minimal Definitions

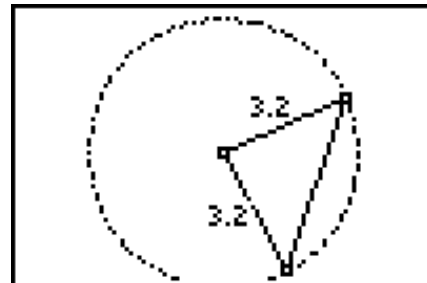
Answers to Questions and Conjectures

Write the steps you used to construct each of the triangles. Be prepared to demonstrate that your construction supports the minimal definition.

Possible triangle constructions based on minimal definitions are given below.

Triangle: The **Triangle** tool constructs, in the sense of this activity, the general triangle.

Isosceles triangle: Construct a circle on the screen using the **Circle** tool. Using the center and radius point on the circle, select one additional point on the circle for the third vertex and construct an isosceles triangle. The construction is valid since all the radii of a circle are congruent.



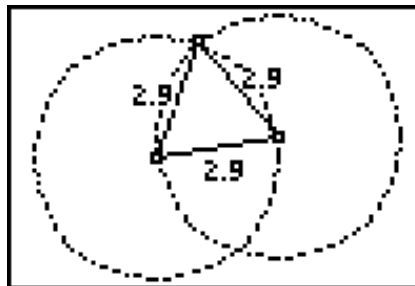
Objectives

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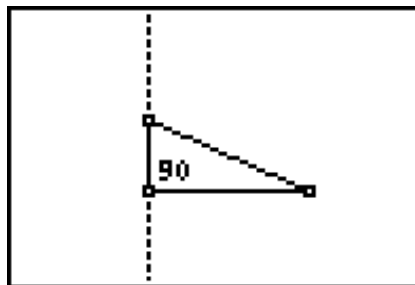


Equilateral triangle: Construct two circles on the screen in such a way that the center of one is the radius point of the other. Construct a triangle using the two center points of the circles and one of the two points of intersection of the circles. The construction is valid since all radii of a circle are congruent and the intersection points of the two circles identify the specific radii that intersect, forming the two other equal sides of the equilateral triangle.

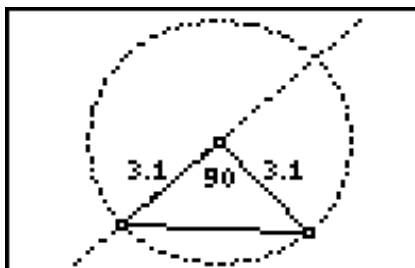


Another method for constructing an equilateral triangle is to use the **Segment** and the **Compass** tools to create two congruent compass circles centered at the endpoints of the segment with radii equal to the length of the segment.

Right triangle: Construct a segment and a perpendicular line at one endpoint of the segment. Construct a right triangle using the endpoints of the segment and any third vertex on the perpendicular line. The construction is valid because the only requisite property of a right triangle is one right angle. The perpendicular line construction guarantees this property.



Right isosceles triangle: Construct a circle and connect its center to its radius point with a segment. Construct a line perpendicular to the segment at the center of the circle. Construct the right isosceles triangle using the center and radius point on the circle and the intersection point of the perpendicular line with the circle. The construction is valid because all the radii of a circle are congruent and the perpendicular construction guarantees a right angle.



Part II: Constructing Triangles using Other Properties

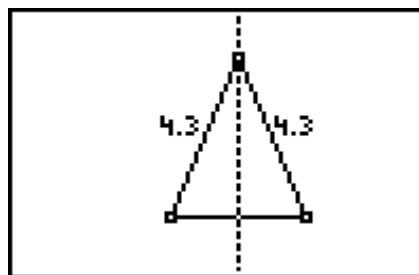
Answers to Questions and Conjectures

Write the steps you used to construct each of the triangles. Explain why each construction is valid even though it does not use the properties of the minimal definitions of each figure. Be prepared to demonstrate.

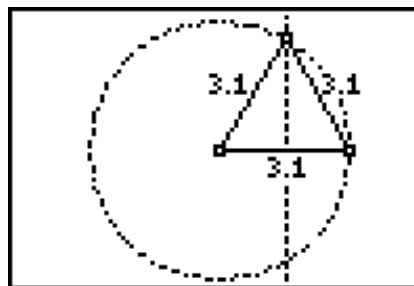
Possible constructions for triangles are given below.

Triangle: A triangle may be constructed using the **Segment** tool to construct three segments with common endpoints. While this construction drags and appears to be a valid triangle, the Cabri® Jr. application does not recognize this figure as a triangle for purposes of area or perimeter measurements or for transformation operations.

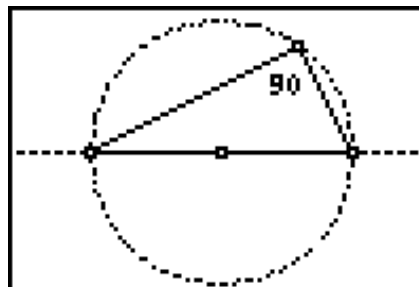
Isosceles triangle: In addition to the commonly defined properties of an isosceles triangle, it is also true that the perpendicular bisector of the base passes through the vertex opposite the base of an isosceles triangle. Using this property, construct a segment for the base of the isosceles triangle and then construct its perpendicular bisector. Construct a point anywhere on the perpendicular bisector and overlay a triangle using this point and the endpoints of the base segment. Measurements confirm that this is an isosceles triangle.



Equilateral triangle: Since an equilateral triangle is a special case of an isosceles triangle, one method of construction uses the perpendicular bisector property cited for isosceles triangles. Construct a base segment and its perpendicular bisector. Select the **Compass** tool and set its size by selecting the base segment. Move the center of the compass circle to either end of the base segment. The compass circle intersects the perpendicular bisector at a point equidistant from both endpoints of the base segment. Overlay a triangle and measure to confirm the construction.

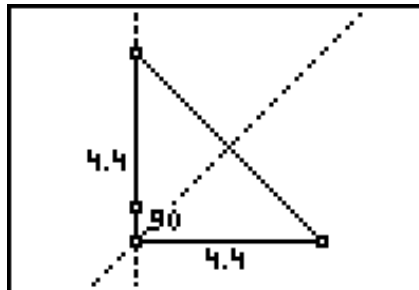


Right triangle: The Central Angle Theorem for Circles states that the measure of a central angle will be twice that of an inscribed angle that meets the circle at the same two points. Construct a circle and, using the **Line** tool, a diameter of the circle. Construct a triangle using the endpoints of the diameter and any point on the circle.



This triangle is a right triangle. The central angle in this case measures 180° since it is a straight angle (the diameter). The measure of the inscribed angle must be half that size, or 90° , creating the right triangle. Interestingly, the vertex of the right angle can be dragged to any position on the circle except the endpoints of the diameter.

Right isosceles triangle: Draw a segment and construct a perpendicular line at one of its endpoints. Construct a point on the perpendicular line. Use the **Angle Bisector** tool to construct the angle bisector of the right angle. (The point constructed on the perpendicular line is needed in the construction of the angle bisector.) Use the



Reflection tool to reflect the other endpoint of the original segment over the angle bisector. Construct an isosceles right triangle using the endpoints of the original segment and the reflected point on the perpendicular line. This construction is valid because of the perpendicular construction, the position of an angle bisector of a right angle, and the properties of a line reflection.