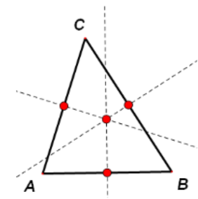
GSP 11.1 Triangle Centers

- ✓ Partner work required (if possible)
- ✓ Name example: Burton_Ciancetta_11.1Triangle_Centers.gsp
- ✓ Save your work frequently. Sometimes the network crashes your application.
- ✓ Use multiple tabs; 1 for part 1, 2 for part 2, etc.

1. Perpendicular Bisectors and the Circumcenter



The **Circumcenter** of a triangle is the intersection of the perpendicular bisectors of the three sides of the triangle.

Question 1
Where is the Circumcenter located (inside or outside the triangle, or on an edge) when a triangle is moved and transformed?

a. When the triangle is an ACUTE triangle (no matter how moved)
b. When the triangle is an OBTUSE triangle (no matter how moved)
c. When the triangle is a RIGHT triangle (no matter how moved)
d. When the triangle is a EQUILATERAL triangle (no matter how moved)

Construction Directions 1ab: Make Flexible Acute and Obtuse Triangles

- Create: a) flexible acute triangle, and b) flexible obtuse triangle.
- Use Construct > Midpoint to create the midpoints of all 3 sides.
- Use Construct > Perpendicular lines to construct the perpendicular bisectors of all 3 sides (don't hide the lines). Make a point where they intersect.
- Measure the vertex angles to ensure that the triangle is a) acute, or b) obtuse.

Construction Directions 1c: Make Flexible Right Triangle

- Make a flexible right triangle that will stay right no matter how moved.
- Construct the Circumcenter of the right triangle, as you did in parts a) and b).
- Measure the vertex angles to make sure that it is a right triangle.

Construction Directions 1d: Make Flexible Equilateral Triangle

- Make a flexible equilateral triangle that will stay equilateral no matter how moved.
- Construct the Circumcenter of the equilateral triangle.
- Measure the angles of your triangle.

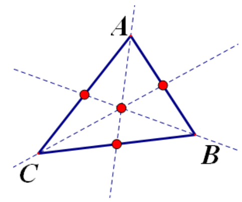
Demonstration 1
Demonstrate what happens in this case by moving around the vertices of your triangles, while making sure the triangles stay (no matter how moved):

a. acute b. obtuse c. right d. equilateral

Answer for 1
Give your answer to questions 1 by using the *Text Tool* and directly typing your answer into your GSP worksheet.

2. Medians and the Centroid

The **Centroid** of a triangle is the intersection of the medians of the three sides of the triangle.



The **Median** of the side of a triangle is the line through a vertex and the midpoint of the opposite side.

Question 2
Where is the Centroid located (inside or outside the triangle, or on an edge) when a triangle is moved and transformed?

a. When the triangle is an ACUTE triangle (no matter how moved)
b. When the triangle is an OBTUSE triangle (no matter how moved)
c. When the triangle is a RIGHT triangle (no matter how moved)
d. When the triangle is a EQUILATERAL triangle (no matter how moved)

Construction Directions 2ab: Make Flexible Acute and Obtuse Triangles

- Create a flexible a) acute triangle, and b) obtuse triangle.
- Use Construct > Midpoint to create the midpoints of all 3 sides.
- Use the line (**not line segment**) tool to construct the medians of all 3 sides (don't hide the full lines).
- Measure the angles of your triangle.
-

Construction Directions 2c: Make Flexible Right Triangle

- Make a flexible right triangle that will stay right no matter how moved.
- Construct the Centroid of the right triangle, as you did in part a) and b).
- Measure the angles of your triangle.

Construction Directions 2d: Make Flexible Equilateral Triangle

- Make a flexible equilateral triangle that will stay equilateral no matter how moved.
- Construct the Centroid of the equilateral triangle.
- Measure the angles of your triangle.

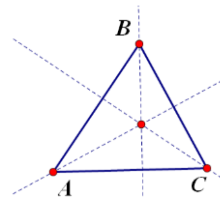
Demonstration 2
Demonstrate what happens in this case by moving around the vertices of your triangles, while making sure the triangles stay (no matter how moved):

a. acute   b. obtuse   c. right   d. equilateral

Answer for 2
Give you answer to question 2 by using the *Text Tool* and directly typing your answer into your GSP worksheet.

3. Altitudes and the Orthocenter

The **Orthocenter** of a triangle is the intersection of the altitudes of the three sides of the triangle.



The **Altitude** of a side of a triangle is the line segment from a vertex of a triangle that is perpendicular to the opposite side.

Question 3
Where is the Orthocenter located (inside or outside the triangle, or on an edge) when a triangle is moved and transformed?

a. When the triangle is an ACUTE triangle (no matter how moved)
b. When the triangle is an OBTUSE triangle (no matter how moved)
c. When the triangle is a RIGHT triangle (no matter how moved)
d. When the triangle is a EQUILATERAL triangle (no matter how moved)

Construction Directions 3ab: Make Flexible Acute and Obtuse Triangles

- Create a flexible a) acute triangle, and b) obtuse triangle.
- Select a vertex and the opposite side of the triangle and construct a perpendicular line to create the altitude for that side. Repeat for all 3 sides (don't hide the full lines).
- Measure the angles of your triangle.

Construction Directions 3c: Make Flexible Right Triangle

- Make a flexible right triangle that will stay right no matter how moved.
- Construct the Orthocenter of the right triangle.
- Measure the angles of your triangle.

Construction Directions 3d: Make Flexible Equilateral Triangle

- Make a flexible equilateral triangle that will stay equilateral no matter how moved.
- Construct the Orthocenter of the equilateral triangle.
- Measure the angles of your triangle.

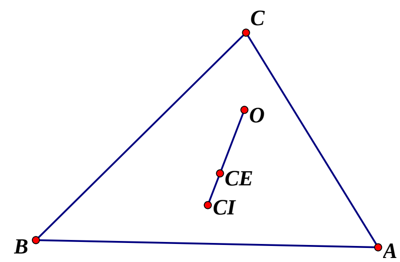
Demonstration 3
Demonstrate what happens in this case by moving around the vertices of your triangles, while making sure the triangles stay (no matter how moved):

a. acute b. obtuse c. right d. equilateral

Answer for 3
Give you answer to question 3 by using the *Text Tool* and directly typing your answer into your GSP worksheet.

4. Circumcenter, Centroid, Orthocenter and the Euler Line.

In any triangle, the Circumcenter, the Centroid and the Orthocenter are on one line, the "Euler Line"



Use the Polygon Tool to create a triangle outline and then construct the Circumcenter, Centroid and Orthocenter of the triangle. Hide all of the construction lines and clearly mark the 3 points (double click on a label to change) as:

O (for orthocenter)
CE (for centroid)
CI (for circumcenter)

Connect these three points with a line segment (the “Euler line”).

a. If the triangle is acute, what happens to the Circumcenter, the Centroid and the Orthocenter? Are any of the centers in the same location? Can you see the Euler line? Support your answer with a diagram of an acute triangle

b. If the triangle is obtuse, what happens to the Circumcenter, the Centroid and the Orthocenter? Are any of the centers in the same location? Can you see the Euler line? Support your answer with a diagram of an obtuse triangle

c. If the triangle is right, what happens to the Circumcenter, the Centroid and the Orthocenter? Are any of the centers in the same location? Can you see the Euler line? Support your answer with a diagram of a right triangle.

d. If the triangle is equilateral, what happens to the Circumcenter, the Centroid and the Orthocenter? Are any of the centers in the same location? Can you see the Euler line? Support your answer with a diagram of an equilateral triangle.