61 Cooperative Learning Activities for Geometry Classes

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7. Triangle Sides

Teacher Guide Page

Learning Outcome: Students will demonstrate their knowledge of the concept of triangle inequality.

NCTM Standards Addressed:

1. Problem solving
2. Communications
3. Reasoning
4. Connections
7. Synthetic geometry
14. Mathematical structure

Time: 30–45 minutes

Materials: Triangle Sides handout, linear measuring tools

Team Size: Three students per group (optimal), selected randomly

Background: This activity is an exploration of the concept of triangle inequality. Students will complete a worksheet individually. They will then form teams and discuss their results. Student teams will make generalizations and form statements that are consistent with their conclusions.

Procedure: Distribute the handout to individual students. Students complete the worksheet. Form teams.

Student directions: "Each of you will compare the results of your work with your team members. Discuss the results, form conclusions, and arrive at generalizations. Finally, write down an analysis of your data. Each team will share its conclusions with the class."

Have a member of each team come to the board and write out the team's analysis. With the entire class, discuss and synthesize the results to arrive at the concept of triangle inequality.

Assessment Opportunities: Student work

Name_____

Date _____

Reproducible 7

Triangle Sides

In the space provided below, draw three line segments that can be placed end to end to make a triangle. List the measurements of the line segments.

Line segments	Diagram of triangle made from line segments

In the space provided below, draw three line segments that cannot be placed end to end to form a triangle.

Line segments	Diagram showing why these segments cannot form a triangle

8. Triangle Angles

Teacher Guide Page

Learning Outcome: Students will demonstrate the ability to associate the relative sizes of angles and lengths of sides in a triangle.

NCTM Standards Addressed:

2. Communication
3. Reasoning
7. Synthetic geometry
14. Mathematical structure

Time: 45 minutes

Materials: Triangle Angles handout, protractors, linear measuring tools

Team Size: Three students per group (optimal), selected randomly

Background: This activity enables students to develop a knowledge of triangle relationships through a process of exploration. After teams are formed, each member of the team will generate data. From the data pool, the team will be challenged to discover the relationship between the length of the sides of the triangle and the sizes of the angles opposite.

Procedure: Form teams. Review and clarify the directions on the handout. Students proceed as directed on the handout. Collect completed student work for formative assessment.

Assessment Opportunities: Student work, teacher observation

Name_____

Date _____

Reproducible 8

Triangle Angles

1. Without collaborating with your teammates, complete the following worksheet. Draw each of the following triangles:

Scalene	Obtuse	Right	Equilateral	Isosceles

Label each triangle *ABC*. Complete the data table.

Type of triangle	Measure of side	Measure of angle
Scalene	*AB* = *AC* = *BC* =	*C* = *B* = *A* =
Obtuse	*AB* = *AC* = *BC* =	*C* = *B* = *A* =
Right	*AB* = *AC* = *BC* =	*C* = *B* = *A* =
Equilateral	*AB* = *AC* = *BC* =	*C* = *B* = *A* =
Isosceles	*AB* = *AC* = *BC* =	*C* = *B* = *A* =

2. Share your results with your teammates. In the space below, write a statement that describes any relationship observed in your data.

_____

_____

_____

9. Triangle Pointers [1]

Teacher Guide Page

Learning Outcome: Students will demonstrate the ability to draw or construct the **median, altitude, angle bisectors,** and **perpendicular bisectors** of a triangle.

NCTM Standards Addressed:

1. Problem solving
2. Communication
3. Reasoning
4. Connections
7. Synthetic geometry

Time: 45 minutes

Materials: Triangle Pointers [1] handout, straightedges, linear measuring tools or construction tools

Team Size: Four or more students per group, selected randomly

Background: This is the first of five activities that will facilitate the construction of student knowledge of the above terms. This knowledge will lead to an understanding of the **centroid, incenter, circumcenter,** and **orthocenter** of a triangle. The overall goal involves the application of this knowledge to introduce geometric theorems.

If geometric constructions have been introduced, their application in these activities is appropriate.

Procedure: Form teams. Review and clarify the directions on the handout.

Careful assessment is key throughout this activity to ensure that students are building a complete and accurate knowledge of terms and concepts. Focus on the team assigned the term "altitude."

After teams assign the terms (see handout) to the team members, students assigned common terms jigsaw to a common location. Jigsaw teams complete the worksheet, return to their home teams, and share their knowledge with their original teammates.

For further individual assessment, assign homework as follows. Assign each student on the team one of the following triangles: obtuse, right, scalene, and isosceles. Have students draw the assigned triangle and draw/construct the median, angle bisector, perpendicular bisector, and altitude of the assigned triangle.

Assessment Opportunities: Student work

Name_____

Date _____

Reproducible 9

Triangle Pointers [1]

Assign one of the following terms to each member of your team:

centroid	**angle bisector**	**perpendicular bisector**	**altitude**

Write the term assigned to you: _____

You will be learning about this term with students from other teams and then return to your home team to share what you have learned with your teammates.

In your "jigsaw" team, learn about the term from a textbook or other resource. On the back of this worksheet draw the following triangles: scalene, obtuse, isosceles, right. Construct or draw the assigned term in each triangle.

10. Triangle Pointers [2]

Teacher Guide Page

Learning Outcome: Students will demonstrate the ability to draw or construct the **centroid, orthocenter, incenter,** and **circumcenter** of a triangle.

NCTM Standards Addressed:

2. Communication
3. Reasoning
4. Connections
7. Synthetic geometry

Time: 45 minutes

Materials: Triangle Pointers [2] handout, straightedges, linear measuring tools or construction tools

Team Size: Four or more students per group, selected randomly

Background: This is the second of five activities that will facilitate the construction of student knowledge of the above terms. Students will use a jigsaw method to build and share their knowledge. A homework assignment will allow students the opportunity to demonstrate their understanding.

Procedure: Distribute assessed student work from Triangle Pointers [1]. Review and discuss any common concerns.

Form teams. Review and clarify the directions on form 1.

Assign the numbers 1 to 4 to team members. Students sharing common numbers meet. Review and clarify the directions on form 2. Jigsaw teams complete form 2 and return to their home teams to share their knowledge.

Assign homework as directed below.

Student directions: "On the reverse side of form 1, draw four congruent triangles. On triangle 1, find the orthocenter. On triangle 2, find the incenter. On triangle 3, find the circumcenter. On triangle 4, find the centroid.

Assessment Opportunities: Student work

Name_____

Date _____

Reproducible 10

Triangle Pointers [2]

Form 1

Assign one of the following terms to each team member. Be sure each term is assigned.

incenter	orthocenter	centroid	circumcenter

Write the term assigned to you. _____

You will learn about the term assigned in a jigsaw team. You will then teach other members of your home team what the term means.

After returning from the jigsaw, take notes as your teammates teach you about each of these terms.

Incenter _____

_____

_____

Orthocenter _____

_____

_____

Centroid _____

_____

_____

Circumcenter _____

_____

_____

(continued)

Name_____

Date _____

Reproducible 10

Triangle Pointers [2] *(continued)*

Form 2

Term Assigned _____

Find your assigned term and associated triangle construction in the list below.

Orthocenter—Altitudes
Circumcenter—Perpendicular Bisectors
Incenter—Angle Bisectors
Centroid—Median

Draw examples of each of the types of triangles listed below. In each triangle, construct/draw the three triangle constructions associated with your assigned term.

Scalene	**Obtuse**
Right	**Isosceles**
Equilateral	

Write what you notice in each instance. You will be sharing this with your "home" teammates.

_____

_____

_____

11. Triangle Pointers [3]

Teacher Guide Page

Learning Outcome: Students will demonstrate knowledge of the significance of the **centroid, incenter,** or **circumcenter** of a triangle.

NCTM Standards Addressed:

2. Communication
3. Reasoning
4. Connections
7. Synthetic geometry

Time: 45 minutes

Materials: Triangle Pointers [3] handout, straightedges, linear measuring tools or construction tools

Team Size: Three students per group, selected randomly

Background: This is the third of five activities.

Team members will be assigned specific tasks. A jigsaw formation will facilitate student learning. Each jigsaw team will receive a different worksheet.

To facilitate this activity, prepare the tools listed in the chart below for distribution.

Procedure: Form teams. Assign each team member one of the following topics:

centroid	incenter	circumcenter

Ensure that each team has a student assigned to each term.

Direct all students assigned the same term to meet.

Assign a gofer for these large teams. Direct the gofers to obtain the handouts and the materials associated with the assigned term.

Centroid	Incenter	Circumcenter
Compass	Compass	Compass
Straightedge	Straightedge	Straightedge
	Protractor	

Review and clarify the directions on the handout. After the jigsaw teams complete their tasks, collect student work for assessment and feedback.

Assessment Opportunities: Student work, teacher observation

Name_____

Date _____

Reproducible 11

Triangle Pointers [3]

Incenter

1. On a separate piece of paper, draw the following triangles:
   scalene obtuse isosceles right equilateral
2. Find the **incenter** of each triangle.
3. Using the compass and a trial-and-error method, draw circles, using the incenter as the center of the circle. Find the circle that has significance to the triangle.
4. Determine the significance of the incenter. Write your response on the back of this sheet.

Name _____

Date _____

Triangle Pointers [3]

Circumcenter

1. On a separate piece of paper, draw the following triangles:
   scalene obtuse isosceles right equilateral
2. Find the **circumcenter** of each triangle.
3. Using the compass and a trial-and-error method, draw circles, using the circumcenter as the center of the circle. Find the circle that has significance to the triangle.
4. Determine the significance of the circumcenter. Write your response on the back of this sheet.

Name _____

Date _____

Triangle Pointers [3]

Centroid

1. On a separate piece of paper, draw the following triangles:
   scalene obtuse isosceles right equilateral
2. Find the **centroid** of each triangle.
3. By gathering data, find the ratio of the distance from the vertex to the **centroid** to the length of the median. Measure carefully. Make a data table on the back of the worksheet. Show the measures and calculated ratios.
4. Determine the predicted theoretical ratio from the calculated ratios, and write it on the back of this sheet.

12. Triangle Pointers [4]

Teacher Guide Page

Learning Outcome: Students will demonstrate the ability to determine the significance of the **centroid**, **incenter**, and **circumcenter** of a triangle.

NCTM Standards Addressed:

1. Problem solving
2. Communication
3. Reasoning
4. Connections
7. Synthetic geometry

Time: 30–45 minutes

Materials: Triangle Pointers [4] handout, protractor, compass, construction tools

Team Size: The same teams as in the previous activity

Background: This is the fourth of five activities.

Formative assessment of the student work from Triangle Pointers [3] is crucial to student success in this activity.

Procedure: Re-form the three jigsaw teams from Triangle Pointers [3].

Assign a gofer to obtain assessed student work from Triangle Pointers [3]. If necessary, allow time for teams to react to teacher assessment and form new conclusions about their work.

Students return to their "home teams" formed at the beginning of Triangle Pointers [3]. Students share their learning.

Distribute the handout for this activity. Review and clarify the directions. Students complete the handout as directed.

Collect student work for formative assessment and review of their self-assessment entries.

Assessment Opportunities: Student work, teacher observation

Name_____

Date _____

Reproducible 12

Triangle Pointers [4]

Work with your "home team" classmates to complete this worksheet.

Draw three different types of triangles in the space below. Be sure to include an obtuse triangle.

1. Select one triangle and find the **centroid** by using one median.
2. Select another triangle and find the center of the inscribed circle. Draw the inscribed circle.
3. Select the third triangle and locate the center of a circumscribed circle. Draw the circle.

Circle the appropriate response to each prompt:

I understand the incenter:	Not at all	Some	A lot
I understand the circumcenter:	Not at all	Some	A lot
I understand the centroid:	Not at all	Some	A lot

13. Triangle Pointers [5]

Teacher Guide Page

Learning Outcome: Students will demonstrate the ability to apply their knowledge of the **medians, angle bisectors, perpendicular bisectors,** and **altitudes** of a triangle.

NCTM Standards Addressed:

1. Problem solving
2. Communication
3. Reasoning
4. Connections
7. Synthetic geometry

Time: 45 minutes

Materials: Triangle Pointers [5] handout, scissors, linear measuring tools, protractors, composition paper, 5" × 8" index cards

Team Size: Three to four students per group, selected randomly

Background: This is the fifth of five activites.

In this activity students will be led through an application of their learning from the past four activities. This activity can also be an exploration into traditional geometric theorems.

Procedure: Form teams. Review and clarify the directions on the handout. Students proceed as directed on the handout.

Form a jigsaw so that students from different teams can share their techniques and outcomes. When students return to their "home teams," encourage them to edit their original responses based on their jigsaw sharing.

Collect completed papers for assessment.

Assessment Opportunities: Student work, teacher observation

Extension Activity: Direct students to write a paper in which they identify a real-life situation in which the medians, angle bisectors, altitudes, or perpendicular bisectors of a triangle are used.

Name_____

Date _____

Reproducible 13

Triangle Pointers [5]

With your teammates, solve each of the problems below. On composition paper, write complete and well-written descriptions of the technique your team used to solve the problems. Include statements that give evidence of your learning and understanding of the geometric concepts included in the problem.

1. Draw a triangle on the 5" × 8" index card. Cut it out with the scissors. Find the median. Balance the triangle on the end of your finger. Describe your findings.

   _____

   _____

   _____

2. A plane is about to land. It is currently 3 miles from where it will stop after landing. The runway is .5 miles long. By carefully creating a scale drawing, determine the number of feet the plane must descend to touch down at the end of the runway.

3. Draw triangle ABC such that angle $A = 50°$, angle $B = 60°$, and angle $C = 70°$. Draw or construct the angle bisectors but only to the incenter. Label the incenter D. Find the measures of the angles formed at point D. Determine the relationship that the angle measures at the incenter have with the vertex angles. Gather as much data as possible from your teammates.