

TITLE OF LESSON

Geometry Unit 1 Lesson 13 – Geometric Concepts, Part 5: Angles II
Prove it! What's on the outside? What's on the inside? Of Geometry

TIME ESTIMATE FOR THIS LESSON

One class period

ALIGNMENT WITH STANDARDS

California – Geometry

Introductory lesson necessary for:

- 4.0 Students prove basic theorems involving congruence and similarity.
 - 5.0 Students prove that triangles are congruent or similar, and they are able to use the concept of corresponding parts of congruent triangles.
 - 6.0 Students know and are able to use the triangle inequality theorem.
 - 7.0 Students prove and use theorems involving the properties of parallel lines cut by a transversal, the properties of quadrilaterals, and the properties of circles.
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MATERIALS

None

LESSON OBJECTIVES

- To give students an introduction to some basic geometric concepts
 - To begin to understand basic properties of angles
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EXPLANATION OF LESSON

This lesson is the second of three introductory lessons on angles. We continue with the introduction to the measurement of angles. We introduce various types of angles including Acute, Right, Obtuse, Straight, Reflex, Adjacent, Vertical, Congruent, Complimentary and Supplementary angles.

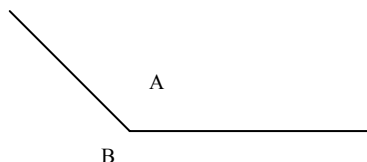
FOCUS AND MOTIVATE STUDENTS

- 1) Homework Check – Stamp/initial complete homework assignment. Pass back graded work and have students place in the appropriate sections of their binders.
 - 2) [Agenda](#) – Have students copy the agenda.
 - 3) Present Homework – (5 minutes) Have individual students present parts of their homework. For instance ask one student to show us what the 30° angle looks like and have the student draw the angle. Then ask each question such as: “if that is a 30° angle then what does a 29° or a 31° angle look like. We want them to understand what larger or smaller angles look like.
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ACTIVITIES – INDIVIDUAL AND GROUP

1. Discussion: Angles that are greater than 180° -- How would an angle look that is greater than 180° ? Draw one on the board. What do you think the largest angle is? We had said earlier that angles are measured between 0° and 360° . These are actually the same. What about the angle on the other side? Draw the angle below without the labels. Ask students about how large they think the angle is. Guide them, through questions, toward 120° (or so—depending on how exact your drawing is!). Label the inside angle A and add the measurement 120° . Now ask what they think the measurement of the other angle is. If no one answers, label the outside angle B . Now, they may be able to see that $m\angle B$ must be 240° . If not, start the chalk/dry erase marker at the beginning of the

angle you drew in to measure 120° for $\angle A$. Trace the 120° , but continue around until you have traced both $\angle A$ and $\angle B$ —and made a full circle on the board. Students should now see clearly that the two angles add up to 360° because they form a circle. Now you can also point out that both 0° and 360° are in the same place. You'll be returning to all of this later in the unit.

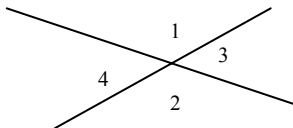


2. (5 minutes): Do some exercises using an analog clock. What is the angle formed when the time is 3 o'clock? What is the angle formed when the time is 9 o'clock? What if we measured it the other way? (One way the angle is 270° and the other way the angle is 90° . What time is it when we have a 60° angle? (2 o'clock, but it could also be other times) What time is it when the angle formed by the hands is 180° ? (It could be 6 o'clock but it could also be 15 minutes before 3 or 20 before 2 or any of an infinite number of times.)
3. **Vocabulary** – Define the following angles:
 - a. **Acute Angle:** (2 minutes) An Acute angle is an angle that measures less than 90° . Demonstrate by drawing an acute angle on the board. Ask if you can think of any example of things that are measured by acute angles. Have the students copy the definition into their binders in the section terms and definitions. Have each student make a drawing of an acute angle to accompany the definition. Have 3 students form an acute angle by standing in the room.
 - b. **Right Angle:** (2 minutes) A right angle is an angle that measures 90° . Demonstrate by drawing a right angle on the board. Ask if you can think of any example of things that are measured by right angles. Have the students copy the definition into their binders in the section terms and definitions. Have each student make a drawing of a right angle to accompany the definition. Have 3 students form a right angle by standing in the room.
 - c. **Obtuse Angle:** (2 minutes) An Obtuse angle is an angle that measures more than 90° but less than 180° . Demonstrate by drawing an obtuse angle on the board. Ask if you can think of any example of things that are measured by obtuse angles. Have the students copy the definition into their binders in the section terms and definitions. Have each student make a drawing of an obtuse angle to accompany the definition. Have 3 students form an obtuse angle by standing in the room.
 - d. **Straight Angle:** (2 minutes) An angle that measures 180° is a straight angle. Demonstrate by drawing a straight angle on the board. Ask if you can think of any example of things that are measured by straight angles. Have the students copy the definition into their binders in the section terms and definitions. Have each student make a drawing of a straight angle to accompany the definition. Have 3 students form a straight angle by standing in the room.
 - e. **Reflex Angle:** (2 minutes) An angle that measures more than 180° and less than 360° is a reflex angle. Demonstrate by drawing a reflex angle on the board. Ask if you can think of any example of things that are measured by reflex angles. Have the students copy the definition into their binders in the section terms and definitions. Have each student make a drawing of a straight angle to accompany the definition. Have 3 students form a reflex angle by standing in the room. What do you notice about the formation of a reflex angle? (It is the same formation as for an obtuse or acute angle. It is measured the other way.)
 - f. **Adjacent Angles:** (5 minutes) Adjacent angles are two angles that have the same vertex and a common side between them. Ask if anyone can draw adjacent angles on the board just from this description. If no one can draw them correctly draw them yourself. Have the students copy the definition into their binders in the section terms and definitions. Have each student make a drawing of adjacent angles to accompany the definition. Ask the question “If we were to form these angles by using students, how many students do we need? Form adjacent angles by having students stand in formation. We have not introduced the addition

angles but we can at least allude to the idea now and later on we will have the students recall this. Note that the two adjacent angles when added together form one large angle that has a size that is equivalent to the addition of the two adjacent angles. Ask the question: “if one adjacent angle measures 30° and the other measures 20° , what do you think the large angle which is composed of the 2 adjacent angles measures?”

- g. Vertical Angles: (5 minutes) Vertical angles are two non adjacent angles formed by two intersecting lines.

So in this drawing angles 1 and 2 are vertical angles and 4 and 3 are vertical angles. Angles 1 and 3, 3 and 2, 2 and 4, and 4 and 1 are all pairs of adjacent angles. Elicit this fact from the students. An important fact about vertical angles is that they are equal in size to each other. See if anyone notices this fact. Have the students copy the definition into their binders in the *terms and definitions* section. Have each student draw vertical angles to accompany the definition. Have the students form vertical angles by standing in formation.



- h. Congruent Angles: (5 minutes) Congruent angles are angles that are equal. What types of angles have we seen that are congruent. (Vertical angles) Have the students copy the definition into their binders in the *terms and definitions* section. Have each student draw adjacent angles to accompany the definition. If we had a right angle (90° angle) and we divided it into two adjacent angles that are congruent what would be the measure of the two adjacent angles? (45°) What would be the measure of 3 adjacent and congruent angles that add up to a straight angle? (60° each). Ask a number of questions of this type.
- i. Complimentary Angles: (5 minutes) Complimentary angles are two angles that measure a total of 90° . Have someone go to the board and demonstrate this concept. Ask a number of questions of the sort “If you have a 30° what is the size of the other angle if the two angles are complimentary?” “Is it possible for one of two complimentary angles to be an obtuse angle?” (No, both must be acute.) Have the students include this definition in their notebooks. Have them form the configuration of complimentary angles by standing in the room.
- j. Supplementary Angles: (5 minutes) Supplementary angles are two angles that measure a total of 180° . Have someone go to the board and demonstrate this concept. Ask a number of questions of the sort “If you have a 30° what is the size of the other angle if the two angles are supplementary?” “Is it possible for one of two supplementary angles to be an obtuse angle?” (Yes) Can both be obtuse? (No) Can both be acute? (No) Can both be neither? (Yes, if they are both right angles.) Have the students include this definition in their notebooks. Have them form the configuration of supplementary angles by standing in the room.

4. Homework Review – Explain the homework assignment. Student binders should have all agendas in the very front, be organized by section and date, and should be ready to turn in for Lesson 15.
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HOMEWORK

- 1) For Lesson 16: Make ten observations of objects, buildings, roads or anything else that is in the configuration of one of the types of angles we have described.
 - 2) **Binders** – Organize binders by date and section. Due Lesson 15.
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GROUP ROLES

Students will be working as individuals for this session.

DOCUMENTATION FOR PORTFOLIO

None