AGA2 Notes for Lesson 1-4 Measuring Angles

Please read pages 27 – 31.

An _____________________ is formed by two rays with the same endpoint.

The rays are the __________________ of the angle.

The endpoint is the ______________________ of the angle.

You can name an angle by:
- its vertex, < A
- a number, < 1
- a point on each ray(side) and the vertex, <BAC or <CAB

When you name angles using three points, the vertex must go in the middle.

The ________________ of an angle is the region containing all
the points between the two sides of the angle.

The _________________ of an angle is the region containing all
the points outside the angle.

Naming Angles:

In this diagram <1 is can also be named <JMK or <KMJ.

What are two other ways of naming <KML?

Think About It: from the diagram above, would it be correct to name any angle <M?
Explain

Complete the Naming Angles Kuta worksheet.
Measuring Angles

One way to measure the size of an angle is in degrees. To indicate the measure of an angle, write a lowercase $m$ in front of the angle symbol. In the diagram, the measure of $\angle A$ is 62. You write this as $m\angle A = 62$. In this book, you will work only with degree measures.

A circle has $360^\circ$, so 1 degree is $\frac{1}{360}$ of a circle. A protractor forms half a circle and measures angles from $0^\circ$ to $180^\circ$.

Using a Protractor to Measure Angles

Consider $\overline{OB}$ and a point $A$ on one side of $\overline{OB}$. Every ray of the form $\overline{OA}$ can be paired one to one with a real number from 0 to 180.

To measure an angle with a protractor, place the horizontal center hole on the vertex and align on side with the horizontal line along the bottom of the protractor.

- If the other side opens counterclockwise, read the protractor angle values from 0 to $180^\circ$ using the inside numbers.

- If the other side opens clockwise, read the protractor angle values from 0 to $180^\circ$ using the outside numbers.

Before completing Angle Measurement with Protractor Kuta worksheet, practice: Use a protractor to measure the following angles, you may need to extend the sides to better read the protractor.
AGA2 Notes for Lesson 1-4 Measuring Angles

You can classify angles according to their measures.

**Key Concept  Types of Angles**

<table>
<thead>
<tr>
<th>Type</th>
<th>Description</th>
<th>Equation</th>
<th>Diagram</th>
</tr>
</thead>
<tbody>
<tr>
<td>acute angle</td>
<td>$0 &lt; \theta &lt; 90$</td>
<td>$\theta$</td>
<td><img src="image" alt="Acute Angle" /></td>
</tr>
<tr>
<td>right angle</td>
<td>$\theta = 90$</td>
<td>$\theta$</td>
<td><img src="image" alt="Right Angle" /></td>
</tr>
<tr>
<td>obtuse angle</td>
<td>$90 &lt; \theta &lt; 180$</td>
<td>$\theta$</td>
<td><img src="image" alt="Obtuse Angle" /></td>
</tr>
<tr>
<td>straight angle</td>
<td>$\theta = 180$</td>
<td>$\theta$</td>
<td><img src="image" alt="Straight Angle" /></td>
</tr>
</tbody>
</table>

Create the four-panel foldable study guide for Types of Angles.

**Measuring and Classifying Angles Based on those Measurements**

Based on the measurements of angles, you can then use those measurements to classify angles by their type.

**What are the measures of $\angle LKN$, $\angle JKL$, and $\angle JKN$? Classify each angle as acute, right, obtuse, or straight.**

![Protractor Image]

Use the definition of the measure of an angle to calculate each measure.

$m\angle LKN = |145 - 0| = 145$; $\angle LKN$ is obtuse.

$m\angle JKL = |90 - 145| = |-55| = 55$; $\angle JKL$ is acute.

$m\angle JKN = |90 - 0| = 90$; $\angle JKN$ is right.

Complete the [Classify Angles](https://example.com) Kuta worksheet.
Congruent Angles

So far we have examined how angles are formed, named, measured, and classified.

In this next section, we will examine pairs of angles.

Let's begin with congruent angles (angles with equivalent measurements).

Angles with the same measure are **congruent angles**. This means that if $m\angle A = m\angle B$, then $\angle A \cong \angle B$. You can also say that if $\angle A \cong \angle B$, then $m\angle A = m\angle B$.

You can mark angles with arcs to show that they are congruent. If there is more than one set of congruent angles, each set is marked with the same number of arcs.

Notice the use of the congruent sign ($\cong$) which indicates equivalent measures. For example, an angle with a measure of $(x + 10)$ is equivalent to an angle with a measurement $(3x)$ when $x = 5$.

Also notice how the “arc” is used to show congruent angles. You do not need to know the actual value of the measurement when showing congruency with arcs.

In the following image, write statements that shows the congruent angles.
Angle Addition

**Postulate 1-8  Angle Addition Postulate**

If point $B$ is in the interior of $\angle AOC$, then $m \angle AOB + m \angle BOC = m \angle AOC$.

Basically, this is saying that if there is a point in the interior of a larger angle, then a ray formed in that angle using that point results in two smaller angles for which the sum of the measurements of those smaller angles is equal to the measure of that larger angle.

**Algebra** If $m \angle RQT = 155$, what are $m \angle RQS$ and $m \angle TQS$?

\[
(4x - 20) + (3x + 14) = 155 \quad \text{Angle Addition Postulate}
\]

\[
7x - 6 = 155 \quad \text{Substitute.}
\]

\[
7x = 161 \quad \text{Combine like terms.}
\]

\[
x = 23 \quad \text{Add 6 to each side.}
\]

\[
m \angle RQS = 4x - 20 = 4(23) - 20 = 92 - 20 = 72 \quad \text{Substitute 23 for } x.
\]

\[
m \angle TQS = 3x + 14 = 3(23) + 14 = 69 + 14 = 83
\]

4. $\angle DEF$ is a straight angle. What are $m \angle DEC$ and $m \angle CEF$?
AGA2 Notes for Lesson 1-4 Measuring Angles

Extensions to Angle Addition

The last example showed that when two angles share a side, the sum of those angle is equal to the value of the outer angle form by the other two sides. We found the measure of the outer angle by adding the measures of the inner angles.

Using the same concept, you can determine the measurement of one of those interior angles if the measure of the outer angle and the measure of one of the interior angles is known.

In the diagram below, \( m<\text{RST} = 158^\circ \) and \( m<\text{RSA} = 75^\circ \), find \( m<\text{AST} \).

\[
\begin{align*}
m<\text{RSA} + m<\text{AST} &= m<\text{RST} & \text{angle addition postulate} \\
75 + m<\text{AST} &= 158 & \text{using substitution} \\
-75 & & -75 \\
\hline
m<\text{AST} &= 83^\circ
\end{align*}
\]

Unknown angles can also be found with algebraic expressions for angle measures.

In the next example, you are given a combination of algebraic and numeric values the angle measures resulting in the following process to solve for \( x \) then using that value to find the measure of the unknown angle.

\[
\begin{align*}
m<\text{YLK} + m<\text{MLY} &= m<\text{MLK} \\
(9x - 6) + 63 &= 15x - 3 \\
9x + 57 &= 15x - 3 \\
9x + 60 &= 15x \\
60 &= 6x \\
x &= 10
\end{align*}
\]

Given \( m<\text{MLK} \) is \( 15x - 3 \) and \( x = 10 \), \( 15(10) - 3 = 150 - 3 = 147^\circ \).

Complete the Angle Addition Kuta worksheet
Lesson Check 1-4

Use the diagram for Exercises 1–3.

1. What are two other names for \( \angle 1 \)?

2. **Algebra** If \( m\angle ABD = 85 \), what is an expression to represent \( m\angle ABC \)?

3. Classify \( \angle ABC \).

5. **Error Analysis** Your classmate concludes from the diagram below that \( \angle JKL \cong \angle LKM \). Is your classmate correct? Explain.
Lesson 1-4 Summative Assessment

Name:

6. Name each shaded angle in three different ways.

7. Using the same diagram as the problem above, name an obtuse angle plus give the measurement of the angle you named.

8. Using the same diagram as the problem above, name an obtuse angle plus give the measurement of the angle you named.

9. Use the diagram below. Find the measure of each angle. Then classify the angle as acute, right, obtuse, or straight.

10. \( \angle EAF \)  

11. \( \angle DAF \)

In this space, draw and label an image of straight angle \(<XYZ\)
Use the diagram below. Complete each statement.

18. \( \angle CBJ \equiv \)

20. If \( m\angle EFD = 75 \), then \( m\angle JAB = \)

22. If \( m\angle ABD = 79 \), what are \( m\angle ABC \) and \( m\angle DBC \)?