

Analytic Geometry January 13, 2016

### Proving Theorems about Lines & Angles

#### Proving the Vertical Angles Theorem

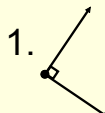

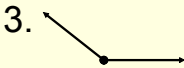
EQ: How do angle relationships work together in two pairs of intersecting, opposite rays?

MCC9-12.G.CO.9 Prove theorems about lines and angles. Theorems include: vertical angles are congruent; when a transversal crosses parallel lines, alternate interior angles are congruent and corresponding angles are congruent; points on a perpendicular bisector of a line segment are exactly those equidistant from the segment's endpoints.

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### Warm-Up:

Label each angle as Acute, Obtuse or Right.

1.  2.  3. 

4.  $m\angle A = 63^\circ$  5.  $m\angle C = 90^\circ$  6.  $m\angle B = 145^\circ$

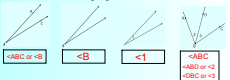
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#### Key Concepts:

**Angles** can be labeled with one point at the vertex, three points with the vertex point in the middle, or with numbers.

If the vertex point serves as the vertex for more than one angle, three points or a number must be used to name the angle.

Name each of the following angles:



$\angle ABC$  or  $\angle CB$     $\angle B$     $\angle 1$     $\angle ABC$     $\angle ABC$  or  $\angle 2$     $\angle ABC$  or  $\angle 3$

**Adjacent angles** are angles that lie in the same plane and share a vertex and a common side. They have no common interior points.

$\angle ABC$  is adjacent to  $\angle CBD$ .

**Nonadjacent angles** have no common vertex or common side, or have shared interior points.

$\angle ABE$  is not adjacent to  $\angle FCD$ .

**Linear Pairs** are pairs of adjacent angles whose non-shared sides form a line.

$\angle ABC$  and  $\angle CBD$  are a linear pair.

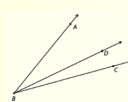
**Vertical angles** are nonadjacent angles formed by two pairs of opposite rays.

Vertical angles are **congruent**.

$\angle ABC$  and  $\angle CBD$  are vertical angles.  
 $\angle ABE$  and  $\angle CBD$  are vertical angles.

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The Angle Addition Postulate means that the measure of the larger angle is made up of the **Sum** of the two smaller angles inside it.

  $\angle ABD + \angle DBC = \angle ABC$

**Supplementary angles** are two angles whose sum is  $180^\circ$ . They can form a linear pair or be nonadjacent.

**Adjacent Supplementary**   **Nonadjacent Supplementary**

$\angle ABD + \angle DBC = 180^\circ$     $\angle PQR + \angle TUV = 180^\circ$

\*adjacent supplementary angles are a linear pair

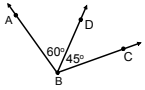
**Complementary angles** are two angles whose sum is  $90^\circ$ . They can form a right angle or be nonadjacent.

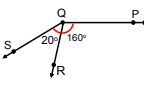
**Adjacent Complementary Angles**   **Nonadjacent Complementary Angles**

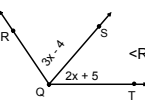
$\angle 1 + \angle 2 = 90^\circ$     $\angle B + \angle C = 90^\circ$

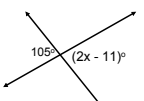
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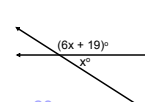
### EXAMPLES: (Vertical Angles, Angle Addition, and Linear Pairs)

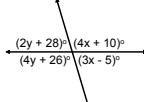
1.   $m\angle ABC = 105^\circ$

2.   $m\angle PQR = 140^\circ$

3.   $\angle RQT = 111^\circ$   
 $x = 22$   
 $\angle RQS = 62^\circ$   
 $\angle SQT = 49^\circ$

4.   $x = 68$

5.   $x = 23$

6.   $x = 25$   
 $y = 21$

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### More Examples: (Complementary and Supplementary Angles)

7. Find the measure of an angle that is 10 more than 3 times its complement.  $\angle A = 70^\circ$

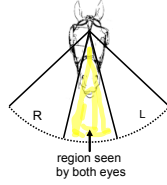
8. The measure of an angle is 30 less than 2 times its complement. Find the measure of the angle and its complement.  $\angle A = 50^\circ$   
 $\angle B = 40^\circ$

9. An angle is 20 less than 3 times its supplement. Find the measure of the angle and its supplement.  $\angle A = 130^\circ$   
 $\angle B = 50^\circ$

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# CHALLENGE!

10. Each eye of a horse wearing blinkers has an angle of vision that measures  $100^\circ$ . The angle of vision that is seen by both eyes measures  $60^\circ$ . Find the angle of vision seen by the horse's left eye alone.



$20^\circ$

11. Using the figure below, find the measure of the angle formed by Park St. and 116th St.



$55^\circ$

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# HOMEWORK WORKSHEET

On-line and textbook help references: p.63  
<http://www.regentsprep.org/Regents/math/geometry/GP5/LAngles.htm>  
<http://www.mathopenref.com/anglesvertical.html>  
<https://www.khanacademy.org/math/geometry/parallel-and-perpendicular-lines/complementary-supplementary-angles/v/complementary-and-supplementary-angles>

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