Parallel Lines Cut by a Transversal Properties

There are 4 named types of angle relationships that are created when two lines **that are parallel** are crossed by the same line (called a transversal): “Corresponding,” “Alternate Exterior,” “Alternate Interior,” and “Same Side Interior.”

Look at the identified angle pairs below, and answer the given questions.

|  |  |  |  |
| --- | --- | --- | --- |
| **Corresponding Angles**  | **Alternate Exterior Angles**  | **Alternate Interior Angles**  | **Same Side Interior Angles**  |
|  |  |  |  |
| $∠1$ **and** $∠5$ are corresponding (matching).$∠2$ **and** $∠6$ are corresponding (matching).$∠3$ **and** $∠7$ are corresponding (matching).$∠4$ **and** $∠8$ are corresponding (matching).1. What makes an angle pair “corresponding”? | $∠1$ **and** $∠8$ are alternate (opposite) exterior (outside).$∠2$ **and** $∠7$ are alternate (opposite) exterior (outside).2. What makes an angle pair “alternate exterior”? | $∠3$ **and** $∠6$ are alternate (opposite) interior (inside).$∠4$ **and** $∠5$ are alternate (opposite) interior (inside).3. What makes an angle pair “alternate interior”? | $∠3$ **and** $∠5$ are same side interior (inside).$∠4$ **and** $∠6$ are same side interior (inside).4. What makes an angle pair “same side interior”? |
| 5. What are the 4 corresponding angle pairs? | 6. What are the 2 alternate exterior angle pairs? | 7. What are the 2 alternate interior angle pairs? | 8. What are the 2 same side interior angle pairs? |

There are 4 properties about these angles that happen **when the lines are marked as parallel.** They are the:

|  |  |  |  |
| --- | --- | --- | --- |
| **Corresponding Angles Postulate** | **Alternate Exterior Angles Theorem** | **Alternate Interior Angles Theorem** | **Same Side Interior Angles Theorem** |
| Given steps:\*The lines are parallel (it says so, or they’re marked with matching arrows).\*The angles are corresponding. | Given steps:\*The lines are parallel (it says so, or they’re marked with matching arrows).\*The angles are alternate exterior. | Given steps:\*The lines are parallel (it says so, or they’re marked with matching arrows).\*The angles are alternate interior. | Given steps:\*The lines are parallel (it says so, or they’re marked with matching arrows).\*The angles are same side interior. |
| The resulting step:The angles are congruent. | The resulting step:The angles are congruent. | The resulting step:The angles are congruent. | The resulting step:The angles add to equal 180˚ |
| EXAMPLE:

|  |  |
| --- | --- |
| $$a||b$$ | Given |
| $$∠5 \& ∠7 are$$Corr. $∠s$ | Given |
| $$∠5≅∠7$$ | Corr. $∠s $Post. |
|  |  |

 | EXAMPLE:

|  |  |
| --- | --- |
| $$a||b$$ | Given |
| $$∠5 \& ∠4 are$$Alt. Ext. $∠s$ | Given |
| $$∠5≅∠4$$ | Alt. Ext. $∠s $Thm. |

 | EXAMPLE:

|  |  |
| --- | --- |
| $$a||b$$ | Given |
| $$∠ 2 \& ∠7 are$$Alt. Int. $∠s$ | Given |
| $$∠2≅∠7$$ | Alt. Int. $∠s $Thm. |

 | EXAMPLE:

|  |  |
| --- | --- |
| $$a||b$$ | Given |
| $$∠6 \& ∠7 are$$S.S. Int. $∠s$ | Given |
| $$m∠6+m∠7=180˚$$ | S.S. Int. $∠s $Thm. |

 |

|  |  |  |
| --- | --- | --- |
| 9. |  | 10. |
| Given:  Prove: $∠5≅∠3$ |  | Given:  Prove: $m∠4+m∠5=180˚$ |
| $$c||d$$ | \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ |  | $$c||d$$ | \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ |
| $$∠5 \& ∠3 are \\_\\_\\_\\_\\_\\_\\_\\_\\_\\_\\_\\_\\_\\_$$ | \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ |  | $$∠4 \& ∠5 are \\_\\_\\_\\_\\_\\_\\_\\_\\_\\_\\_\\_\\_\\_$$ | \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ |
| $$∠5≅∠3$$ | \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ |  | $$m∠4+m∠5=180˚$$ | \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ |

|  |  |  |
| --- | --- | --- |
| 11. |  | 12. |
| Given:  Prove: $∠2≅∠8$ |  | Given:  Prove: $∠2≅∠6$ |
| $$c||d$$ | \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ |  | $$c||d$$ | \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ |
| $$∠2 \& ∠8 are \\_\\_\\_\\_\\_\\_\\_\\_\\_\\_\\_\\_\\_\\_$$ | \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ |  | $$∠2 \& ∠6 are \\_\\_\\_\\_\\_\\_\\_\\_\\_\\_\\_\\_\\_\\_$$ | \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ |
| $$∠2≅∠8$$ | \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ |  | $$∠2≅∠6$$ | \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ |

**--------PROOF REVIEW: ----------------------------------------------------------------------------------------------------------------------**

|  |  |
| --- | --- |
| Write your own proof that uses the setup shown on the right. | Given: $∠2 \& ∠3$ are a linear pair.$ m∠2=\left(3x+1\right)˚$ and  $m∠3=\left(2x-6\right)˚$Prove: $m∠3=68˚$ |
|  | Statements | Reasons |
|  |  |