3.1 – Identify Pairs of Lines and Angles

<u>Defined Terms</u>

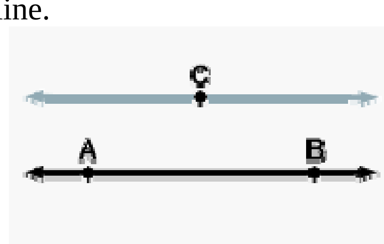
Parallel Lines – Two lines that are coplanar and do not intersect.

Skew Lines – Two lines that are NOT coplanar and do not intersect.

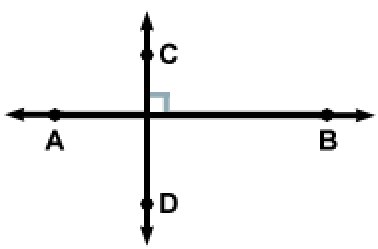
Parallel Planes – Two planes that do not intersect.

<u>Postulates</u>

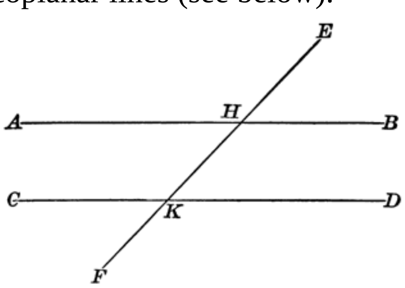
Parallel Postulate – If there is a line and a point not on the line, then there is exactly one line through the point parallel to the given line.



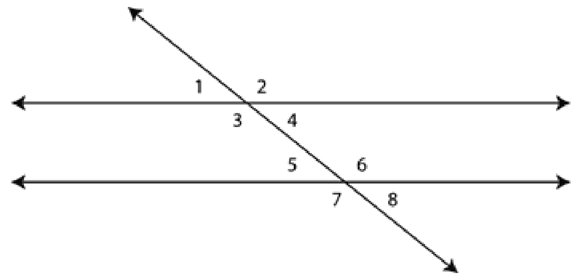
Perpendicular Postulate – If there is a line and a point not on the line, then there is exactly one line through the point perpendicular to the given line.



Transversal – a line that intersects two or more coplanar lines (see below).



When two lines intersect with a transversal, 8 angles are formed (below).



<u>Special Angle Relationships</u>

The angle relationships are defined below, including all angles that match the description from the figure above.

Corresponding Angles
Two angles that have corresponding positions

1 and 5	2 and 6	3 and 7	4 and 8

Alternate Interior Angles
Two angles that lie between the two lines and on opposite sides of the transversal

3 and 6	4 and 5

Alternate Exterior Angles
Two angles that lie outside the two lines and on opposite sides of the transversal

1 and 8	2 and 7

Consecutive Interior Angles
Two angles that lie between the two lines and on the same side of the transversal

3 and 5	4 and 6

3.2 – Use Parallel Lines and Transversals

Postulates and Theorems

Corresponding Angles Postulate
If two parallel lines are cut by a transversal, then corresponding angles are congruent.

Alternate Interior Angles Theorem
If two parallel lines are cut by a transversal, then alternate interior angles are congruent.

Alternate Exterior Angles Theorem
If two parallel lines are cut by a transversal, then alternate exterior angles are congruent.

Consecutive Interior Angles Theorem
If two parallel lines are cut by a transversal, then consecutive interior angles are supplementary.

3.3 – Prove Lines are Parallel

Postulates and Theorems

Corresponding Angles Converse
If two parallel lines are cut by a transversal so that the corresponding angles are congruent, then the lines are parallel.

Alternate Interior Angles Converse
If two parallel lines are cut by a transversal so that the alternate interior angles are congruent, then the lines are parallel.

Alternate Exterior Angles Converse
If two parallel lines are cut by a transversal so that the alternate exterior angles are congruent, then the lines are parallel.

Consecutive Interior Angles Converse
If two parallel lines are cut by a transversal so that the consecutive interior angles are supplementary, then the lines are parallel.

3.4 – Find and Use Slopes of Lines

Slope – The slope of a nonvertical line is the ratio of vertical change (*rise*) to horizontal change (*run*) for any two points on the line.

If a line in the coordinate plane contains the points (x_1, y_1) and (x_2, y_2) then the slope of the line, symbolized by the letter *m*, is

$$m = \frac{rise}{run} = \frac{\text{change in } y}{\text{change in } x} = \frac{y_2 - y_1}{x_2 - x_1}$$

Slopes of Lines in the Coordinate Plane

Negative slope: <u>falls</u> from left to right
Positive slope: <u>rises</u> from left to right
Zero slope (slope of 0): horizontal
Undefined slope: vertical

Slopes of Parallel Lines
In a coordinate plane, two nonvertical lines are parallel if and only if they have the same slope. Additionally, any two vertical lines are parallel.

Slopes of Perpendicular Lines
In a coordinate plane, two nonvertical lines are perpendicular if and only if their slopes are opposite reciprocals. Another way to look at it is that the product of their slopes must be -1.

Example – Suppose $\overline{AB} \perp \overline{CD}$. See the table of sample slopes for $\overline{AB}$ and $\overline{CD}$.

$\overline{AB}$	$\overline{CD}$
$-\frac{2}{3}$	$\frac{3}{2}$
3	$-\frac{1}{3}$
$\frac{1}{2}$	-2

3.5 – Write and Graph Equations of Lines

Slope-Intercept Form of a Line
The equation of a line is written in slope-intercept form as

$$y = mx + b$$

Where *m* is the slope and *b* is the y-intercept

For example, if a line has a slope of 3 and a y-intercept of -5, then the equation of the line would be

$$y = 3x - 5$$

Another example: if the equation of a line is $y = -\frac{1}{2}x + 4$, the slope of the line is $-\frac{1}{2}$ and the y-intercept is 4.

Writing the equation of a line given a point and a slope

Example 1 Write the equation of a line that passes through the point $(2, 4)$ and has a slope of -3.

To write the equation of the line, we need to know the slope (*m*) and the y-intercept (*b*). We know *m*, so we find *b* as follows:

We substitute *m*, *x* and *y* into the equation:

So $y = mx + b$ becomes $4 = -3 \cdot 2 + b$,
then $4 = -6 + b$ and $b = 10$.

So the equation is $y = -3x + 10$.

3.6 – Thms. about Perpendicular Lines

Theorems

Theorem 3.8 – If two lines intersect to form a linear pair of congruent angles, then the lines are perpendicular.

Theorem 3.9 – If two lines are perpendicular, then they intersect to form four right angles.

Theorem 3.10 – If two sides of two adjacent acute angles are perpendicular, then the angles are perpendicular.

Theorem 3.11 – If a transversal is perpendicular to one of two parallel lines, then it is perpendicular to the other line.

Theorem 3.12 – If two lines are perpendicular to the same line, then they are perpendicular to each other.

Distance from a Point to a Line

The distance from a point to a line is the length of a perpendicular segment from the point to the line.