

Name: _____

Date: _____

Unit 2: Perpendicular and Parallel Lines

Parallel Lines and Planes

Objectives: SWBAT identify relationships between lines

A. Parallel and perpendicular lines

PARALLEL LINES-

Lines that are coplanar and do not intersect.

PARALLEL PLANES-

Planes that do not intersect.

PERPENDICULAR LINES-

Lines that intersect at a right angle.

SKEW LINES-

Lines that are not on the same plane, and do not intersect.

Examples

1. Find all planes parallel to plane SKLM

NQRT

2. Find all segments that intersect with \overline{MT}

$\overline{MS}, \overline{ML}, \overline{TR}, \overline{NT}$

3. Find all segments parallel to \overline{MT}

\overline{SN}

4. Find all segments skew to \overline{MT}

$\overline{SK}, \overline{NQ}, \overline{QR}, \overline{KQ}, \overline{KL}$

5. Find all planes parallel to MTRL

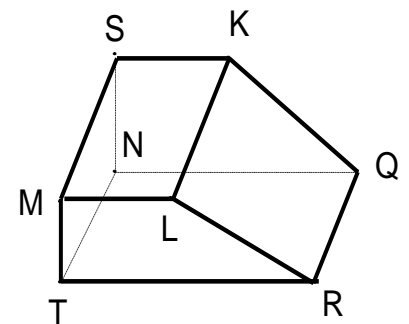
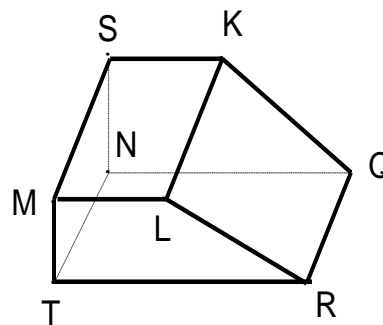
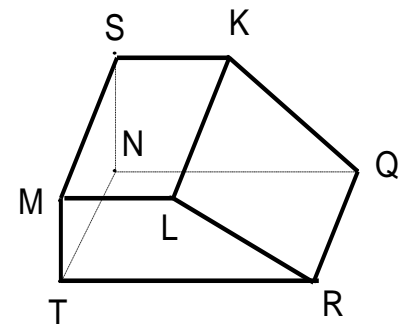
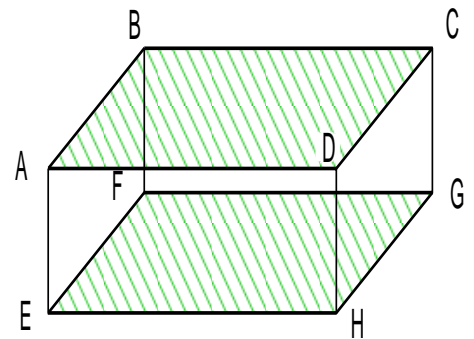
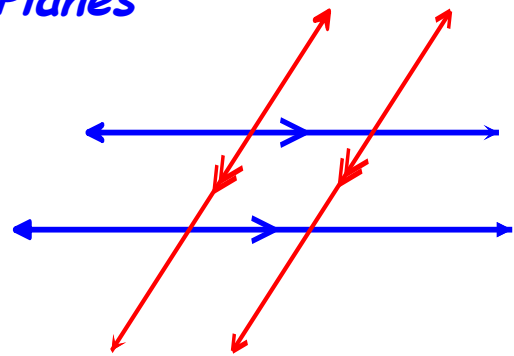
NQKS

6. Find all segments parallel to \overline{NT}

$\overline{SM}, \overline{KL}, \overline{QR}$

7. Find all segments skew to \overline{KL}

$\overline{NQ}, \overline{TR}, \overline{SN}, \overline{MT}$



Parallel Lines and Transversals

Objectives: SWBAT identify relationships between lines and identify angles formed by transversals.

B. Transversal: - a line intersecting two other lines

CORRESPONDING ANGLES~ SAME SPOT

When two parallel lines are cut by a transversal, then the angles in the same position are corresponding angles.

ALTERNATE EXTERIOR ANGLES~ OPPOSITE OUTSIDE

When two parallel lines are cut by a transversal, then the angles on the outside of the parallel lines, and opposite sides of the transversal are Alternate Exterior Angles.

ALTERNATE INTERIOR ANGLES~ OPPOSITE INSIDE

When two parallel lines are cut by a transversal, then the angles on the inside of the parallel lines, and opposite sides of the transversal are Alternate Interior Angles.

CONSECUTIVE INTERIOR ANGLES~ SAME SIDE SUPPLEMENTARY

When two parallel lines are cut by a transversal, then the angles on the inside of the parallel lines, and the same side of the transversal are Consecutive Interior Angle.

VERTICAL ANGLES~

When two lines, segments, or opposite rays intersect, then the opposite angles are congruent.

Examples

1- Find all the Corresponding Angles.

$$\angle A \cong \angle E, \angle C \cong \angle G, \angle B \cong \angle F, \angle D \cong \angle H$$

2. Find all the Alternate Interior Angles.

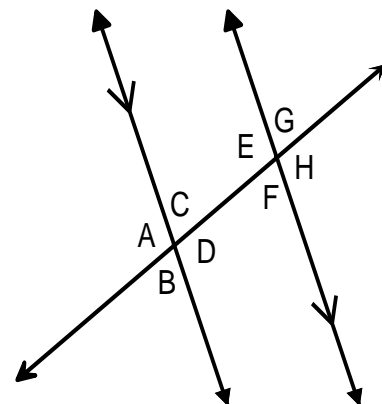
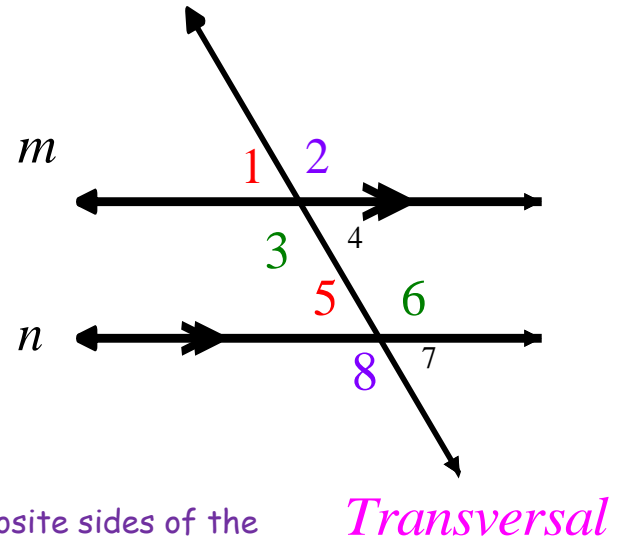
$$\angle D \cong \angle E, \angle C \cong \angle F$$

3. Find all the Alternate Exterior Angles.

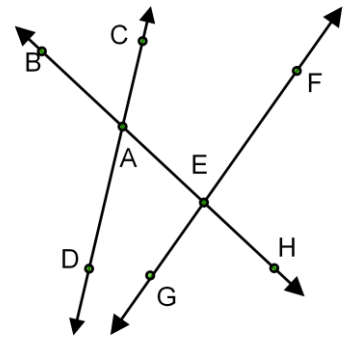
$$\angle B \cong \angle G, \angle A \cong \angle H$$

4. Find all the Consecutive Interior Angles.

$$m\angle C + m\angle E = 180, m\angle D + m\angle F = 180$$



5. Use the diagram to the right to identify the following angle relationships.



a) $\angle BAD$ and $\angle HEF$

Alternate Exterior Angles

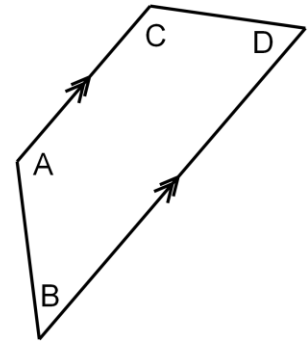
b) $\angle CAH$ and $\angle BEF$

Consecutive Interior Angles

c) $\angle GEH$ and $\angle DAE$

Corresponding Angles

6. Given the following diagram find the relationship of $\angle A$ and $\angle B$



Consecutive Interior Angles

7. Given the following map, describe the corner street angles of John's house, Georgia's House, and Philip's house.

John & Georgia

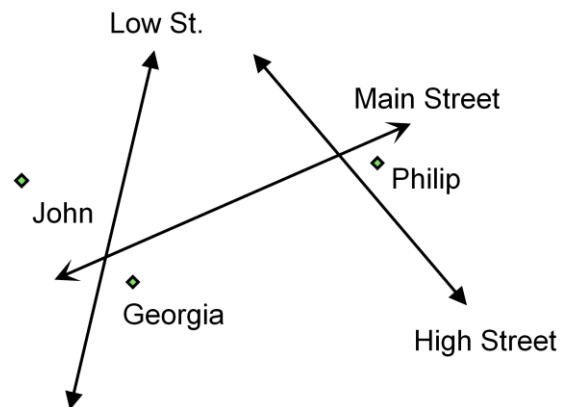
Vertical Angles

Georgia & Philip

Corresponding Angles

Philip & John

Alternate Exterior Angles



Parallel Lines and Transversals

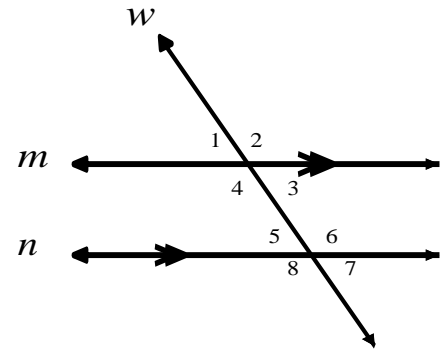
Objectives: SWBAT prove and use results about parallel lines and transversals.

A. PROPERTIES OF PARALLEL LINES

B. Transversal:

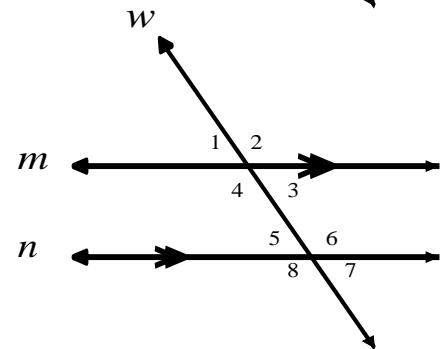
CORRESPONDING ANGLES~

When two parallel lines are cut by a transversal, then the angles in the same position are corresponding angles, and are congruent to each other.



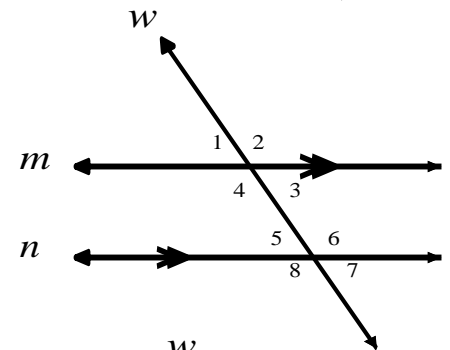
ALTERNATE EXTERIOR ANGLES~

When two parallel lines are cut by a transversal, then the angles on the outside of the parallel lines, and opposite sides of the transversal are Alternate Exterior Angles. And are congruent to each other.



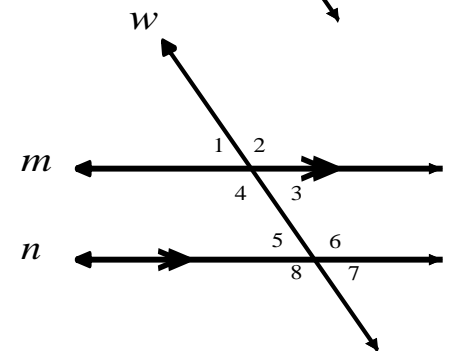
ALTERNATE INTERIOR ANGLES~

When two parallel lines are cut by a transversal, then the angles on the inside of the parallel lines, and opposite sides of the transversal are Alternate Interior Angles. And are congruent to each other.



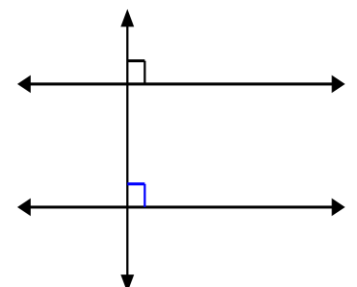
CONSECUTIVE INTERIOR ANGLES / SAME SIDE SUPPLEMENTARY~

When two parallel lines are cut by a transversal, then the angles on the inside of the parallel lines, and the same side of the transversal are Consecutive Interior Angle. And are supplementary to each other.



~ Perpendicular Transversal Theorem

If a line is perpendicular to one line, then it is perpendicular, to every line to every line to that one.



Review:

Supplementary Angles: Angles that adds up to 180 degrees

Vertical Angles: When two lines, segments, or opposite rays intersect, then the opposite angles are congruent.

EXAMPLES:

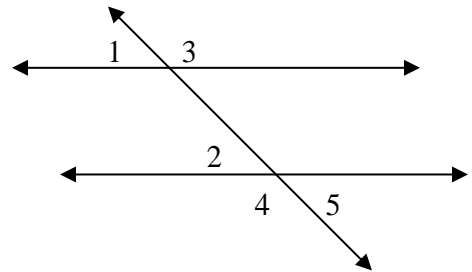
1. Given $m\angle 2 = 65^\circ$, find each measure, and tell which postulate you used.

a. $m\angle 1 = 65$ (Corresponding to $\angle 2$)

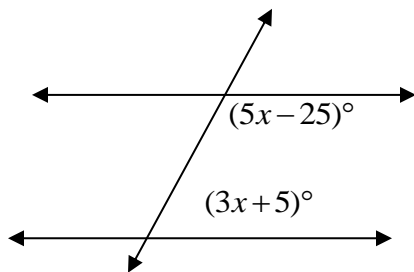
b. $m\angle 4 = 115$ ($\angle 3$ are supplementary to $\angle 1$, so $\angle 1$ is 115, since $\angle 3$ and $\angle 4$ are Alternate Exterior Angles so they are congruent)

c. $m\angle 5 = 65$ (Alternate Exterior angles with $\angle 1$)

d. $m\angle 3 = 115$ ($\angle 3$ are supplementary to $\angle 1$, so $\angle 1$ is 115)



2. Assume the lines are parallel to find the value of x .



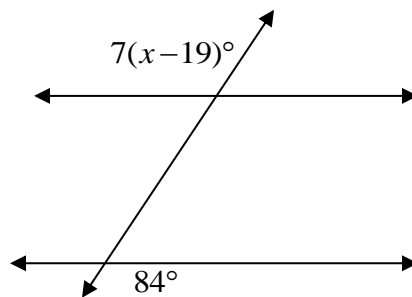
These are Consecutive Interior angles and are supplementary.

$$5x - 25 + 3x + 5 = 180$$

$$8x - 20 = 180$$

$$8x = 200$$

$$x = 25$$



These are Alt Exterior Angles and are congruent.

$$7(x - 19) = 84$$

$$7x - 133 = 84$$

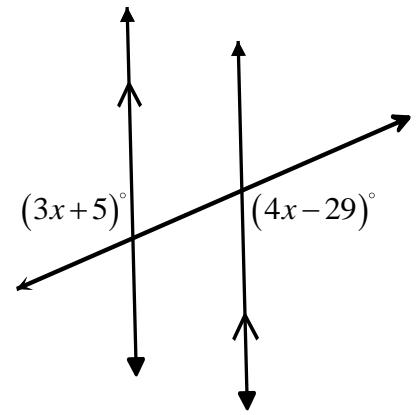
$$7x = 217$$

$$x = 31$$

5. Find x

They are Alternate Exterior Angles and so they are congruent.

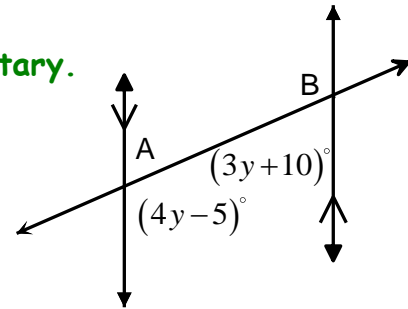
$$\begin{aligned}3x + 5 &= 4x - 29 \\5 &= x - 29 \\34 &= x\end{aligned}$$



6. Find y , then use y to find $m\angle A$ and $m\angle B$

They are Consecutive Interior Angles, and are supplementary.

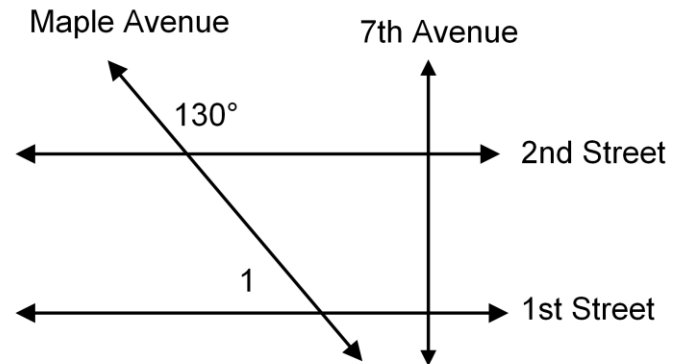
$$\begin{aligned}4y - 5 + 3y + 10 &= 180 \\7y + 5 &= 180 \\7y &= 175 \\y &= 25\end{aligned}$$



7. Seventh Avenue runs perpendicular to both 1st and 2nd streets. However, Maple Avenue makes a 130 degree angle with 2nd street. What is the measure of angle 1?

Since 7th is Perpendicular to 2nd and 1st Street, And 1st and 2nd are parallel. Given that, Maple Avenue is a transversal to two parallel Lines.

$\angle 1$ is a linear pair with the Correspond Angle of the 130 angle.



$$\begin{aligned}m\angle 1 + 130 &= 180 \\-130 &\quad -130 \\m\angle 1 &= 50^\circ\end{aligned}$$

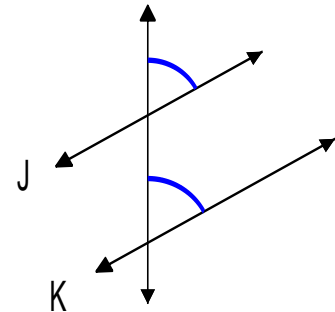
Proving Lines are Parallel

Objectives: SWBAT prove that two lines are parallel

A. PROVING PARALLEL LINES USING CONVERSES

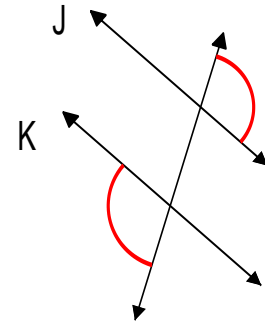
CORRESPONDING ANGLES CONVERSE POSTULATE

If the Corresponding Angles are congruent, then the lines are parallel.



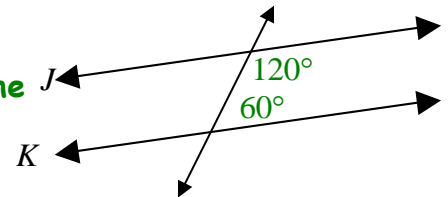
ALTERNATE INTERIOR ANGLES THEOREM CONVERSE

If the Alternate interior Angles are congruent, then the lines are parallel.



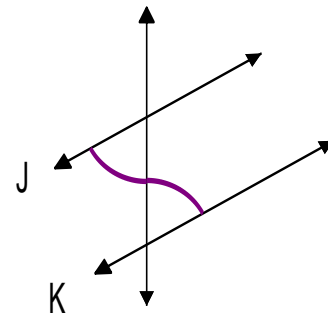
CONSECUTIVE INTERIOR ANGLES THEOREM CONVERSE

If the Consecutive Interior Angles are supplementary, then the lines are parallel.



ALTERNATE EXTERIOR ANGLES THEOREM CONVERSE

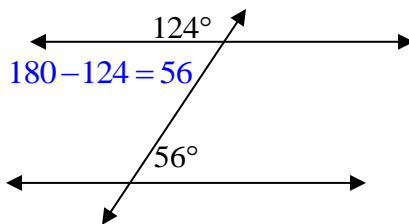
If the Alternate Exterior Angles are congruent, then the lines are parallel.



EXAMPLES

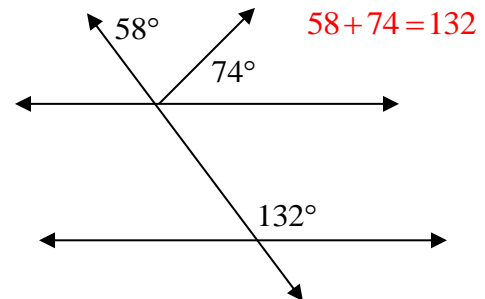
- Is it possible to tell if the lines are parallel? If so, tell which theorem or postulate allows us to conclude this.

a.



These are supplementary (also a Linear Pair). This angle is then congruent to the Alternate Interior angle, so they are parallel

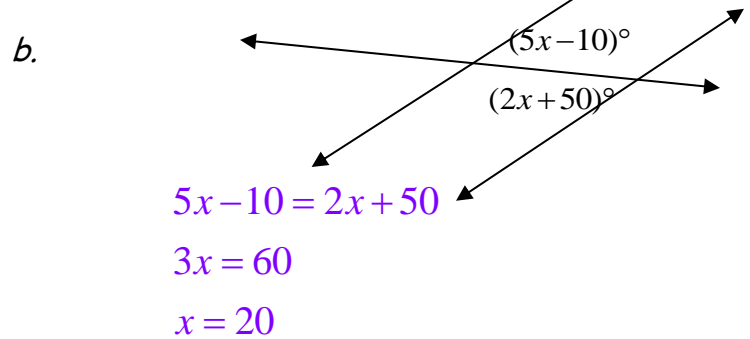
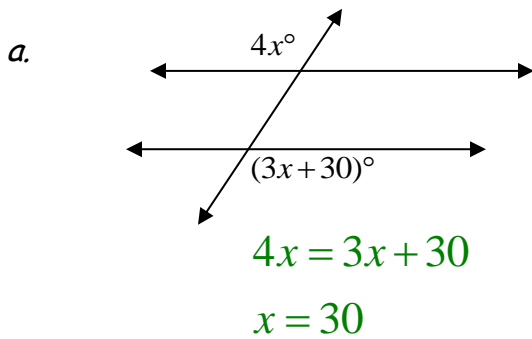
b.



These angles are Congruent Corresponding Angles so then they are parallel lines.

2. Solve for x to make lines parallel:

You are looking for an "x" value that will make the Postulates work.



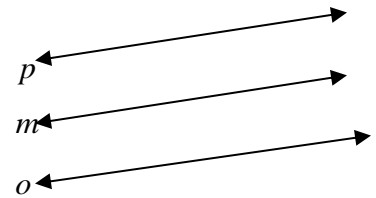
These are Alternate Exterior Angles.

These are Alternate Interior Angles.

A. PROVING TWO LINES ARE PARALLEL

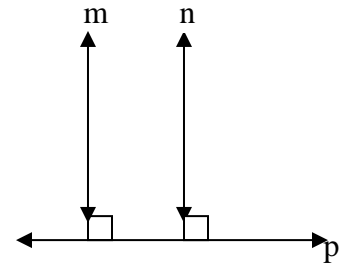
Transitive Parallel Lines Theorem

If a line is parallel to another line, then it will be parallel to all other lines.



Perpendicular - Parallel Theorem

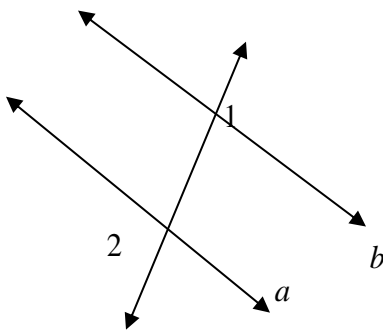
If two lines are perpendicular to one line then they are parallel.



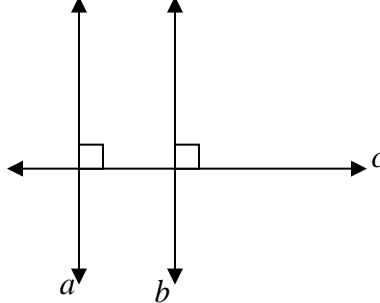
EXAMPLES:

State the postulate used to conclude $a \parallel b$.

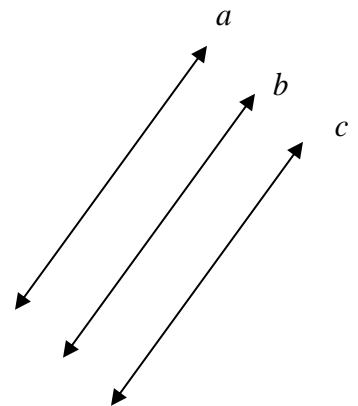
Given: $\angle 1 \cong \angle 2$



Given: $a \perp c$ and $b \perp c$.



Given: $a \parallel c$, $c \parallel b$



Alternate Exterior Angles Converse Theorem

Perpendicular Parallel Theorem

Transitive Parallel Lines Theorem

Slope

Objectives: SWBAT find the slopes of lines and use slopes to identify parallel and perpendicular.

A. SLOPE - A ratio of vertical changes and horizontal changes of a line.

$$M = \frac{\text{rise}}{\text{run}} = \frac{\Delta y}{\Delta x} = \frac{y_2 - y_1}{x_2 - x_1}$$

Slope Review:

1. Find the slope given two points:

a. $(-2,10),(3,3)$

$$\frac{y_2 - y_1}{x_2 - x_1} = \frac{3 - 10}{3 - (-2)} = \frac{-7}{5}$$

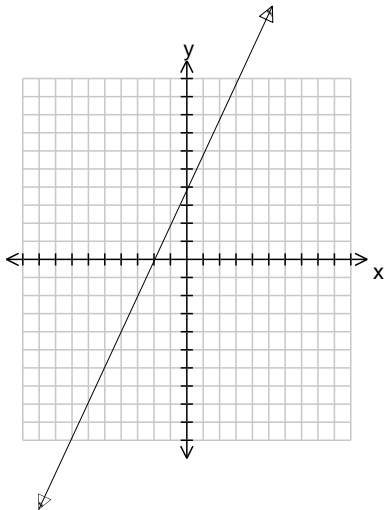
b. $(-1,2),(1,-4)$

$$\frac{y_2 - y_1}{x_2 - x_1} = \frac{-4 - 2}{1 - (-1)} = \frac{-6}{2} = -3$$

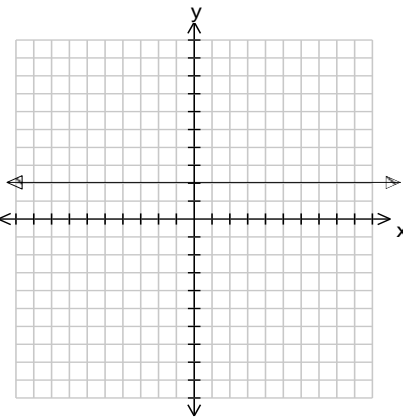
c. $(-2,2),(3,2)$

$$\frac{y_2 - y_1}{x_2 - x_1} = \frac{2 - 2}{3 - (-2)} = \frac{0}{5} = \text{no slope}$$

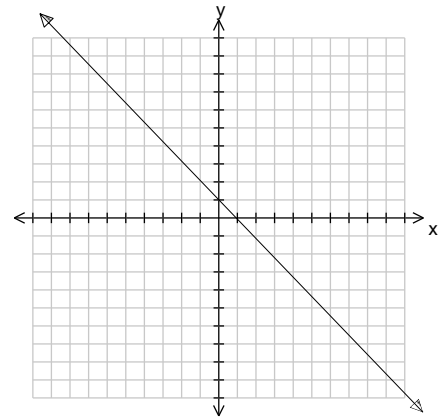
2. Find the slope of the given graphs:



$$\frac{\text{rise}}{\text{run}} = \frac{4}{2} = 2$$



$$\frac{\text{rise}}{\text{run}} = \frac{0}{x} = \text{no slope}$$



$$\frac{\text{rise}}{\text{run}} = \frac{-1}{1} = -1$$

SLOPE OF PARALLEL LINES POSTULATE~

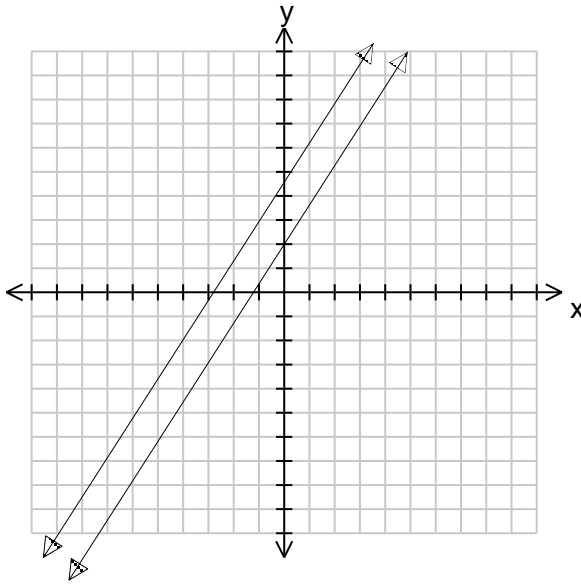
Parallel lines have the SAME SLOPE

SLOPE OF PERPENDICULAR LINES POSTULATE~

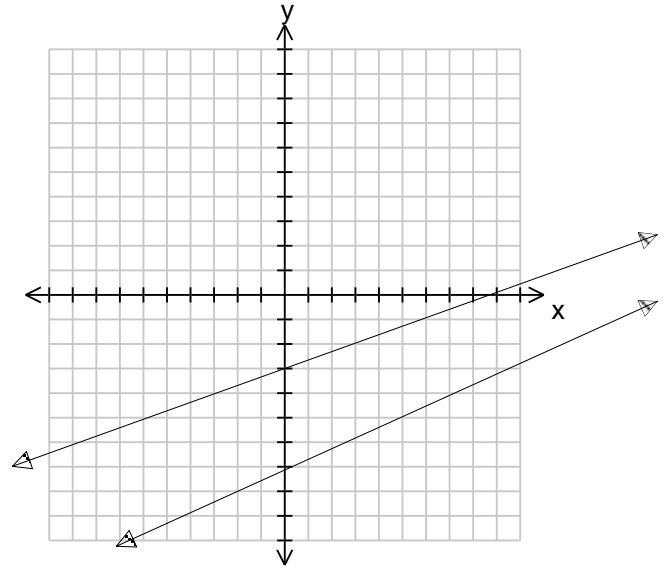
Perpendicular lines have a negative reciprocal slope

Examples:

Find the slope of each line and determine if they are parallel or not.



A - Same rise over run (slope) so they are parallel



B - It's almost obvious, but they have different slopes

Review: Find the reciprocal, and then find the negative reciprocal

Reciprocal - Flip the Fraction

a. $\frac{3}{2}$

$$\frac{3}{2} \rightarrow \frac{2}{3} \rightarrow -\frac{2}{3}$$

b. $-\frac{8}{5}$

$$-\frac{8}{5} \rightarrow -\frac{5}{8} \rightarrow \frac{5}{8}$$

Negative Reciprocal - Flip the Fraction & Change the sign

c. 2

$$2 \rightarrow \frac{1}{2} \rightarrow -\frac{1}{2}$$

d. $\frac{-3}{8}$

$$\frac{-3}{8} \rightarrow \frac{8}{-3} \rightarrow \frac{8}{3}$$

Find the Slope of the following Lines:

- a. A line parallel to another line with slope of 4

Parallel lines have the same slope $\rightarrow 4$

- b. A line parallel to another line with slope of $\frac{2}{3}$

Parallel lines have the same slope $\rightarrow \frac{2}{3}$

- c. A line perpendicular to another line with slope of $\frac{1}{2}$

Perpendicular Lines have a negative reciprocal slope $\rightarrow -2$

- d. A line perpendicular to another line with slope of -4

Perpendicular Lines have a negative reciprocal slope $\rightarrow \frac{1}{4}$

Use the given points to determine if \overline{AB} and \overline{CD} are parallel, perpendicular or neither.

$$A(1, 2) \quad B(3, 3) \quad C(5, -2) \quad D(3, -2)$$

$$AB = \frac{y_2 - y_1}{x_2 - x_1} = \frac{3 - 2}{3 - 1} = \frac{1}{2}$$

$$CD = \frac{y_2 - y_1}{x_2 - x_1} = \frac{-2 - (-2)}{3 - 5} = \frac{0}{2} = 0$$

neither

$$A(5, 1) \quad B(4, 0) \quad C(-1, -6) \quad D(-4, -3)$$

$$AB = \frac{y_2 - y_1}{x_2 - x_1} = \frac{0 - 1}{4 - 5} = \frac{-1}{-1} = 1$$

$$CD = \frac{y_2 - y_1}{x_2 - x_1} = \frac{-3 - (-6)}{-4 - (-1)} = \frac{3}{-3} = -1$$

Perpendicular

Partitioning a Segment

Objectives: SWBAT find a point on a line segment between two given points that divides into a specific ratio:

Vocabulary:

Partition:

Ratio:

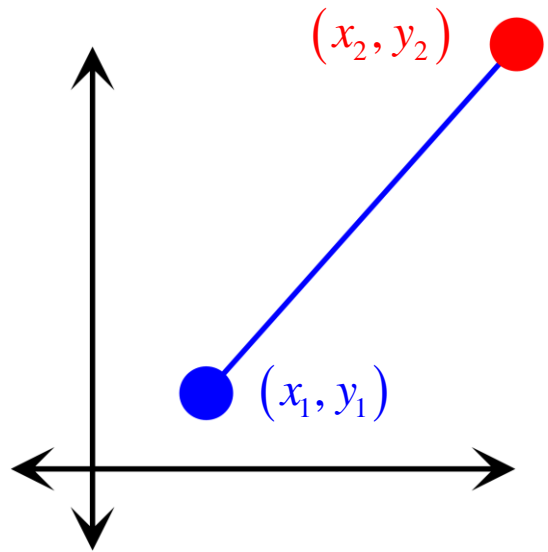
Partition Formula:

(x_1, y_1) = 1st point

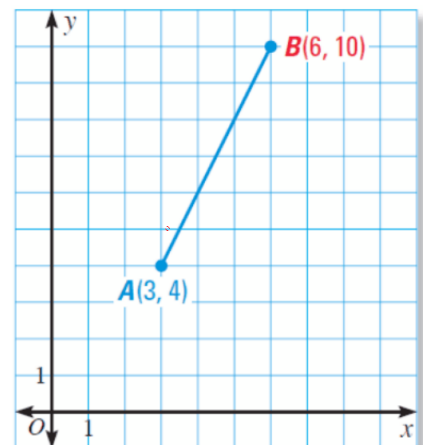
(x_2, y_2) = 2nd point

$a : b = \frac{a}{b}$ = ratio

$$\left((x_2 - x_1) \left(\frac{a}{a+b} \right) + x_1, (y_2 - y_1) \left(\frac{a}{a+b} \right) + y_1 \right)$$



1. Find the coordinates of P along the directed line segment AB so that the ratio of AP to PB is 3 to 2.



2. Find the coordinates of P along the directed line segment AB so that the ratio of AP to PB is 3 to 7. Given that $A(-2, 1)$ and $B(4, 5)$.

3. Find the coordinates of P along the directed line segment AB so that the ratio of AP to PB is 1 to 4. Given that $A(8, 0)$ and $B(3, -2)$.

Writing Equations in Slope – Intercept Form

Objectives: SWBAT write the equation of a line using $y = mx + b$.

Write an equation in slope-intercept form using the following information.

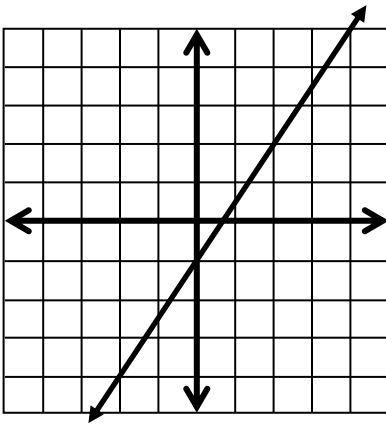
a. a slope of -2 and a y-intercept of 6

b. a slope of -1 and a y-intercept of -3

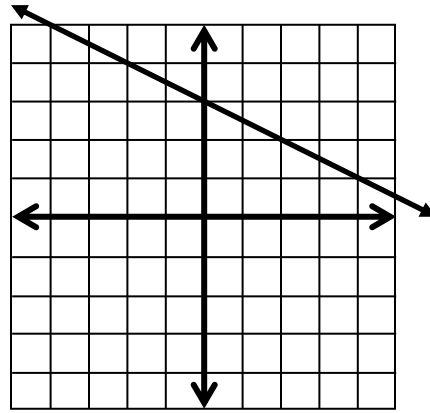
c. crosses the y-axis at 2 and has a slope of $\frac{1}{2}$

d. a slope of -2 and passes through $(0, 5)$

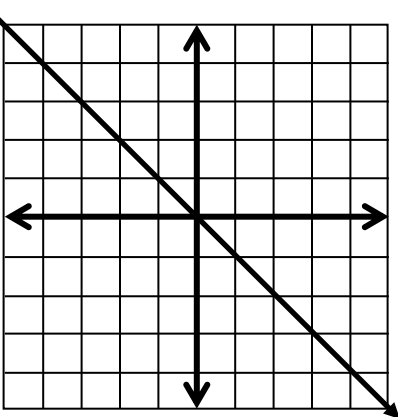
e.



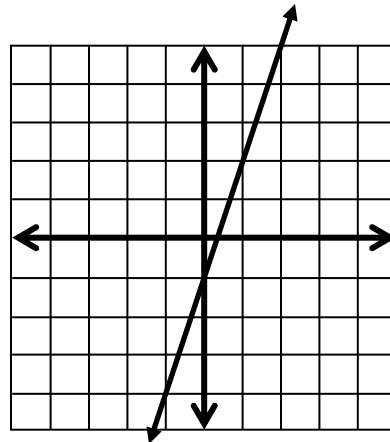
f.



g.



h.



Write an equation in slope-intercept form using the following information.

a. a slope of -2 and passes through $(4, -3)$

b. passes through $(6, 5)$ and has a slope of $\frac{2}{3}$

c. passes through $(-9, 5)$ and has a slope of 1

d. passes through $(8, -3)$ and $(0, -7)$

g. passes through $(-3, 2)$ and $(1, -6)$

h. a linear function where $f(4) = 5$ and $f(3) = -1$

Write Linear Equations in Point-Slope Form

Objectives: SWBAT write the equation of a line using the point slope formula

Point-slope form of a linear equation –

Write an equation in point-slope form using the following information. Then change the equation to slope-intercept form.

a. passes through $(-3, 7)$ and has a slope of 4

b. has a slope of $-\frac{1}{2}$ and passes through $(0, 6)$

c. has a slope of -5 and passes through $(2, 0)$

d. passes through $(-4, -1)$ and $(4, 2)$

Write Linear Equations in Standard Form

Objectives: SWBAT write the equation of a line in standard form

Standard form of a linear equation –

Write the following equations in Standard form.

a. $y = 2x + 4$

b. $y - 3 = 5(x + 2)$

c. $-7y = 5x$

d. $3x + 5 = 4y - 1$

Write an equation in Standard form using the following information.

f. has a slope of $-\frac{3}{4}$ and passes through (8, -3)

g. passes through (7, 1) and (3, 9)

h. Which equation of the line passes through $(\frac{15}{4}, -\frac{1}{2})$ with a slope of $m = -\frac{2}{3}$?

A. $-8x + 12y = 24$

C. $8x + 12y = -49$

B. $8x + 12y = 24$

D. $24x + 36y = -82$

Write Equations of Parallel and Perpendicular Lines

Objectives: SWBAT determine if two lines are parallel, perpendicular, or just intersect
SWBAT write equations that are parallel or perpendicular to another line through a given point

Parallel Lines –

Perpendicular Lines –

Determine if each pair of lines are parallel, perpendicular, the same line, or neither.

a. $y = \frac{1}{3}x$ and $y = -3x + 5$

b. $y = 2x - 3$ and $y = \frac{1}{2}x - 3$

c. $y = x - 3$ and $y = x + 1$

d. $y = \frac{3}{4}x - 3$ and $y = -\frac{4}{3}x + 5$

e. $y = -3x + 5$ and $y = 5 - 3x$

f. $y = x + 3$ and $y = 3 - x$

Writing equations of PARALLEL lines.

g. Write the linear equation parallel to $y = 4x + 1$ and passes through (2, 4).

h. Write the equation of the line parallel to $4x - 2y = 10$ that passes through (-6, 1).

i. Which equation of the line passes through (8, 10) and is parallel to the graph of the line $y = \frac{8}{3}x + 7$.

A. $y = \frac{8}{3}x - \frac{34}{3}$

C. $y = 6x - \frac{34}{3}$

B. $y = \frac{8}{3}x + \frac{8}{3}$

D. $y = 16x + \frac{8}{3}$

Writing equations of PERPENDICULAR lines.

j. Write the equation of the line perpendicular to
through

$y = 2x - 5$ that passes through $(6, 7)$

k. Write the equation of the line that passes

$(-7, -3)$ and is perpendicular to $x - 3y = 5$.

l. Which equation of the line passes through $(4,7)$ and is perpendicular to the graph of the line that passes through the points $(1,3)$ and $(-2,9)$?

A. $y = 2x - 1$

C. $y = \frac{1}{2}x - 5$

B. $y = \frac{1}{2}x + 5$

D. $y = -2x + 15$