3.6 Prove Theorems About Perpendicular Lines

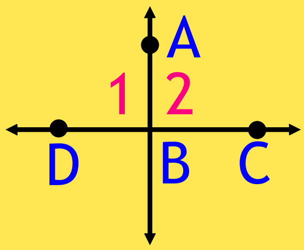
Theorem 3.8

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*.

$\overleftrightarrow{AB} \perp \overleftrightarrow{BC}$. What can you conclude?



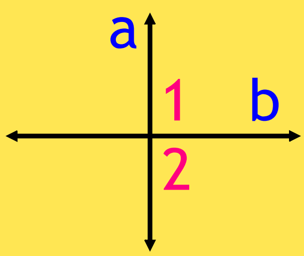
$\angle 1$ & $\angle 2$ are right $\angle$s

$\angle 1$ & $\angle 2$ form a linear pair

$\angle 1$ & $\angle 2$ are supp

$m\angle 1 = 90$ & $m\angle 2 = 90$

$\angle 1 \cong \angle 2$. What can you conclude?



$a \perp b$

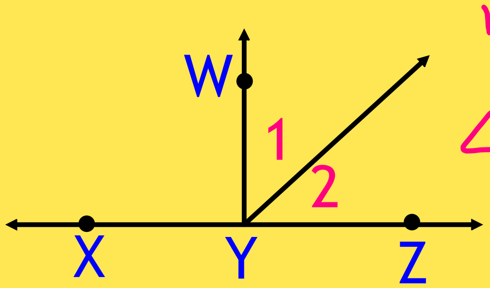
$m\angle 1$ & $m\angle 2 = 90$

$\angle 1$ & $\angle 2$ are supp

Theorem 3.10

If two sides of two adjacent acute angles are perpendicular, then the angles are *complementary*.

$\overleftrightarrow{WY} \perp \overleftrightarrow{XZ}$.
What can you conclude about $\angle 1$ and $\angle 2$?



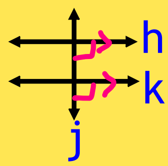
∠1 & ∠2 are adj.

∠1 & ∠2 form a right ∠

∠1 & ∠2 are comp.

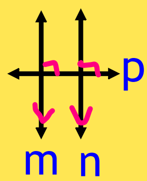
Theorem 3.11 Perpendicular Transversal Thm.

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

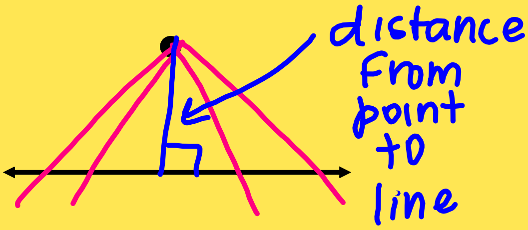


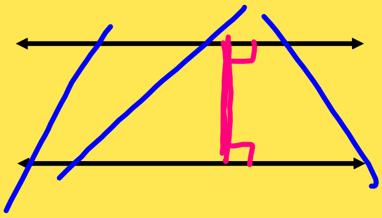
Theorem 3.12 Lines Perpendicular to a Transversal Theorem

In a plane, if two lines are perpendicular to the same line, then they are parallel to each other.



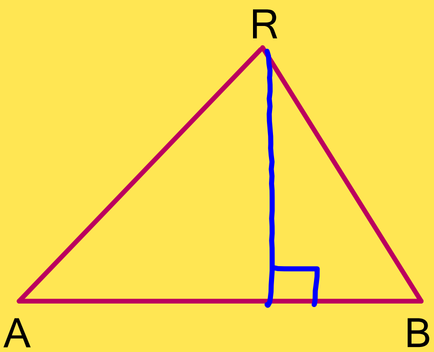
The distance from a point to a line is the length of the perpendicular segment from the point to the line.

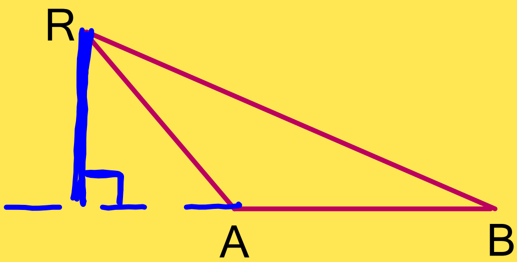




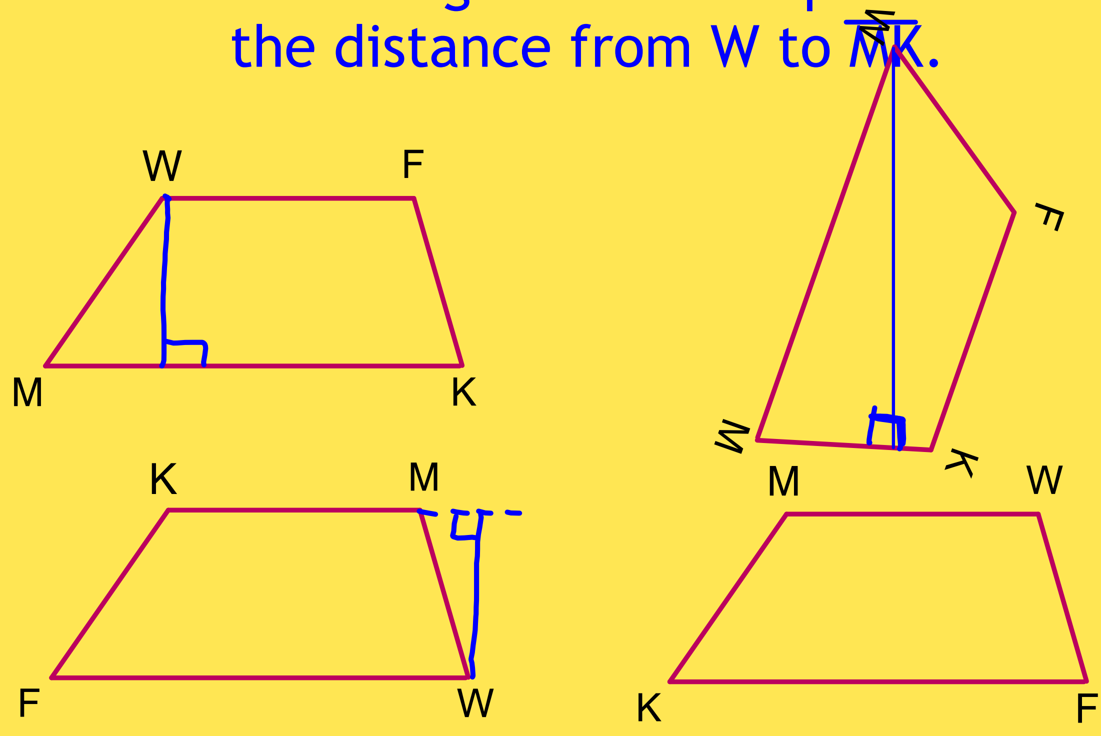
The distance between two parallel lines is the length of any perpendicular segment joining the two lines.

Draw the segment that represents the distance from R to $\overline{AB}$.





Draw the segment that represents the distance from W to $\overline{MK}$.



Graph the equation y = 2x - 2. $m=2$ $y\text{-int}=-2$

Plot the ordered pair (-4,0).

Graph a perpendicular line through this point.

Find the distance from the point (-4,0) and the original equation.

$(-4,0)$ $(0,-2)$

x_1 y_1 x_2 y_2

$\sqrt{(x_2-x_1)^2+(y_2-y_1)^2}$

$\sqrt{(0 - -4)^2+(-2-0)^2}$

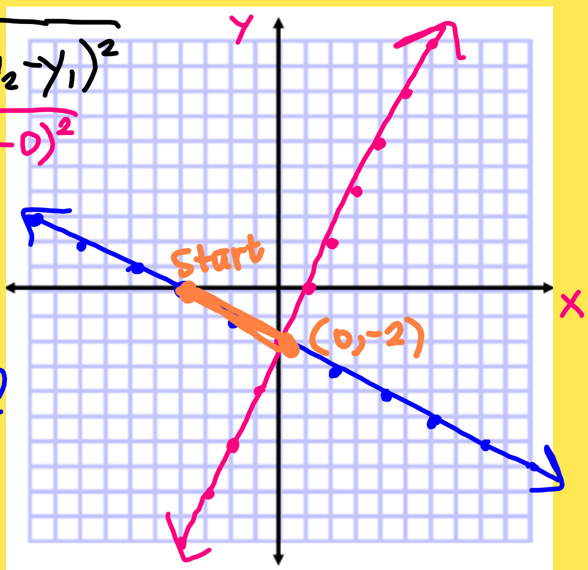
$\sqrt{(4)^2+(-2)^2}$

$\sqrt{16+4}$

$\sqrt{20}$

$\boxed{2\sqrt{5}}$

$2\,|\,20$
$2\,|\,10$
5



opp. rec. slopes

$m=\frac{2}{1}$

$m_\perp=-\frac{1}{2}$

Graph the equation $2x + y = 0$.

$y = -2x$ $m = -\frac{2}{1}$

$-2x \quad -2x$

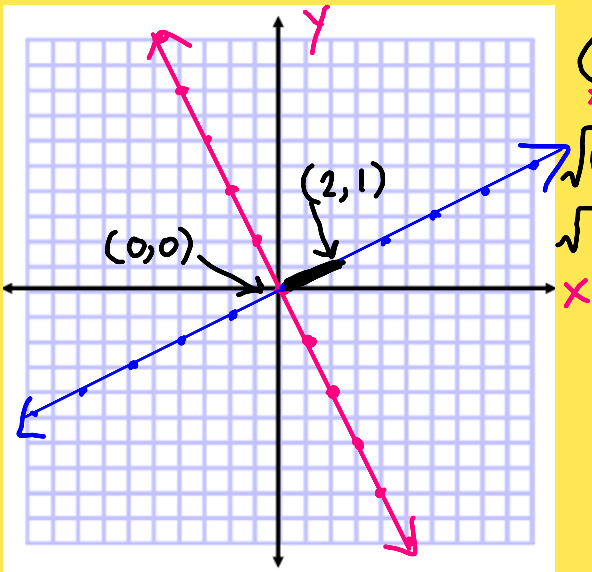
$y\text{-int} = 0$

Plot the ordered pair (2,1).

Graph a perpendicular line through this point.

Find the distance from the point (2,1) and the original equation.

$m_\perp = \frac{1}{2}$



$(0,0)$ $(2,1)$

$x_1\ y_1$ $x_2\ y_2$

$\sqrt{(x_2-x_1)^2+(y_2-y_1)^2}$

$\sqrt{(2-0)^2+(1-0)^2}$

$\sqrt{(2)^2+(1)^2}$

$\sqrt{4+1}$

$\boxed{\sqrt{5}}$

Graph the equation $x - 2y = 8$.

$5\,|\,45$

$3\,|\,9$

3

Plot the ordered pair (3,-10).

Graph a perpendicular line through this point.

Find the distance from the point (3,-10) and the original equation.

$x - 2y = 8$

$-x \qquad -x$

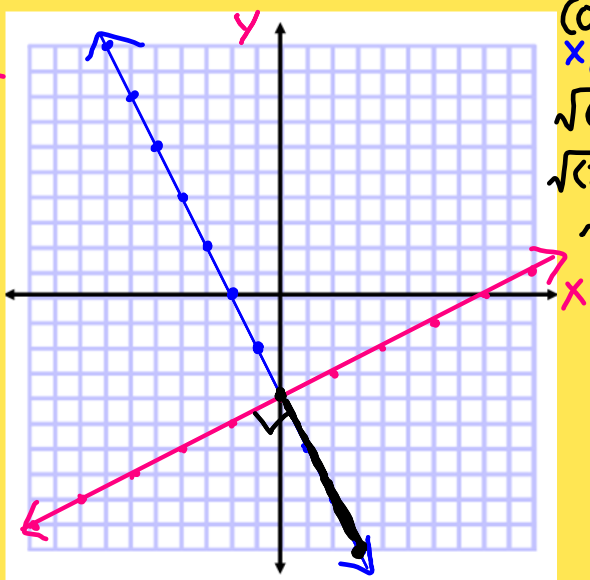
$\frac{-2y}{-2} = \frac{-x}{-2} + \frac{8}{-2}$

$y = \frac{1}{2}x - 4$

$m = \frac{1}{2}$

$y\text{-int} = -4$

$m_\perp = -\frac{2}{1}$



$(0,-4)$ $(3,-10)$

$x_1\ y_1$ $x_2\ y_2$

$\sqrt{(x_2-x_1)^2+(y_2-y_1)^2}$

$\sqrt{(3-0)^2+(-10+4)^2}$

$\sqrt{(3)^2+(-6)^2}$

$\sqrt{9+36}$

$\sqrt{45}$

$\boxed{3\sqrt{5}}$