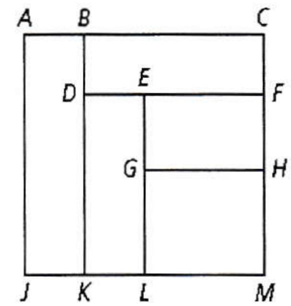
Name______________________________________Date______________________________

3.4 – Properties of Perpendicular Lines

1) Suppose you are laying tiles. You place several different rectangles together to form a larger rectangle.



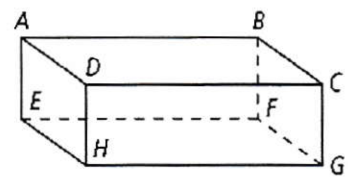
a. $\overline{BC}$ is parallel to $\overline{DF}$, $\overline{DF}$ is parallel to $\overline{GH}$. What is the relationship between $\overline{BC}$ and $\overline{GH}$? What property explains this?

$\overline{BC} \parallel \overline{GH}$. Transitive Property

b. $\overline{BK}$ is parallel to $\overline{EL}$. $\overline{GH}$ is perpendicular to $\overline{BK}$. What is the relationship between $\overline{GH}$ and $\overline{EL}$? What theorem would explain this?

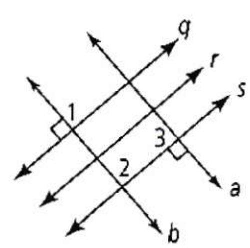
$\overline{GH} \perp \overline{EL}$. Perpendicular Transversal theorem

2) A student says that according to the *Perpendicular to the Same Line Theorem*, $\overleftrightarrow{AB}$ and $\overleftrightarrow{BC}$ must be parallel because they are both perpendicular to $\overleftrightarrow{BF}$. Explain the student's error.



$\overrightarrow{AB}$ and $\overleftrightarrow{BC}$ are perpendicular to $\overleftrightarrow{BF}$. However, they are skew. They need to be on the same plane to be parallel.

3) Complete this paragraph proof.



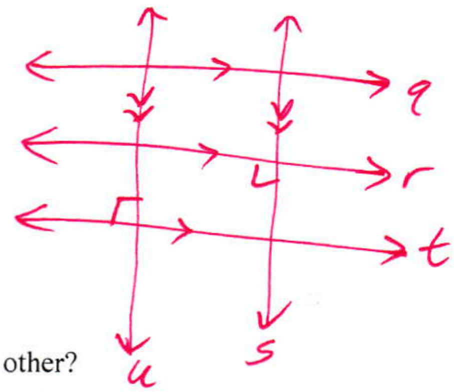
Given: $q \parallel r$, $r \parallel s$, $b \perp q$, and $a \perp s$

Prove: $a \parallel b$

Proof: Because it is given that $q \parallel r$ and $r \parallel s$, then $q \parallel s$ by the transitive property. This means that $\angle 1 \cong \angle$ 2 because they are corresponding angles. Because $b \perp q$, $m\angle 1 = 90$. So, $m\angle 2 =$ 90°. This means $s \perp b$, by definition of perpendicular lines. It is given that $a \perp s$, so $a \parallel b$ by the Perpendicular to the Same Line Theorem.

4) Draw a diagram that meets the criteria listed below. Then describe how all the lines are related to each other.

a. $q \parallel r$
b. $r \perp s$
c. $t \parallel q$
d. $u \perp t$



How are they all related to each other?

$q \parallel r \parallel t$ $\qquad$ $s \parallel u$

$s \perp q, r,$ and t

$u \perp q, r,$ and t

In #5 and 6, *a, b, c,* and *d* are distinct lines in the same plane. For each combination of relationships, tell how *a* and *c* relate. Justify your answer with a theorem.

5. $a \perp b;\ b \perp c$

$a \parallel c$

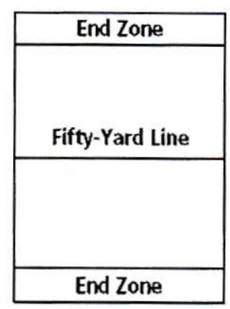
Perp. to the Same Line Theorem

6. $a \perp b;\ b \parallel c$

$a \perp c$

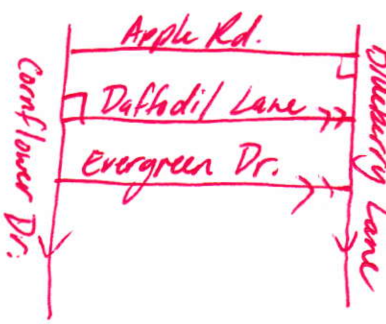
Perp. Transversal Theorem

7) The recreation department is setting up the football field. They check to make sure that the 50-yd line and the end zone lines are perpendicular to the right sideline. Does this mean both sidelines are parallel? Explain.



No. The 50 yd-line and the end zone lines need to be perpendicular to the left sideline as well in order for the sidelines to be parallel.

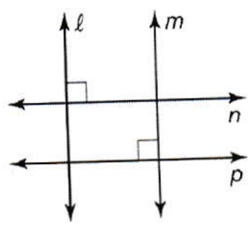
8) Apple Road is perpendicular to Blueberry Lane. Blueberry Lane is parallel to Cornflower Drive. Cornflower Drive is perpendicular to Daffodil Lane. Daffodil Lane is parallel to Evergreen Drive. Draw a diagram to explain how each street is related to every other street. What can you conclude about Apple Road and Evergreen Drive? Explain.



They are parallel.
The Perpendicular Transversal Theorem shows they are both $\perp$ to Cornflower Drive. The Perpendicular to Same Line Theorem proves they are parallel to each other.

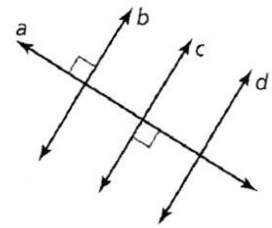
In #9 and 10, determine which lines, if any, must be parallel. Explain your reasoning.

9)



None.
No lines are perpendicular to the same line.

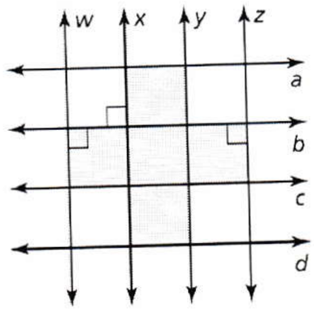
10)



b||c

b and c are both perpendicular to line a. (Perpendicular to the Same Line theorem)

11. Determine which lines must be parallel. Explain your reasoning.



w||x
w||z
x||z

All ⊥ to line b. (Perp. to the Same Line theorem)