Name Solution Key Time _____ Seat #_____

Assignment 2: Working with Planes

1. We often speak of objects being 2-dimensional or 3-dimensional. Is it really possible to have an object that is only 2-dimensional? Why or why not?

It is impossible to have a PHYSICAL 2-dimensional object (if it had no thickness we couldn't see or touch it). 2-dimensional objects like a plane are MENTAL objects and only exist in our minds. Sometimes we MODEL 2-dimensional objects using 3-dimensional objects, like a desk top representing a plane.

2. In class we said that the spaghetti noodle was a model of 1-dimension.

   (a) How does the spaghetti model 1-dimensional space?

It has length and we focus on the length while ignoring its width and depth.

   (b) How is the spaghetti not actually a 1-dimensional object?

It is a PHYSICAL object with length, width & depth.

3. When we say it takes 2 points to determine a line, what do we mean?

For any 2 points there is exactly one (one and only one) line that contains those points. Once you have 2 points, that defines the line that contains them.

4. When we say it takes 3 points to determine a plane, what do we mean? (Be careful, there is a special condition involved in this.)

For any 3 Non-colinear points there is exactly one (one and only one) plane that contains the 3 points. One you have 3 non-colinear points, that is enough to define the plane that contains them.

5. In what ways are the geometric concepts of "angle" and "dihedral angle" different?

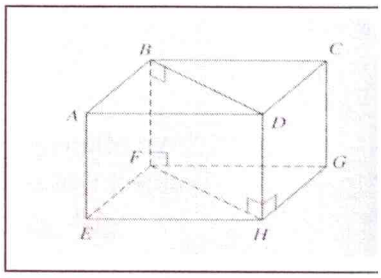
An angle is a 2-D object and the sides are RAYS.

A dihedral angle exists (usually) in 3D and its sides are half-planes.

6. In what ways are the geometric concepts of "angle" and "dihedral angle" similar in meaning?

They both refers to the orientation of one object to another. It describes the "angle of inclination" between 2 rays (forming an angle) or between 2 planes forming dihedral angles.

7. The figure at the right is a rectangular box in which EFGH and ABCD are rectangles and BF is perpendicular to planes EFGH and ABCD. Carefully study this figure and then answer the questions below.



(a) Line segment BD is **marked** as perpendicular to what line segment in the picture? $\overline{BF}$ or $\overline{FB}$

(b) Line segment GH is **marked** as perpendicular to what line segment in the picture? $\overline{DH}$

(c) Line segment DH is **marked** as perpendicular to two different line segments and 1 plane.

Those lines are $\overline{HG}$ and $\overline{HF}$ and the plane is EFGH

(d) Because we know that EFGH is a rectangle, we know that line segment EF is parallel to line segment $\overline{GH}$.

(e) Because we know that EFGH is a rectangle, we know that line segment EF is perpendicular to line segment $\overline{EH}$ and also to line segment $\overline{FG}$.

(f) Since ABCD is a rectangle, we know line segment AD is parallel to line segment $\overline{BC}$.

(g) Since we know that the figure is a rectangular box, we know that plane CDHG is parallel to plane ABFE

(h) Since we know that the figure is a rectangular box, we know that plane CDHG is perpendicular to planes ABCD and EFGH.
or ADHE and BCGF

(i) Generally we say that if two lines are perpendicular to the same line, the first two lines are parallel However, in this picture, segment DB and segment GF are both perpendicular to segment FB, but DB and GF are NOT parallel.

- What is the condition that allows this to happen?
  $\overline{DB}$ and $\overline{GF}$ are skew. They are NOT in the same plane.
- What is the correct geometric term for how lines DB and GF are related? Describe the meaning of this geometric term.
  SKEW

(j) What is the intersection of line BD and plane EFG? $\emptyset$

(k) What is the intersection of plane FBG and plane CDH? $\overleftrightarrow{CG}$