

# Points, Lines, and Planes

## Three Dimensional Geometry

**But not airplanes!**



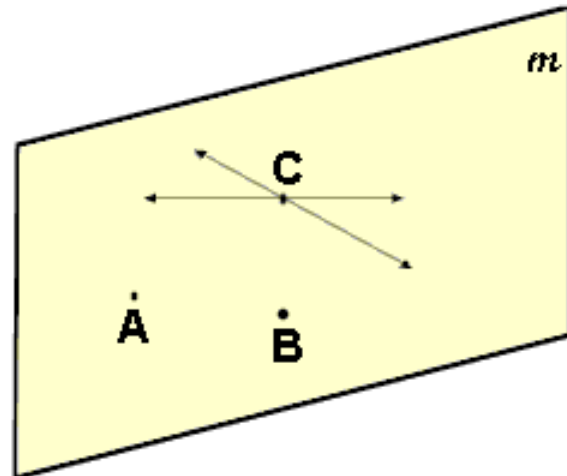
# Undefined Terms

- **Point:** Has no dimension, in other words no length, width, or thickness
  - named by a single letter
- **Line:** has no thickness but its length extends in one dimension and goes on forever in both directions.
  - Name by two points on the line or by a single lowercase letter



# Planes

- Planes have no thickness but extend indefinitely in all directions.
  - Represented by a shape that resembles a tabletop or parallelogram
  - Planes are named by:
    - A single letter
      - Example: plane  $m$
    - Any three points in the plane
      - Example: Plane ABC



# Important Vocabulary

## Collinear points

Points on the same line

A•                      B•                      C•

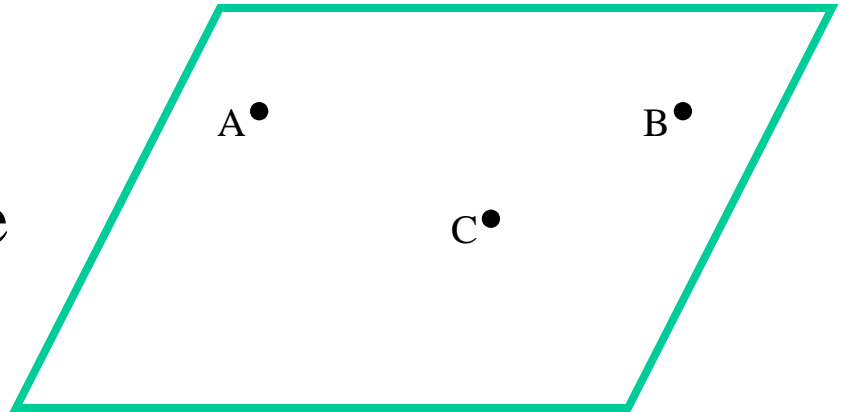
## Non – collinear points

Points not on the same line

A•                      B•  
                                 C•

## Coplanar points

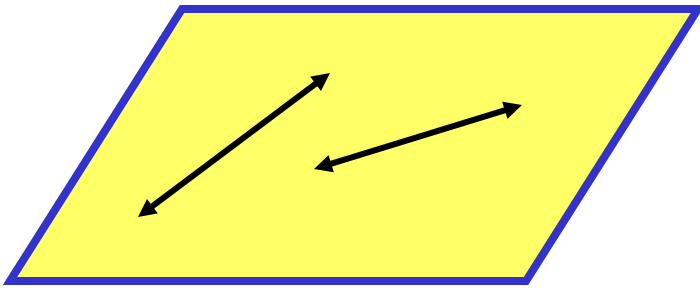
A set of all points lying  
in the same plane



# Important Vocabulary

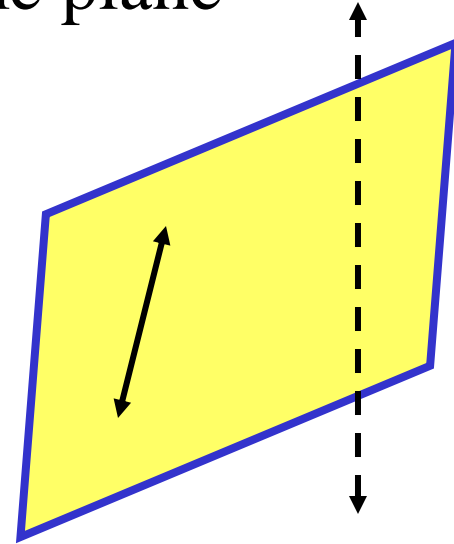
## Coplanar Lines

Lines that lie in the same plane



## Skew Lines

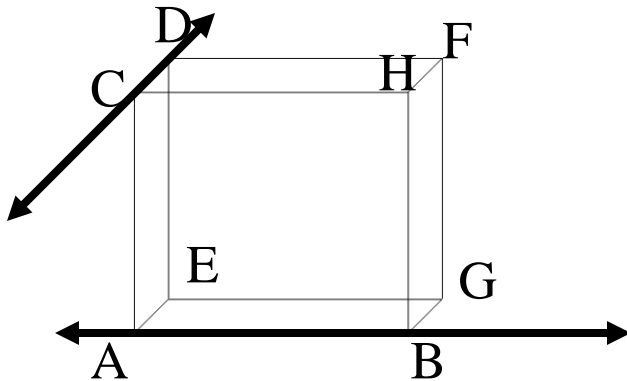
Lines that do not lie in the same plane



# Skew Lines

## Skew lines

Lines that are not parallel or intersecting



**Note:** NO plane will contain lines **AB** and **CD**.

# Lines and Planes

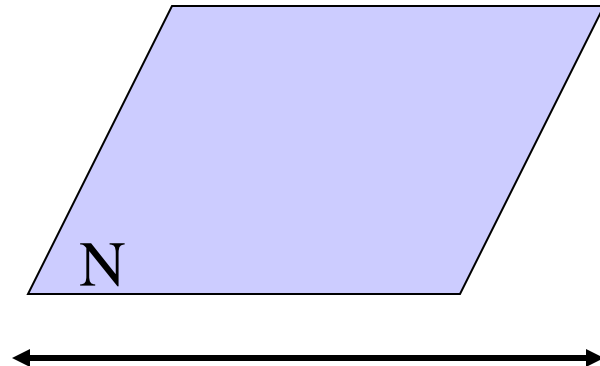
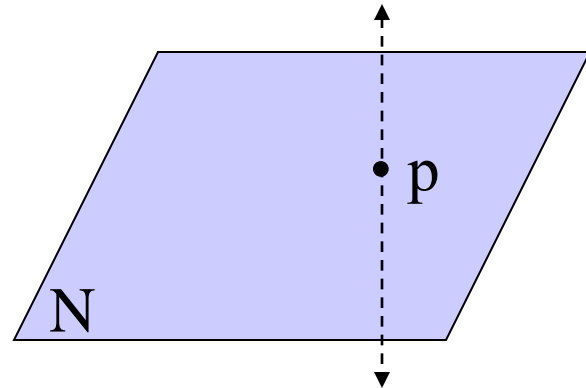
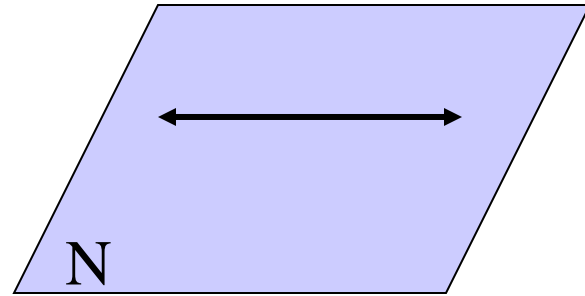
- A line can be in a given plane

OR

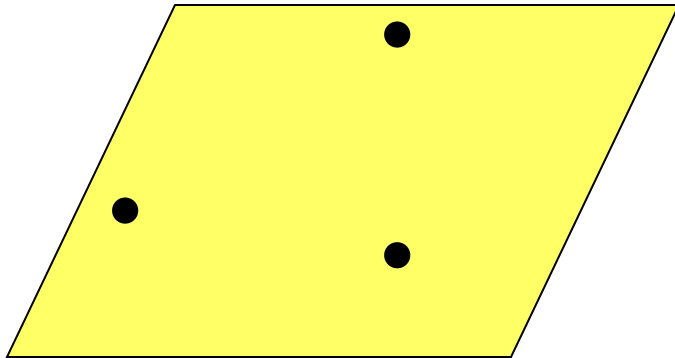
- A line can intersect a plane at one point

OR

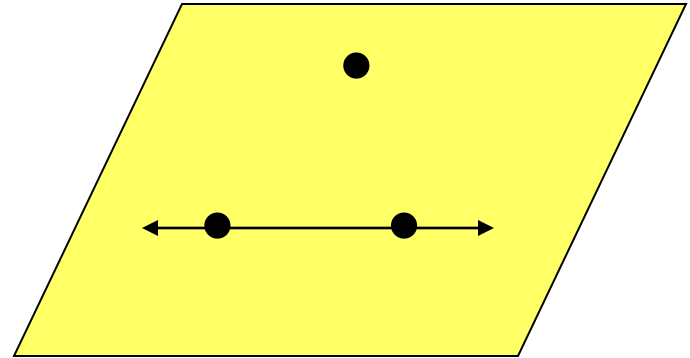
- A line may not intersect a plane at all and is parallel to the plane



# What *Determines* a Plane?



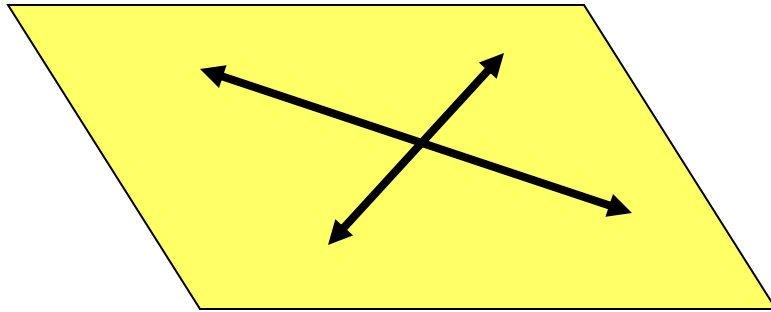
Three noncollinear points



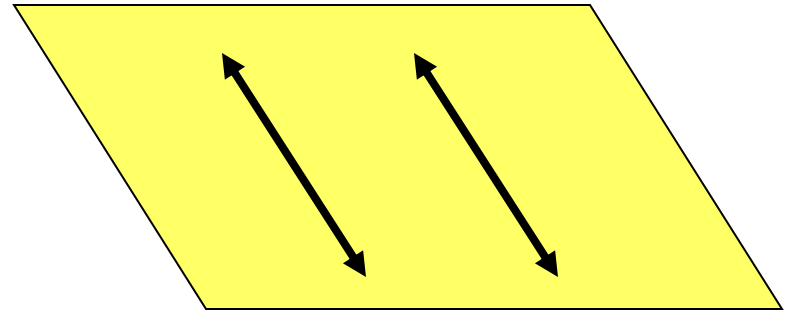
A line and a point not on  
the line



# What *Determines* a Plane?



Two intersecting lines



Two parallel lines

You've heard of parallel lines...

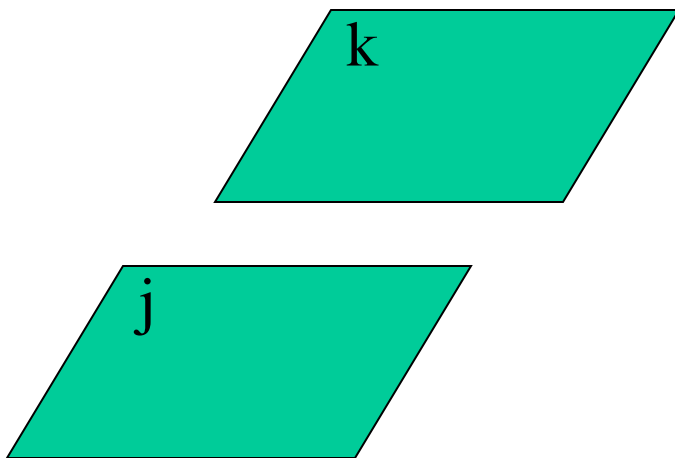
What about parallel *planes*?

**Parallel Planes:** Planes that do not intersect

Are there parallel planes in the *classroom*??

***YES!! The ceiling and floor***

*Draw two parallel planes, call them  $j$  and  $k$ :*



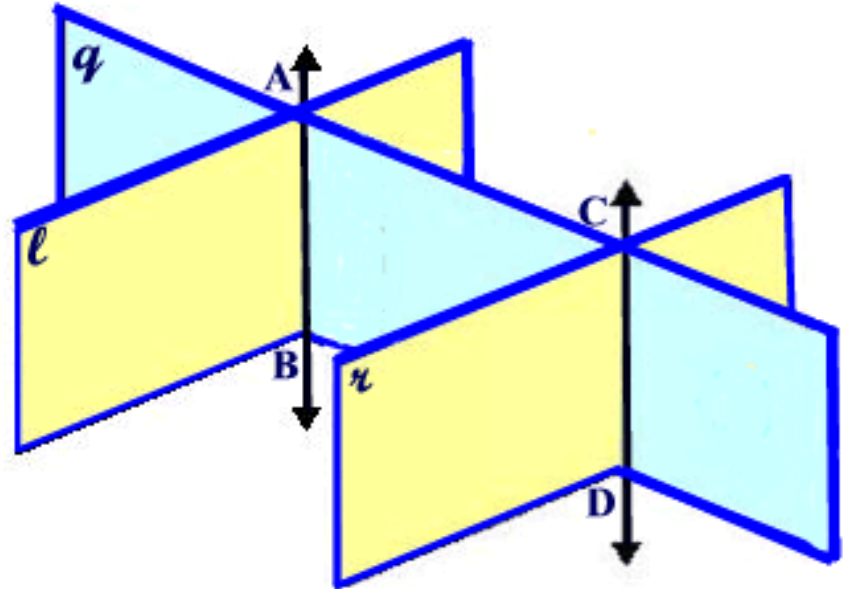
# Intersecting Planes

Use the picture to answer the following:

**What is formed when two planes intersect?**

Answer: A line

Plane  $q$  and plane  $l$   
intersect to form line  
AB



# Intersecting Planes

Dihedral Angle: the angle formed  
when two planes meet

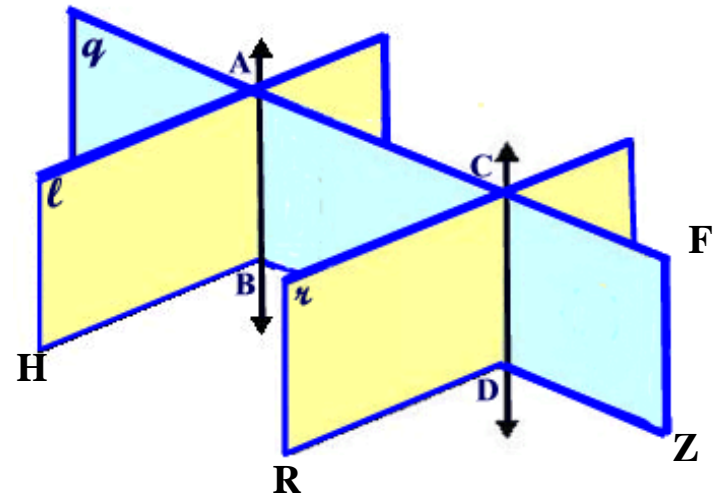
## Naming Dihedral Angles

A point in one plane – the edge – A point in the other plane

Name at least two dihedral angles from the picture:

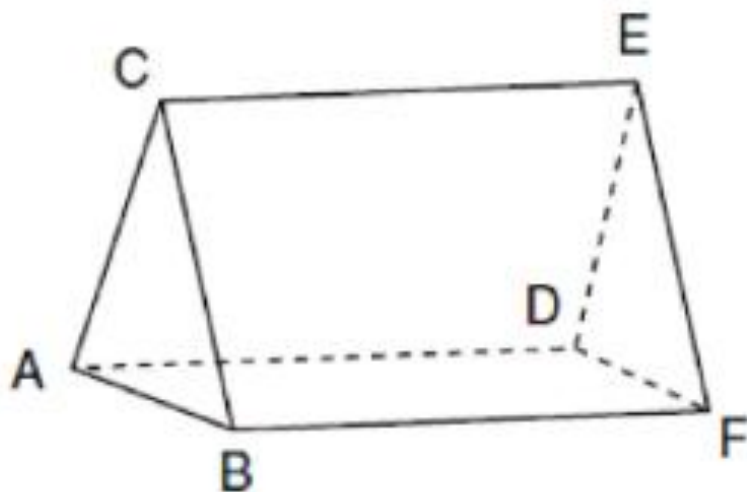
Dihedral angle  $F - CD - R$

Dihedral angle  $C - AB - H$



# Regents Questions

1. The figure in the diagram below is a triangular prism.

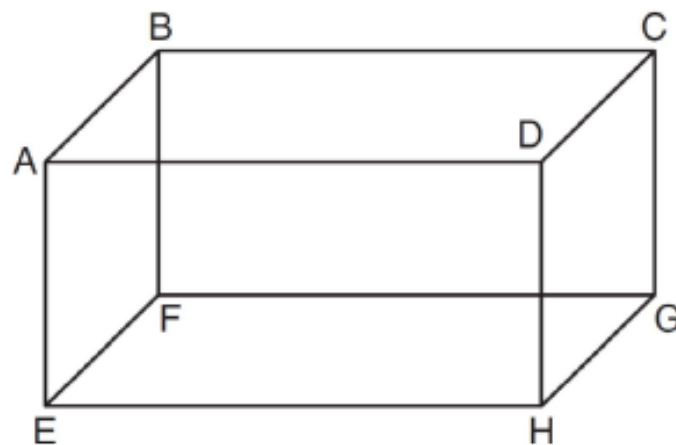


Which statement must be true?

- 1)  $\overline{DE} \cong \overline{AB}$
- 2)  $\overline{AD} \cong \overline{BC}$
- 3)  $\overline{AD} \parallel \overline{CE}$
- 4)  $\overline{DE} \parallel \overline{BC}$

3

2. The diagram below shows a rectangular prism.



Which pair of edges are segments of lines that are coplanar?

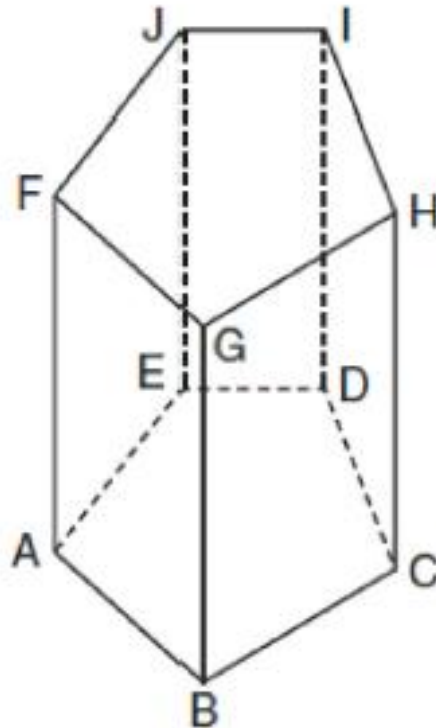
- 1)  $\overline{AB}$  and  $\overline{DH}$
- 2)  $\overline{AE}$  and  $\overline{DC}$
- 3)  $\overline{BC}$  and  $\overline{EH}$
- 4)  $\overline{CG}$  and  $\overline{EF}$

3

# Regents Questions

3.

The diagram below shows a right pentagonal prism.



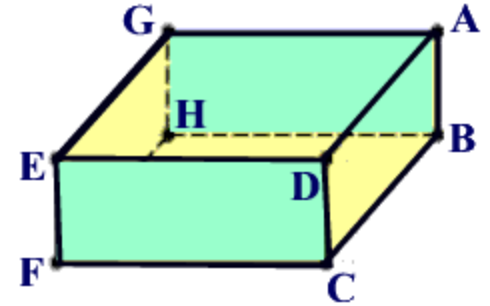
4

Which statement is always true?

- 1)  $\overline{BC} \parallel \overline{ED}$
- 2)  $\overline{FG} \parallel \overline{CD}$
- 3)  $\overline{FJ} \parallel \overline{IH}$
- 4)  $\overline{GB} \parallel \overline{HC}$

# Practice with lines and planes

1. In this rectangular sided box, which set of sides lie in the same plane?



**Answer:** AB and BC

2. True or false: When two planes intersect, two lines are formed.

**Answer:** FALSE, only one line is formed.

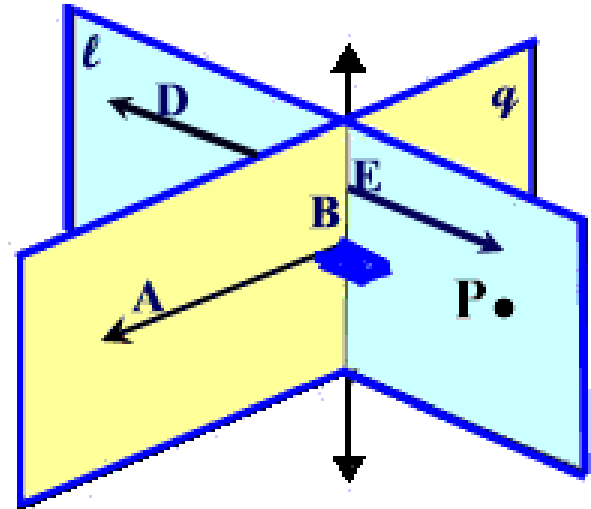
# Practice with lines and planes

3. Which of the following statements is TRUE from the picture?

**Answer:** Point  $p$  is in plane  $l$

4. If two lines intersect, only one plane contains both the lines. TRUE or FALSE?

**Answer:** TRUE

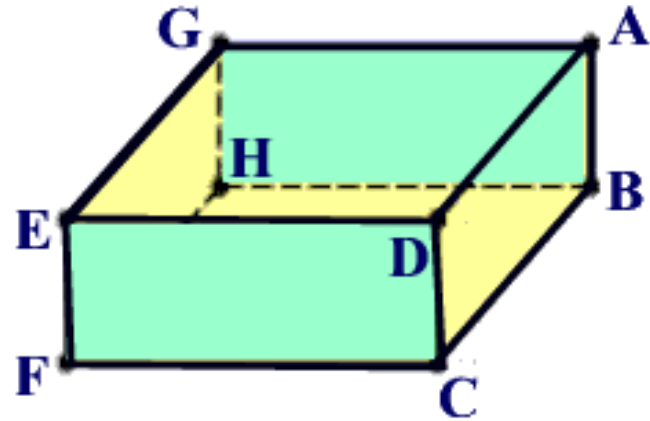




# Practice with lines and planes

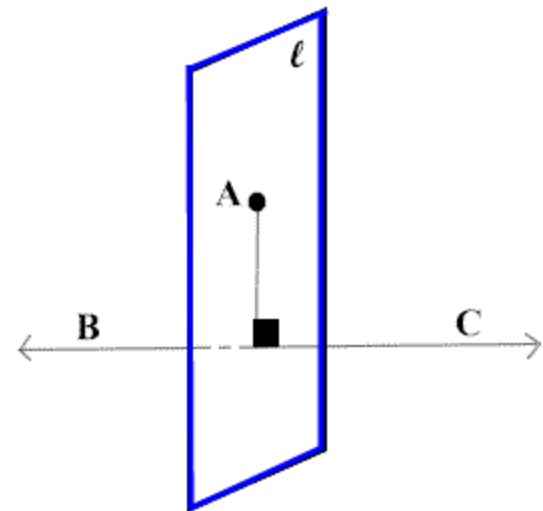
5. For this rectangular solid, plane  $GHB$  and  $EFC$  are \_\_\_\_\_.

**Answer:** Parallel



6. Which of the following statements is true from the picture?

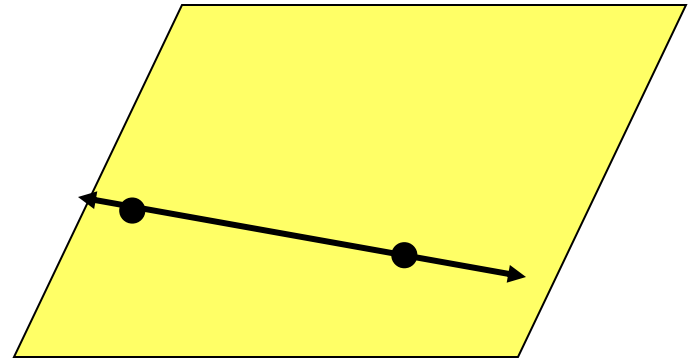
**Answer:** Plane  $l$  is perpendicular to line BC.



# Practice with lines and planes

7. If two points lie in a plane, the line joining them also lies in the same plane.  
TRUE or FALSE?

**Answer:** TRUE



8. For this rectangular solid, which plane(s) contain  $D$  and are parallel to plane  $FEG$ ?

**Answer:** Only plane DAB

