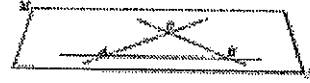


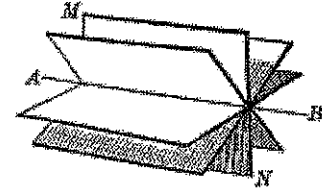
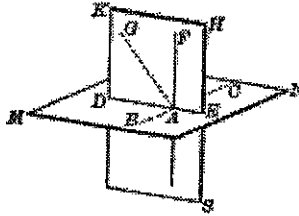
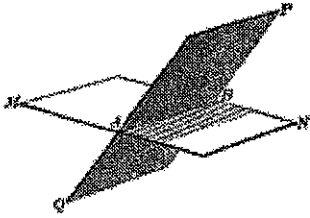
Parallel Lines in a Plane



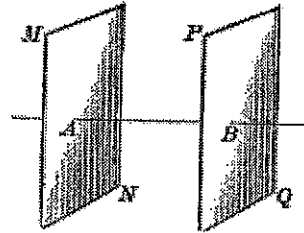
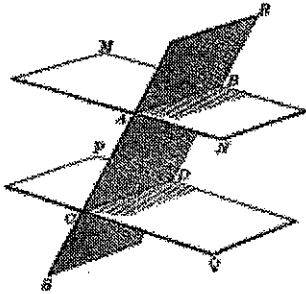
Intersecting Lines in a Plane



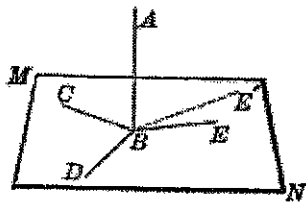
Intersecting Planes



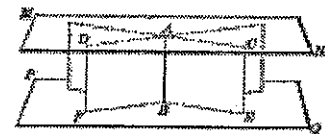
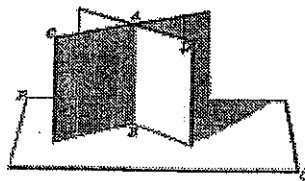
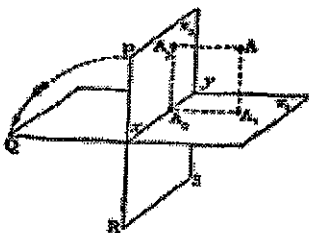
Parallel Planes



Line(s) Perpendicular to a Plane



Perpendicular Planes



Name _____

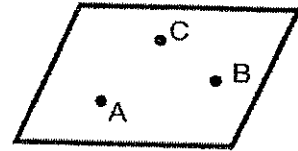
Date _____

Points, Lines and Planes

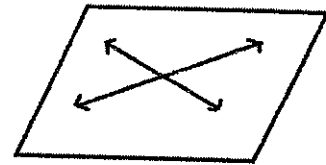
- Two points define a _____



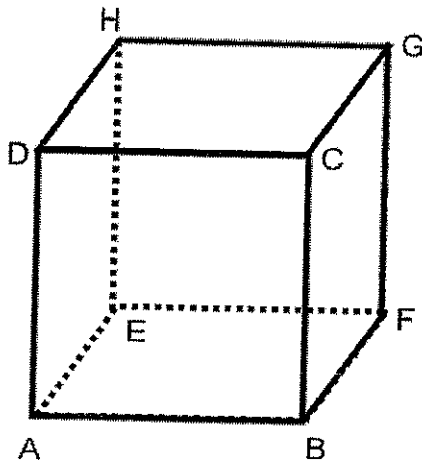
- Three points define a _____



- Two intersecting lines also determine a _____



In the following diagram,



- \overline{AB} and \overline{CD} are _____

- \overline{AB} and \overline{BF} are _____

- \overline{AB} and \overline{CG} are _____

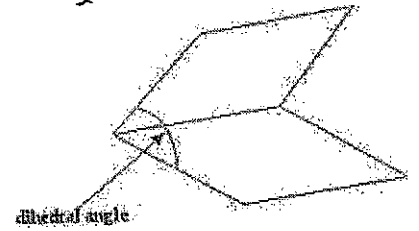
Definition: _____ are lines that do not intersect and are not parallel.

INTERSECTING PLANES

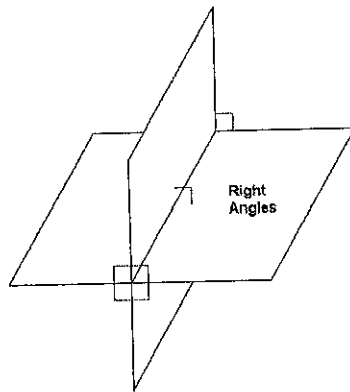
• If two lines intersect, their intersection is a _____

• If two planes intersect, their intersection is a _____

Definition: A _____ is where two planes meet.

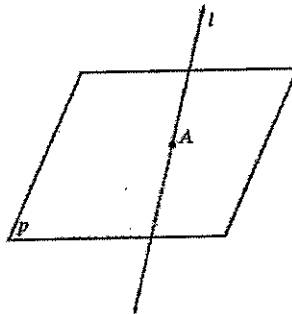


Definition: If two planes intersect to form a right dihedral angle, then they are _____.



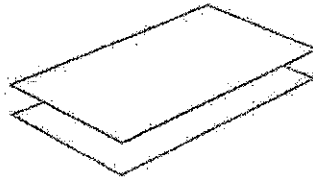
• Two planes are perpendicular if and only if one plane contains a line perpendicular to the other.

• If a plane and a line not on the plane intersect, it is at exactly _____ point.

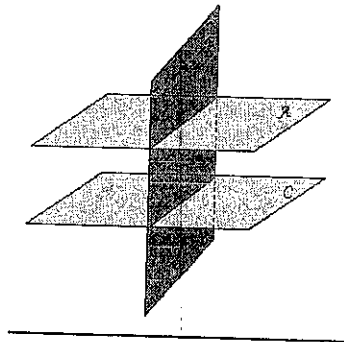


PARALLEL PLANES

Definition: _____ are planes that have no points in common

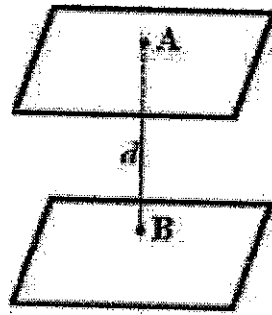


- If a plane intersects two parallel planes, the intersection is _____.



- Two planes perpendicular to the same plane are _____.

Definition: The distance between two parallel planes is the length of the _____
_____ to both planes with an endpoint on each plane.



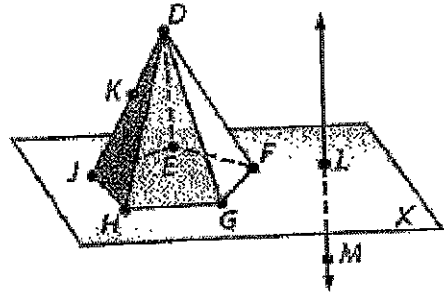
Examples:

1a) How many planes appear in this figure?

b) Name three points that are collinear.

c) Name the intersection of plane HDG with plane X.

d) At what point do \overleftrightarrow{LM} and \overleftrightarrow{EF} intersect? Explain.

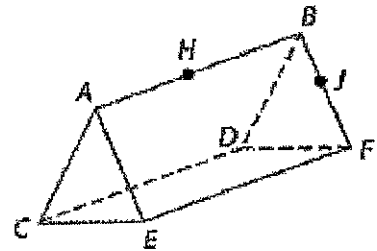


2a) How many planes are shown in the figure?

b) Name three points that are collinear.

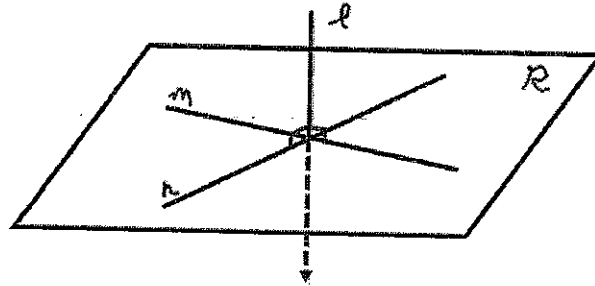
c) Are the points A, H, J, and D coplanar? Explain.

d) Are the points B, D and F coplanar? Explain.



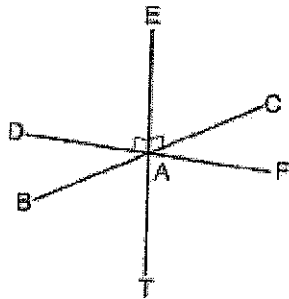
More Points, Lines and Planes Theorems

- If a line is perpendicular to each of two intersecting lines at the point of intersection, then it is also perpendicular to the plane determined by them.



Examples:

1. As shown in the diagram below, \overline{FD} and \overline{CB} intersect at point A and \overline{ET} is perpendicular to both \overline{FD} and \overline{CB} at A .



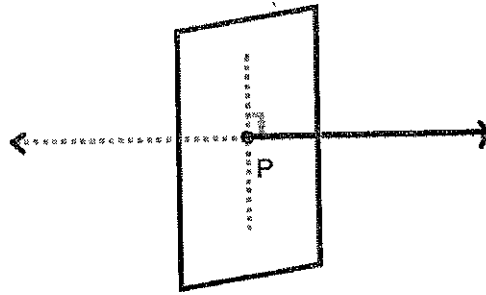
2. Lines j and k intersect at point P . Line m is drawn so that it is perpendicular to lines j and k at point P . Which statement is correct?
- 1) Lines j and k are in perpendicular planes.
 - 2) Line m is in the same plane as lines j and k .
 - 3) Line m is parallel to the plane containing lines j and k .
 - 4) Line m is perpendicular to the plane containing lines j and k .

Which statement is *not* true?

- 1) \overline{ET} is perpendicular to plane BAD .
- 2) \overline{ET} is perpendicular to plane FAB .
- 3) \overline{ET} is perpendicular to plane CAD .
- 4) \overline{ET} is perpendicular to plane BAT .

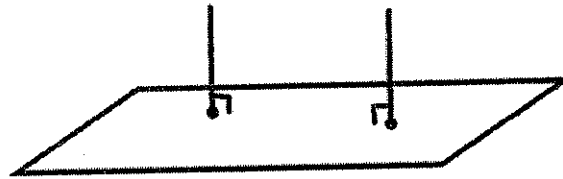
3. In plane \mathcal{P} , lines m and n intersect at point A . If line k is perpendicular to line m and line n at point A , then line k is
- 1) contained in plane \mathcal{P}
 - 2) parallel to plane \mathcal{P}
 - 3) perpendicular to plane \mathcal{P}
 - 4) skew to plane \mathcal{P}

- Through a given point, there passes one and only one plane perpendicular to given line.



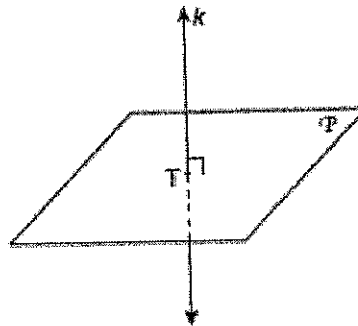
- Also, through a given point, there passes one and only one line perpendicular to a given plane.

- If two lines are perpendicular to the same plane then the lines are _____.



- If a line is perpendicular to a plane, then every _____ is also perpendicular to the given plane.

In the diagram below, line k is perpendicular to plane \mathcal{P} at point T .

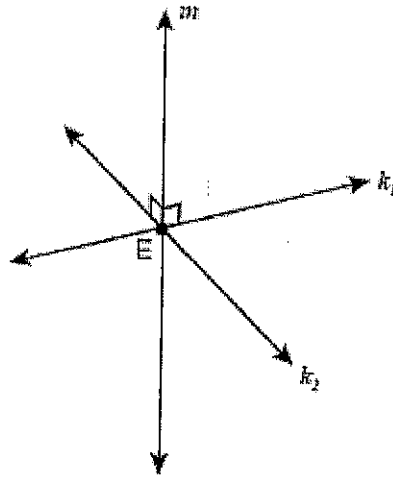


Which statement is true?

- | | |
|---|--|
| 1) Any point in plane \mathcal{P} also will be on line k . | 3) All planes that intersect plane \mathcal{P} will pass through T . |
| 2) Only one line in plane \mathcal{P} will intersect line k . | 4) Any plane containing line k is perpendicular to plane \mathcal{P} . |

Three Dimensional Mixed Review Questions

1) Lines k_1 and k_2 intersect at point E . Line m is perpendicular to lines k_1 and k_2 at point E .



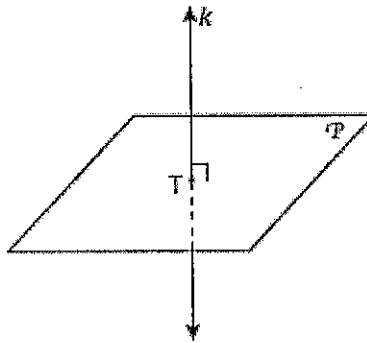
Which statement is always true?

- 1) Lines k_1 and k_2 are perpendicular.
 - 2) Line m is parallel to the plane determined by lines k_1 and k_2 .
 - 3) Line m is perpendicular to the plane determined by lines k_1 and k_2 .
 - 4) Line m is coplanar with lines k_1 and k_2 .
- 2) Point P is on line m . What is the total number of planes that are perpendicular to line m and pass through point P ?
- | | |
|------|-------------|
| 1) 1 | 3) 0 |
| 2) 2 | 4) infinite |
- 3) Through a given point, P , on a plane, how many lines can be drawn that are perpendicular to that plane?
- 1) 1
 - 2) 2
 - 3) more than 2
 - 4) none
- 4) If two different lines are perpendicular to the same plane, they are
- | | |
|--------------|----------------|
| 1) collinear | 3) congruent |
| 2) coplanar | 4) consecutive |

- 5) Lines m and n intersect at point A . Line k is perpendicular to both lines m and n at point A . Which statement *must* be true?
- 1) Lines m , n , and k are in the same plane.
 - 2) Lines m and n are in two different planes.
 - 3) Lines m and n are perpendicular to each other.
 - 4) Line k is perpendicular to the plane containing lines m and n .

- 6) Point A lies in plane \mathcal{B} . How many lines can be drawn perpendicular to plane \mathcal{B} through point A ?
- 1) one
 - 2) two
 - 3) zero
 - 4) infinite

- 7) In the diagram below, line k is perpendicular to plane \mathcal{P} at point T .



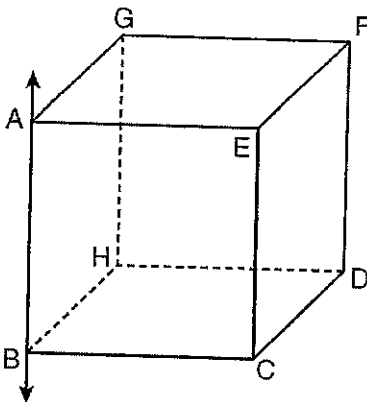
Which statement is true?

- | | |
|---|--|
| 1) Any point in plane \mathcal{P} also will be on line k . | 3) All planes that intersect plane \mathcal{P} will pass through T . |
| 2) Only one line in plane \mathcal{P} will intersect line k . | 4) Any plane containing line k is perpendicular to plane \mathcal{P} . |

- 8) If \overleftrightarrow{AB} is contained in plane \mathcal{P} , and \overleftrightarrow{AB} is perpendicular to plane \mathcal{R} , which statement is true?

- 1) \overleftrightarrow{AB} is parallel to plane \mathcal{R} .
- 2) Plane \mathcal{P} is parallel to plane \mathcal{R} .
- 3) \overleftrightarrow{AB} is perpendicular to plane \mathcal{P} .
- 4) Plane \mathcal{P} is perpendicular to plane \mathcal{R} .

9) In the diagram below, \overleftrightarrow{AB} is perpendicular to plane $AEFG$.



Which plane must be perpendicular to plane $AEFG$?

- | | |
|-----------|-----------|
| 1) $ABCE$ | 3) $CDFE$ |
| 2) $BCDH$ | 4) $HDFG$ |

10) If two distinct planes, \mathcal{A} and \mathcal{B} , are perpendicular to line c , then which statement is true?

- 1) Planes \mathcal{A} and \mathcal{B} are parallel to each other.
- 2) Planes \mathcal{A} and \mathcal{B} are perpendicular to each other.
- 3) The intersection of planes \mathcal{A} and \mathcal{B} is a line parallel to line c .
- 4) The intersection of planes \mathcal{A} and \mathcal{B} is a line perpendicular to line c .

11) In three-dimensional space, two planes are parallel and a third plane intersects both of the parallel planes. The intersection of the planes is a

- | | |
|----------|-------------------------------|
| 1) plane | 3) pair of parallel lines |
| 2) point | 4) pair of intersecting lines |

12) Line k is drawn so that it is perpendicular to two distinct planes, P and R . What must be true about planes P and R ?

- 1) Planes P and R are skew.
- 2) Planes P and R are parallel.
- 3) Planes P and R are perpendicular.
- 4) Plane P intersects plane R but is not perpendicular to plane R .

