SECTION 1 – 1

Points, Lines and Planes

OBJECTIVES

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1) To identify, name, and draw points, line segments, rays, and planes
2) To apply basic facts about points, lines, and planes

UNDEFINED TERMS

Point – names a location and has no size. It is represented by a dot and named with a capital letter.

P●

This is "Point P".

UNDEFINED TERMS

Line – a straight path that has no thickness and extends forever.

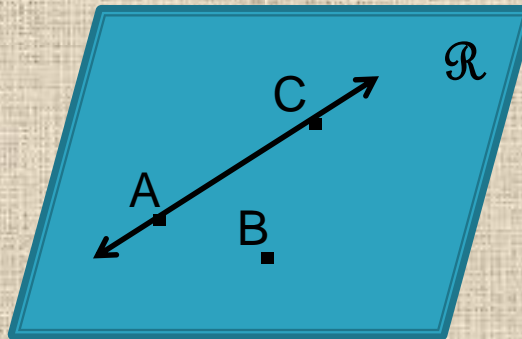A line contains infinitely many points.

Line ℓ

$\overleftrightarrow{XY}$

$\overleftrightarrow{YX}$

UNDEFINED TERMS

Plane – a flat surface that has no thickness and extends forever
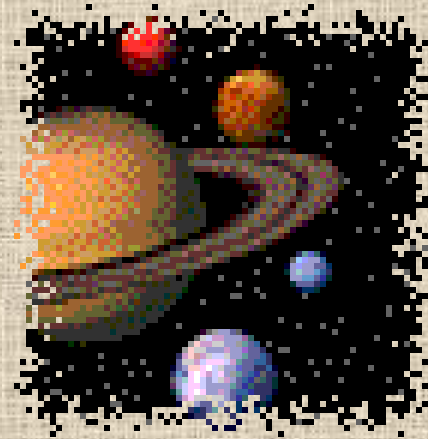
A plane contains infinitely many lines.

Plane $\mathcal{R}$; Plane ACB; Plane CBA, etc.

SPACE

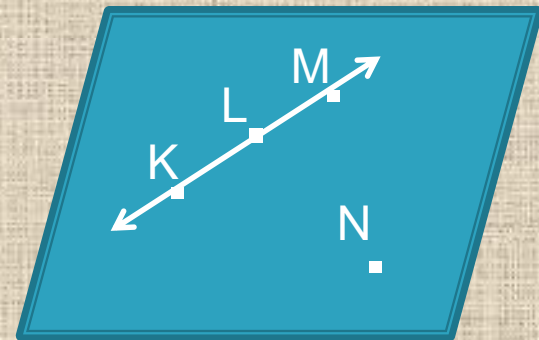**set of all points in three directions**

Collinear points – Points that lie on the same line

Coplanar – Points (and lines) that lie in the same plane

All the points of a line are coplanar.

Points K, L, and M are collinear.

Points K, L, M, and N are coplanar.

SEGMENT

part of a line that consists of two points (called endpoints) and all points between them.

A line segment is named with the two endpoints.
A segment is above the endpoints.

Say: "line segment AB" or "line segment BA"

Write $\overline{AB}$ or $\overline{BA}$

RAY

part of a line that starts at an endpoint and extends forever in one direction.

R ————————————→ S

A ray is named by the endpoint and another point on the ray. The **endpoint is first.** Ray above letters.

Say: "ray RS"

Write $\overrightarrow{RS}$

OPPOSITE RAYS

Opposite rays – two rays that have a common endpoint and form a line

$\overrightarrow{EF}$ and $\overrightarrow{EG}$ are opposite rays.

This is why a ray is sometimes called a "half-line".
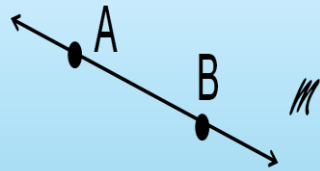
POSTULATE/AXIOM

A postulate is a statement that is accepted as true without proof.

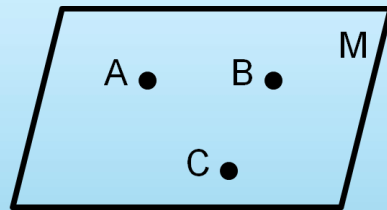A postulate cannot be proven, but it cannot be disproven.

Postulate

1–1–1

Through any two points there is exactly one line.

Line *m* is the only line that passes through points A and B.

Postulate

1-1-2

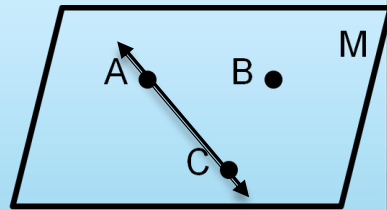Through any three noncollinear points there is exactly one plane containing them.

A ●   B ●   M

C ●

Points A, B and C are noncollinear. Plane M is the only plane that contains them.

Postulate

1–1–3

If two points lie in a plane, then the line containing those points lies in the plane.

Points A and C are contained in Plane M. $\overleftrightarrow{AC}$ is also contained in Plane M.
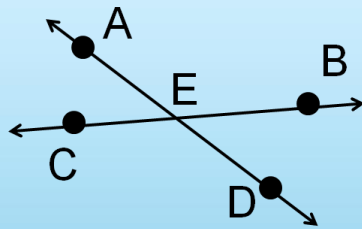
INTERSECTION

The set of points two or more geometric figures have in common

Postulate

1-1-4

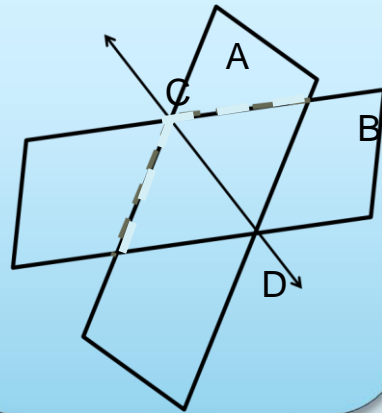If two distinct lines intersect, then they intersect in exactly one point.

$\overleftrightarrow{AD}$ and $\overleftrightarrow{CB}$ intersect in point E.

Postulate

1–1–5

If two distinct planes intersect, then they intersect in exactly one line.


Plane A and plane B intersect in $\overleftrightarrow{CD}$.

Use the figure below to answer the questions. Note that $\overleftrightarrow{RN}$ pierces the plane at N. It is not coplanar with plane V.

1. Name two segments shown in the figure.

2. What is the intersection of $\overleftrightarrow{CM}$ and $\overleftrightarrow{RN}$?

3. Name three collinear points.

4. What are two other ways to name plane V?

5. Are points R, N, M, and X coplanar?

6. Name two rays shown in the figure.

7. Name a pair of opposite rays with end point N.
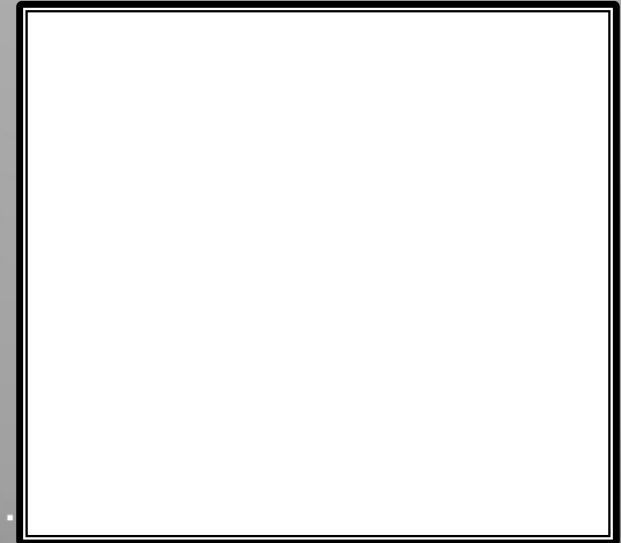
1. *AWV.* EX: $\overline{NM}$ and $\overline{AX}$
2. Point N
3. Points A,N,X or C,N,M
4. AWV. EX: Plane ANC or Plane MCX
5. No
6. AWV. EX: $\overrightarrow{NR}$ and $\overrightarrow{CM}$
7. $\overrightarrow{NA}$ and $\overrightarrow{NX}$ or $\overrightarrow{NM}$ and $\overrightarrow{NC}$
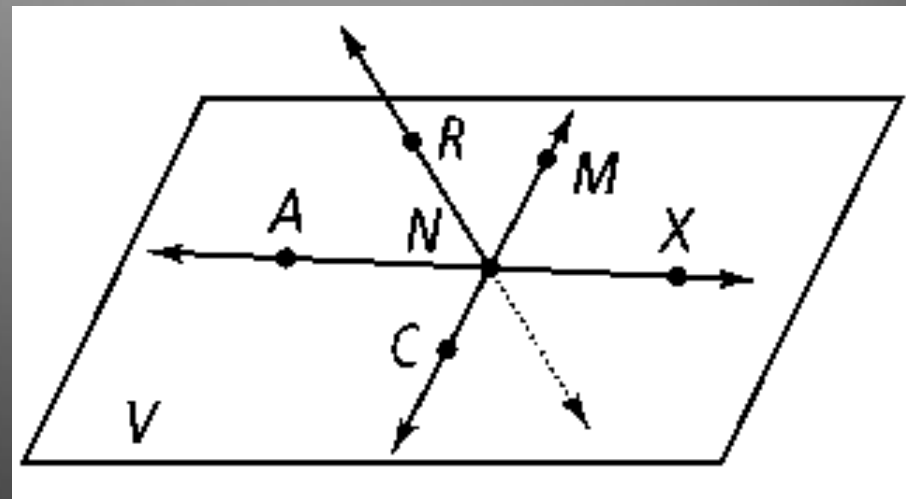
Determine whether each statement is always, sometimes, or never true.

- 8. $\overrightarrow{GH}$ and $\overrightarrow{HG}$ are the same ray.

  9. $\overrightarrow{JI}$ and $\overrightarrow{JL}$ are opposite rays.

10. A plane contains only three points.

11. Three noncollinear points are contained in only one plane.

12. If $\overleftrightarrow{EG}$ lies in plane X, then point G lies in plane X.

13. If three points are coplanar, they are collinear.

Name the intersection of the following figures.

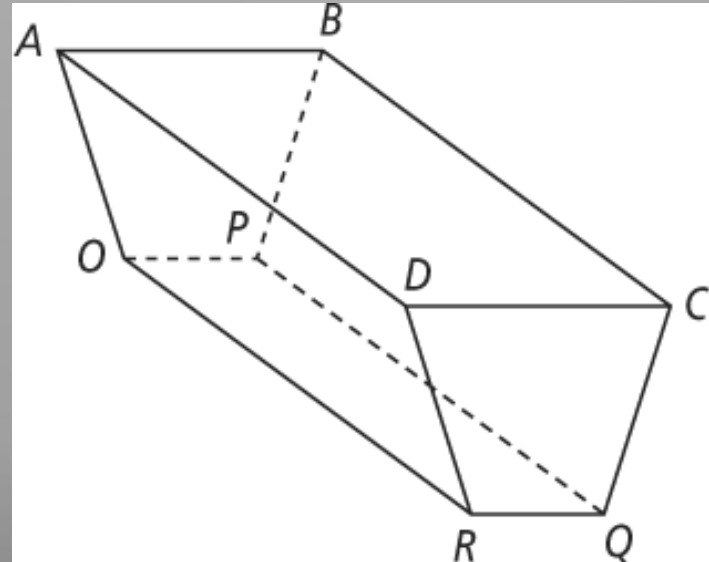14. Planes ABP and BCD

15. $\overleftrightarrow{RQ}$ and $\overleftrightarrow{RO}$

16. Planes *ADR and DCQ*

17. Planes BCD and BCQ

18. $\overleftrightarrow{OP}$ and $\overleftrightarrow{QP}$

Name two planes that intersect in the given line.

19. $\overleftrightarrow{RO}$

20. $\overleftrightarrow{DA}$

14. $\overleftrightarrow{AB}$
15. Point *R*
16. $\overleftrightarrow{DR}$
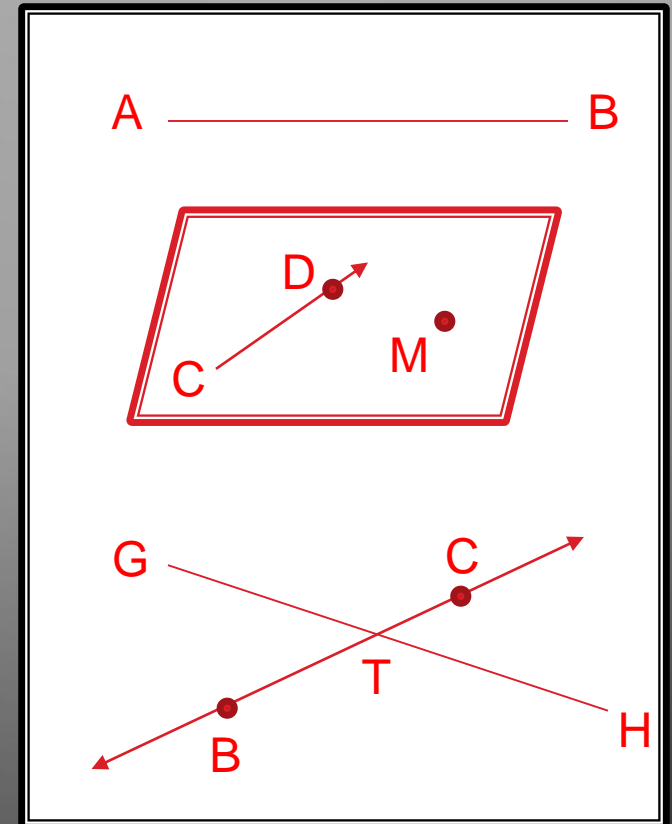17. $\overleftrightarrow{BC}$
18. Point *P*
19. Planes *ADR* and *RQP*
20. Planes *ABC* and *AOR*

Represent the following figures:

21. A line segment with endpoints A and B

22. A plane containing $\overrightarrow{CD}$ and Point M

23. $\overleftrightarrow{BC}$ intersecting $\overline{GH}$ at Point T

SUMMARY

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1. The three undefined terms are the point, line and plane. They are the basis for all Geometric figures.
2. Points that lie on the same line are collinear.
3. Points and lines in the same plane are coplanar.
4. Segments and rays are parts of lines.

SUMMARY

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Point minimums:
1. Through any two points there is exactly one line.
2. Through any three noncollinear points there is exactly one plane.

Intersections:
3. Two distinct lines intersect in a point.
4. Two distinct planes intersect in a line.

LEARNING RUBRIC

- Got It: Applies always/sometimes/never reasoning to basic Geometric figures
- Almost There: Represents basic figures in a diagram
- Moving Forward: Identifies intersections of lines and planes
- Getting Started: Identifies figures in diagrams

HOMEWORK

- Pages 9–11:
- 14–20 even;
- 24–28 even;
- 31–34 all;
- 36, 40