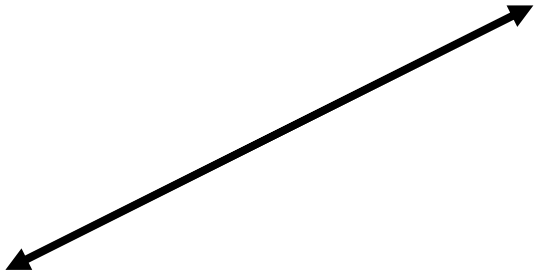
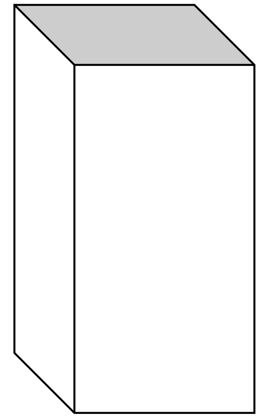




Geometry

Chapter 1: POINTS, LINES, PLANES, AND ANGLES

NAME

Section 1-1: A Game and Some Geometry

EQUIDISTANT

Section 1-2: Points, Lines, and Planes

3 Undefined terms in Geometry:

1.

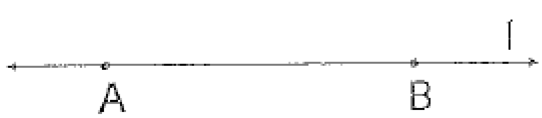
2.

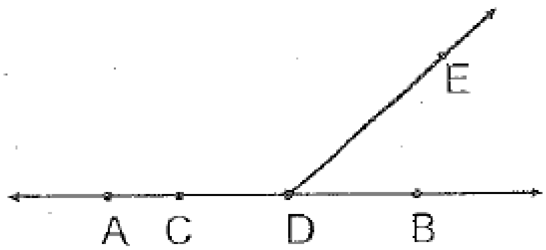
3.

POINT

•A

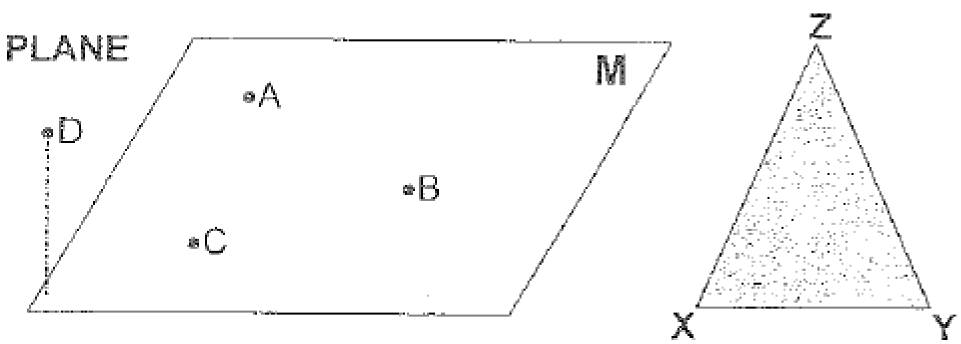
LINE





COLLINEAR POINTS –

NONCOLLINEAR POINTS -



COPLANAR POINTS –

NONCOPLANAR POINTS -

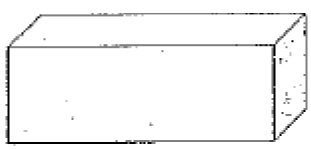
A LINE CONSISTS OF AT LEAST ______ POINTS.

A PLANE CONSISTS OF AT LEAST ______ POINTS.

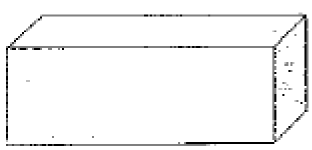
SPACE -

INTERSECTION -

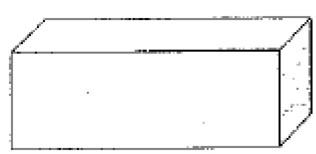
The intersection of 2 lines is a ______________.



The intersection of 2 planes is a ____________.



The intersection of a plane and a line not on that plane is a ______________.



Examples:

Classify each statement as true or false.

1. $\overleftrightarrow{PF}$ ends at P.

2. Point S is on an infinite number of lines.

3. A plane has no thickness.

4. Collinear points are coplanar.

5. Planes have edges.

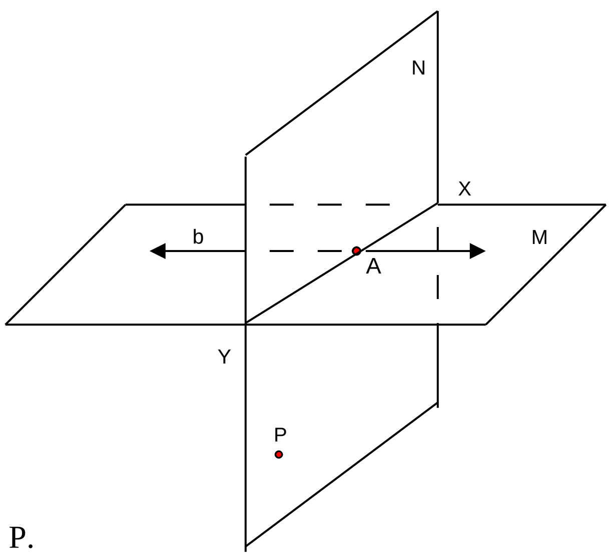
6. Two planes intersect in a line segment.

7. Two intersecting lines meet in exactly one point.

8. Points have no size.

9. Line XY can be denoted as $\overleftrightarrow{XY}$ or $\overleftrightarrow{YX}$.

Use the diagram below to classify each statement as true or false.



10. P is in M.

11. b is in M.

12. $\overleftrightarrow{YX}$ contains P.

13. A in on b.

14. A and P are in M.

15. N contains P.

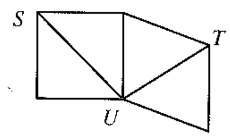
Points, Lines, and Planes

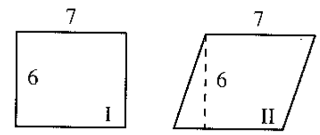
For use after Section 1–2

Estimate to compare the values.

1. The distance from U to S and the distance from U to T ______________

2. The area of figure I (area I) and the area of figure II (area II) ______________





Classify each statement as true or false. (Write T or F.)

3. $\overleftrightarrow{AB}$ is in plane M. ________

4. M contains $\overleftrightarrow{CD}$. ________

5. $\overleftrightarrow{AB}$ intersects N at E. ______

6. $\overleftrightarrow{AB}$ intersects $\overleftrightarrow{CD}$ at D. ________

7. F is in plane N. ________

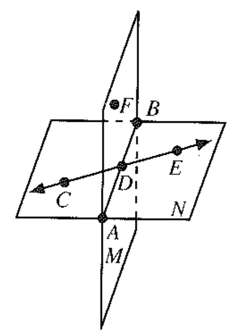
8. B is in plane N. ________

9. A, D, and F are coplanar. ________

10. N contains C, D, E, and F. ________

11. E is on $\overleftrightarrow{CD}$. ________

12. C, D, and E are collinear. ________



Exs. 3–12

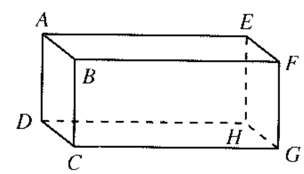
Name a fourth point that is in the same plane as the given points.

13. A, B, F ________

14. E, H, G ________

15. C, G, E ________

16. E, B, C ________



Exs. 13–20

Name each of the following.

17. Three lines that intersect at point E ______________

18. The plane that does *not* intersect plane $FGHE$ ______________

19. Two planes that intersect in $\overleftrightarrow{CG}$ ______________

20. Three planes that intersect at point D ______________

Sketch and label the figures described.

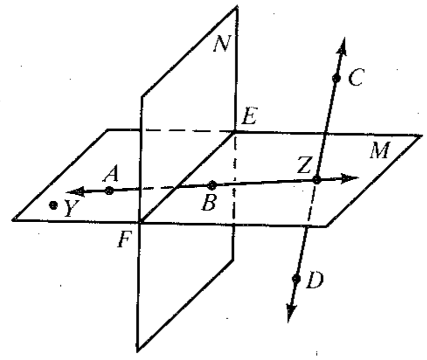
21. Vertical planes P and Q intersect in $\overleftrightarrow{RS}$.

22. Horizontal plane M containing $\overleftrightarrow{AB}$ intersects $\overleftrightarrow{AC}$ at point A.

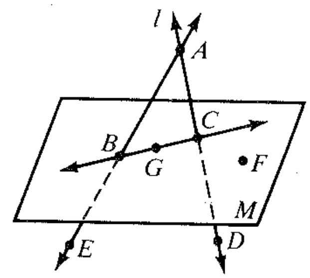
1–2 Points, Lines, and Planes *(continued)*

intersection the set of points in both figures
(Dashes in the diagrams indicate parts hidden from view.)

Z is **on** $\overleftrightarrow{AB}$.
$\overleftrightarrow{AB}$ **contains** Z.
$\overleftrightarrow{AB}$ **passes through** Z.
$\overleftrightarrow{AB}$ and $\overleftrightarrow{CD}$ **intersect at** Z.
Plane M contains $\overleftrightarrow{AB}$ and Y.
$\overleftrightarrow{CD}$ intersects M at Z.
M and N intersect in $\overleftrightarrow{EF}$.
$\overleftrightarrow{EF}$ is the **intersection of** M and N.
M and N contain $\overleftrightarrow{EF}$.

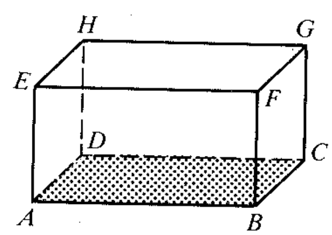


Classify each statement as true or false.



1. $\overleftrightarrow{BC}$ is in plane M.
2. Plane M contains $\overleftrightarrow{AB}$.
3. Line l intersects $\overleftrightarrow{AB}$ at point B.
4. $\overleftrightarrow{AB}$ and $\overleftrightarrow{DA}$ intersect at A.
5. $\overleftrightarrow{AD}$ is in plane M.
6. Plane M intersects $\overleftrightarrow{AE}$ at point B.
7. $\overleftrightarrow{AE}$ intersects plane M at point B.
8. A, B, and E are collinear.
9. B, F, and D are collinear.
10. A, B, and C are coplanar.
11. B, C, F, and G are coplanar.
12. A, B, C, and G are coplanar.
13. A, B, C, and F are coplanar.

The plane that contains the shaded region can be called plane *ABCD*.

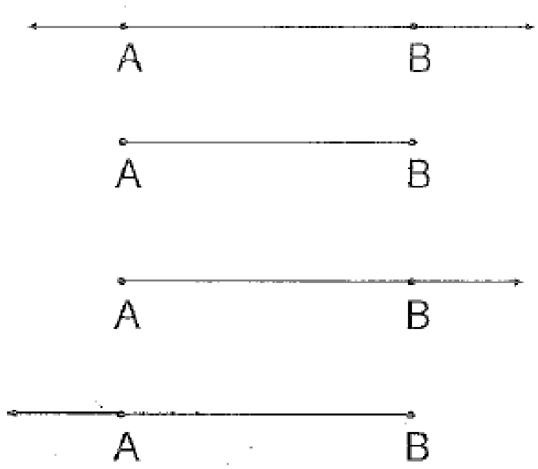


14. Name three lines that intersect at point G.
15. Name two planes whose intersection is $\overleftrightarrow{FB}$.
16. Name the intersection of plane $EHGF$ and plane $EFBA$.
17. Name two planes that do not intersect.
18. Are points D, H, G, and C coplanar?
19. Are points D, H, G, and F coplanar?
20. Are points A, B, G, and H coplanar?

Sketch and label the figures described. Use dashes for parts hidden from view.

21. Line $\overleftrightarrow{AB}$ intersects plane X at point C.
22. Two planes M and N intersect in line l.
23. Horizontal plane P contains two lines $\overleftrightarrow{RS}$ and $\overleftrightarrow{TU}$ that intersect at point O.

Section 1-3: Segments, Rays, and Distance

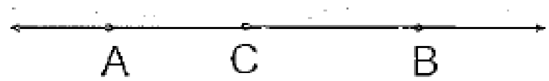


Ray: ______________________________

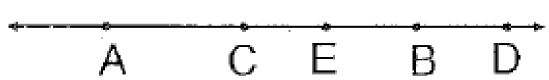
____

Segment: ______________________________

____



Opposite Rays – 2 rays that have a ____________ ______________ and go in ______________ directions.



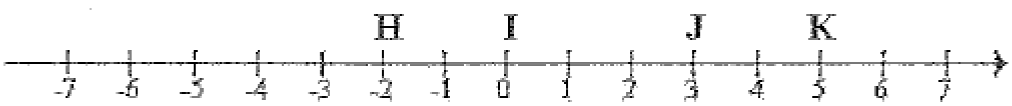
List some pairs of opposite rays.

Postulates:

Theorems:

Length of a segment:

Ruler Postulate:



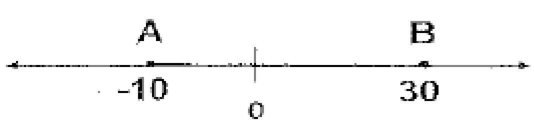
HI = ______

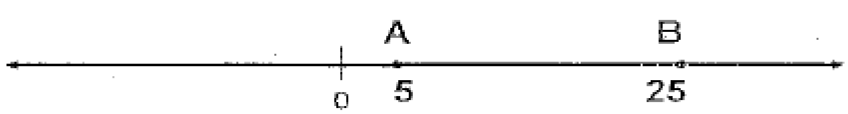
IJ = ______

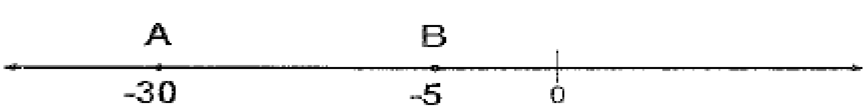
JK = ______

HJ = ______

IK = ______

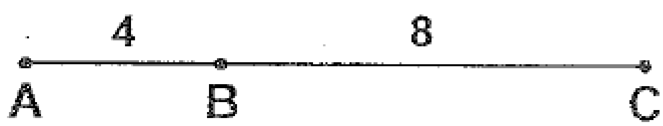




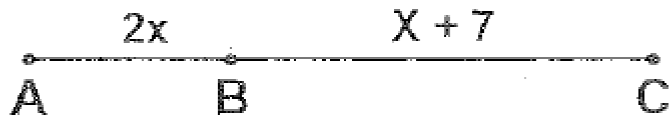


Segment Addition Postulate: If B is between A & C, then AB + BC = ______.

Example 1   AC = ______



Example 2 If $AC = 16$, find x.



Example 3 If $AC = 30$, find BC.

Congruent – objects that have the

same ________ and ___________ $\cong$

Congruent Segments – segments that

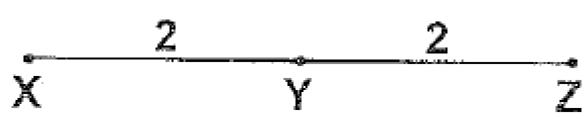
have ___________ _____________

If DE = FG, then $\overline{DE} \cong \overline{FG}$.

Midpoint of a Segment: the point that

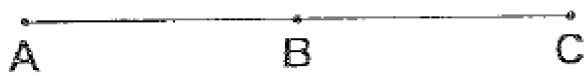
_________________ the segment into _____

_____ segments



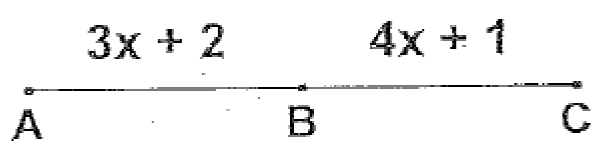
Example 4

Given B is the midpoint of $\overline{AC}$, $AB = 4x$, and $AC = 32$. Find x.

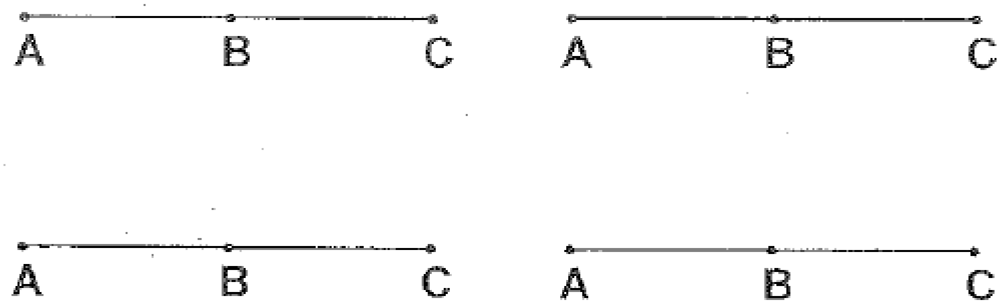


Example 5

Given B is the midpoint of $\overline{AC}$, Find AC.



Bisector of a Segment: a __________, __________________, ________, or _____________ that intersects a segment at its ____________________



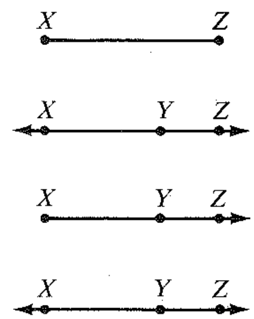
1–3 Segments, Rays, and Distance

Objectives: Use symbols for lines, segments, rays, and distances; find distances. Use the Segment Addition Postulate.

In learning a new language, the first things you need to learn are vocabulary and rules of grammar. In geometry, you need vocabulary, symbols, and rules called *postulates*.

segment A segment is named by giving its endpoints. X and Z are the endpoints of $\overline{XZ}$. $\overline{XZ}$ and $\overline{ZX}$ are the same segment. Y is **between** X and Z. Y must be on $\overleftrightarrow{XZ}$.

ray A ray is named by giving its endpoint and another point on the ray. The endpoint of a ray is always named first.
$\overrightarrow{XY}$ and $\overrightarrow{XZ}$ are the same ray.
$\overrightarrow{XZ}$ and $\overrightarrow{ZX}$ are different rays.
$\overrightarrow{YX}$ and $\overrightarrow{YZ}$ are **opposite rays.**

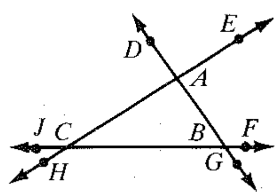


Refer to the diagram at the right.

1. Give several names for the line.
2. Name several segments in the figure.
3. Name several rays in the figure.
4. Name two pairs of opposite rays.

Classify each statement as true or false.

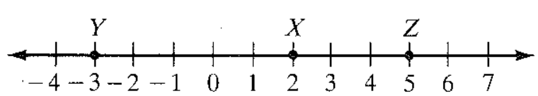
5. C is between A and B.
6. $\overrightarrow{AD}$ and $\overrightarrow{AG}$ are opposite rays.
7. $\overline{CB}$ is the same as $\overline{BC}$.
8. $\overrightarrow{CB}$ is the same as $\overrightarrow{BC}$.
9. $\overleftrightarrow{CB}$ is the same as $\overleftrightarrow{BC}$.
10. $\overline{CB}$ is the same as $\overleftrightarrow{BC}$.
11. $\overleftrightarrow{JF}$ is the same as $\overleftrightarrow{CB}$.
12. $\overrightarrow{BA}$ is the same as $\overrightarrow{BD}$.



length XZ is the length of $\overline{XZ}$ or the distance between point X and point Z. You can find the length of a segment on the number line by computing the absolute value of the difference of the coordinates of the endpoints. Length must be a positive number.

Example 1

Find XZ and YX.



Solution

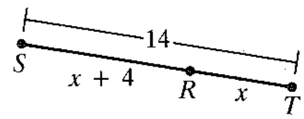
$XZ = |2 - 5| = |-3| = 3$ $\quad$ $YX = |-3 - 2| = |-5| = 5$

or $XZ = |5 - 2| = |3| = 3$ $\quad$ *or* $YX = |2 - (-3)| = |5| = 5$

Segment Addition Postulate **If B is between A and C, then $AB + BC = AC$.**

Example 2

R is between S and T, with $RT = x$,
$SR = x + 4$, and $ST = 14$.
Find the value of x. Then find RT and SR.



Solution

$SR + RT = ST$ (by the Segment Addition Postulate)

$x + x + 4 = 14$

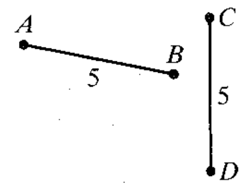
$2x + 4 = 14$

$2x = 10$

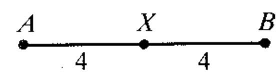
$x = 5$ $\quad RT = x = 5$

$SR = x + 4$
$= 5 + 4$
$= 9$

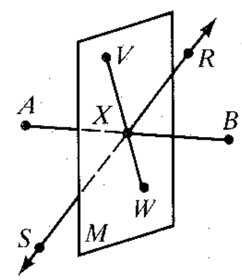
congruent Two objects that have the same size and shape are congruent ($\cong$). For example, **congruent segments** have the same length. If $AB = CD$, then $\overline{AB} \cong \overline{CD}$.



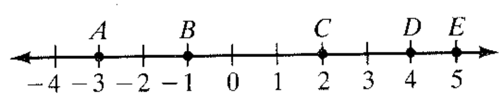
midpoint of a segment A midpoint divides a segment into two congruent segments. X is the midpoint of $\overline{AB}$, so $\overline{AX} \cong \overline{XB}$.



bisector of a segment A segment bisector is a line, segment, ray, or plane that intersects a segment at its midpoint. $AX = XB$, so plane M, $\overleftrightarrow{RS}$, and $\overline{VW}$ are all bisectors of $\overline{AB}$.



For Exercises 13–16, refer to the number line at the right.



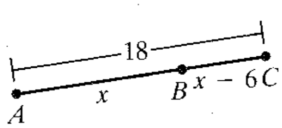
13. Find BD.

14. Find the length of $\overline{AC}$.

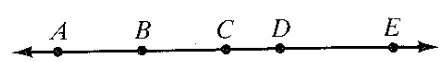
15. Find the distance between B and E.

16. Find the coordinate of the midpoint of $\overline{AE}$.

17. Find the value of x.



18. In the diagram, $\overline{AC} \cong \overline{CE}$ and B is the midpoint of $\overline{AC}$. $CD = 2$ and $AB = 3$. Find BC, AC, and DE.



Review for quiz on 1-1 to 1-3

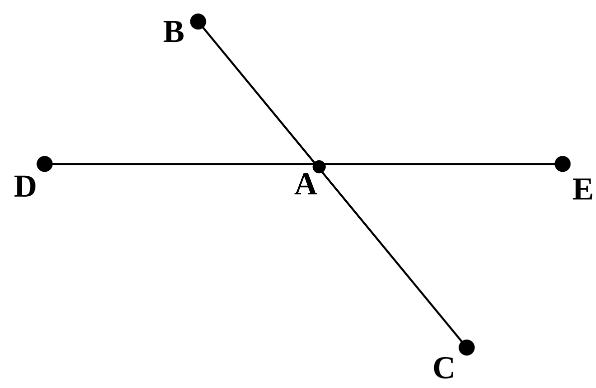
I. Vocabulary

- Point
- Line
- Plane
- Space
- Collinear
- Coplaner
- Ray
- Segment
- Distance
- Congruent
- Segment Bisector
- Midpoint of a Segment

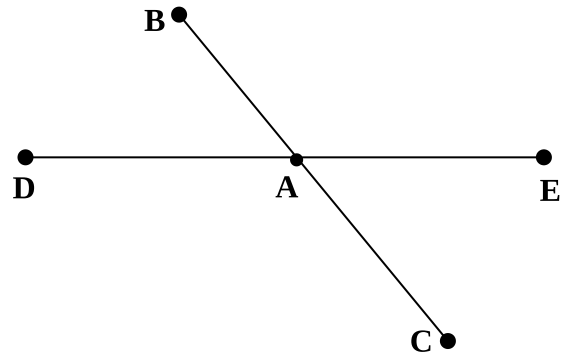
II. A is the midpoint of $\overline{DE}$.
Solve for x.

BA = 3x + 6, AC = 18, BC = 5x – 12

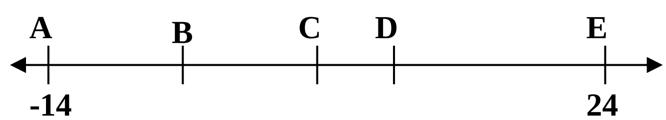
x = ______



DA = 3x + 60, EA = 10x – 17, x = ______



In the following diagram, C is the midpoint of $\overline{AE}$.
B is the midpoint of $\overline{AC}$. CD = 4 and AB = 9.5



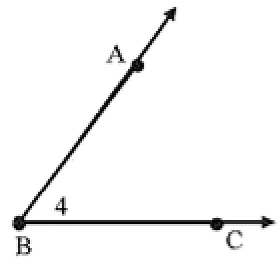
AC = ______

DE = ______

Coordinate for D = _____

Coordinate for C = _____

Section 1-4: Angles



Angle – figure formed by 2 rays that have the same endpoint

The rays are the ___________.

The common endpoint is the ___________.

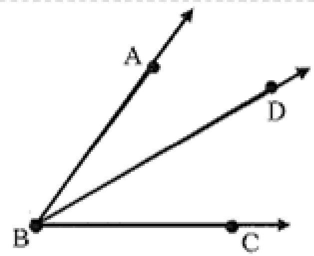
When naming an angle, use ___ letters, ___ letter, or ___ number.

Name the angle.

Vertex = _____

Sides = _____ and _____

Name 3 angles.



Angles are measured in _______________.

There are 4 classifications of angles.

____

Measures between _____ and _____

____

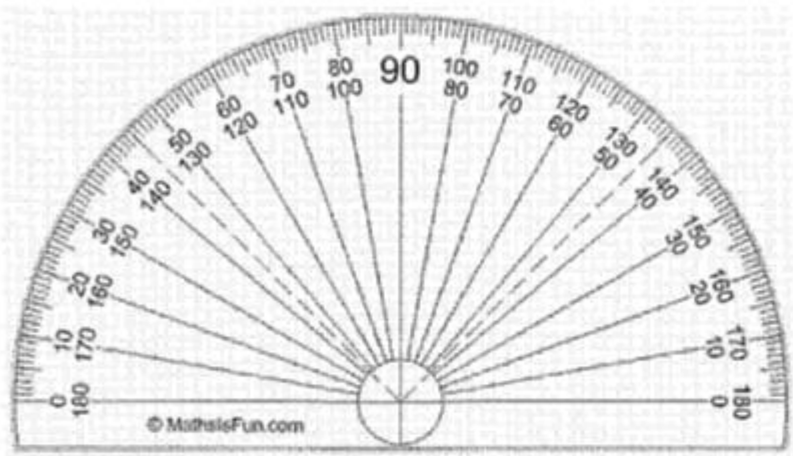
Measure ______

____

Measures between _____ and ______

____

Measure ______



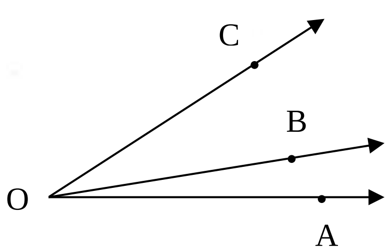
Protractor Postulate: Given $\angle QOP$, if $\overrightarrow{OP}$ is paired with x and $\overrightarrow{OQ}$ is paired with y, then $m\angle QOP = |x - y|$.

Example 1 20° and 90°

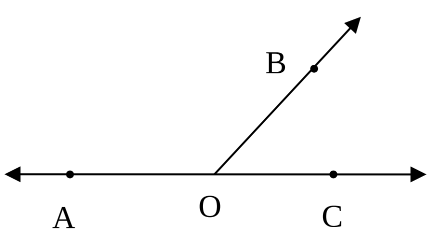
Example 2 90° and 120°

Example 3 90° and 40°

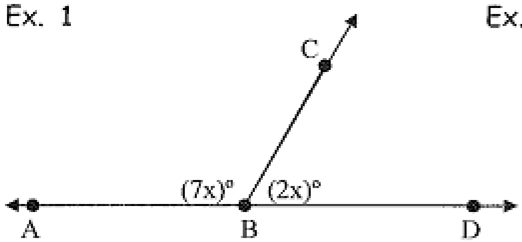
Angle Addition Postulate: If point B lies in the interior of $\angle AOC$, then $m\angle AOB + m\angle BOC = m\angle AOC$.



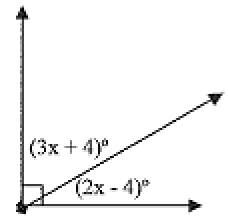
Angle Addition Postulate: If $\angle AOC$ is a straight angle, then $m\angle AOB + m\angle BOC = 180°$.



Ex. 1



Ex. 2



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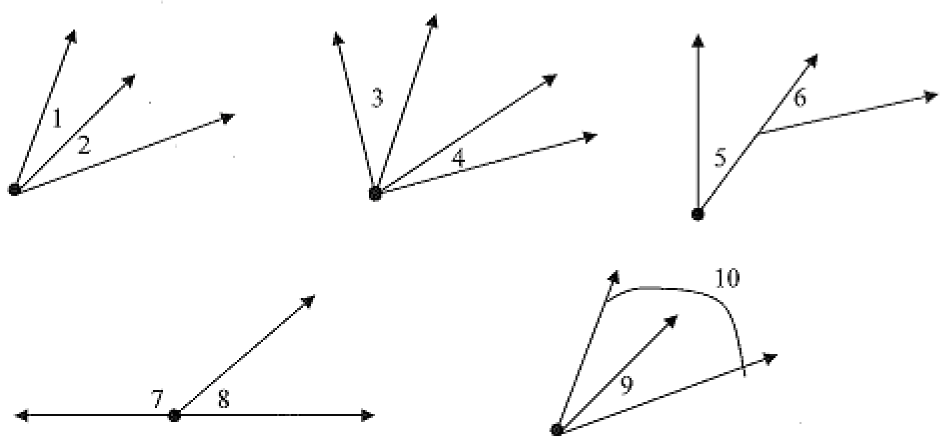
congruent angles – angles that have ____________ ________________

adjacent angles – 2 angles in a __________ that have a ____________

____________ and a ____________ __________, but

no common interior points

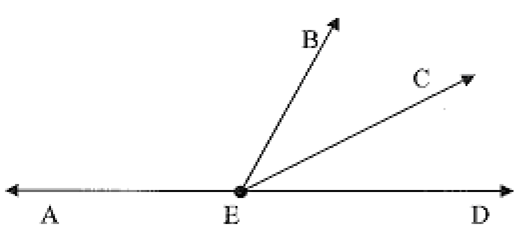


bisector of an angle – a ______ that divides an angle into 2

________________ angles

Ex. Given: $\overrightarrow{EC}$ bisects $\angle BED$, $m\angle AEB = 19x$, $m\angle BEC = 8x + 20$

Find: x & $m\angle CED$

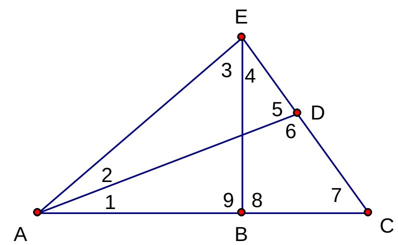


Examples:

Give another name for each angle.

1. $\angle$DEB   2. $\angle$CBE   3. $\angle$BEA

4. $\angle$DAB   5. $\angle$7   6. $\angle$9



7. m$\angle$1 + m$\angle$2 = m$\angle$_______

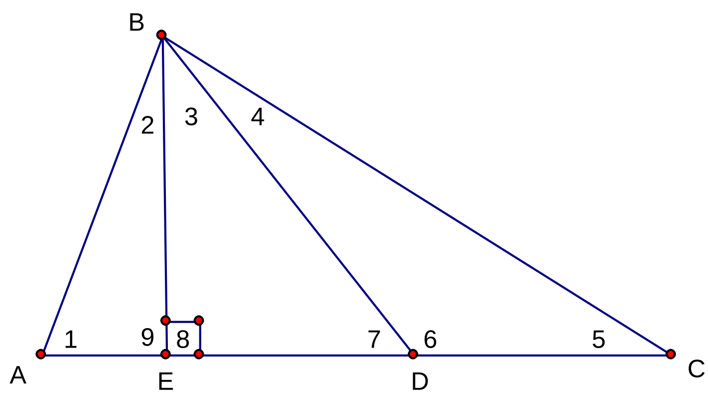
8. m$\angle$3 + m$\angle$4 = m$\angle$_______

9. m$\angle$5 + m$\angle$6 = m$\angle$_______ or _______

---

10. Name the vertex of $\angle$3.

11. Name the right angle.



State another name for each angle.

12. $\angle$1

13. $\angle$6

14. $\angle$EBD

15. $\angle$4

16. $\angle$BDE or $\angle$BDA

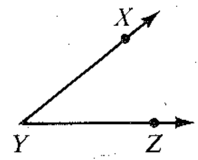
17. $\angle$2

18. $\angle$5

19. $\angle$9

1–4 Angles

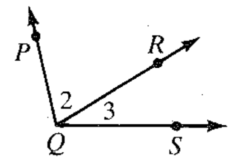
Objectives: Name angles and find their measures. Use the Angle Addition Postulate.



angle A figure formed by two rays with the same endpoint is an angle. In $\angle XYZ$, $\overrightarrow{YX}$ and $\overrightarrow{YZ}$ are the **sides** of the angle. Y is called the **vertex** of the angle. Another name for $\angle XYZ$ is $\angle Y$.

Example 1

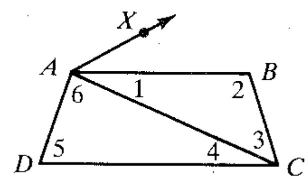
a. Name three different angles in the diagram.
b. Give another name for $\angle PQR$ and for $\angle 3$.



Solution

a. $\angle PQS$, $\angle PQR$, $\angle RQS$
b. $\angle PQR$ can be called $\angle 2$; $\angle 3$ can be called $\angle RQS$.
In this figure, you could not call any of the angles $\angle Q$ because it would not be clear which angle with vertex Q you meant.

Refer to the diagram at the right.



1. Name the vertex and sides of $\angle XAC$.
2. How many angles have A as the vertex? List them.
3. Give another name for $\angle 6$, $\angle ABC$, $\angle ADC$, and $\angle 4$.

measure of an angle You can use a protractor to find a number associated with each side of an angle. To find the measure in degrees of an angle ($m\angle XYZ$), compute the absolute value of the difference of these numbers.

Example 2

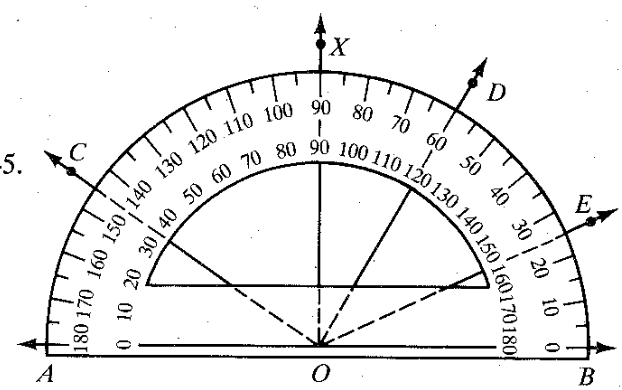
Find $m\angle COD$ and $m\angle BOE$.

Solution

As you can see, $\overrightarrow{OD}$ is on 60 and $\overrightarrow{OC}$ is on 145.

$$m\angle COD = |60 - 145| = |-85| = 85$$

$$m\angle BOE = |25 - 0| = 25$$



Referring to the protractor and angles in Example 2 above:

$\angle XOC$ is **acute** since $0 < m\angle XOC < 90$.

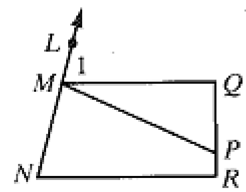
$\angle AOE$ is **obtuse** since $90 < m\angle AOE < 180$.

$\angle AOX$ is a **right** angle since $m\angle AOX = 90$.

$\angle AOB$ is a **straight** angle since $m\angle AOB = 180$.

1–4 Angles *(continued)*

State whether each angle appears to be acute, right, obtuse, or straight. Then estimate its measure.

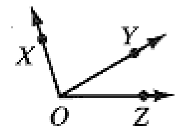


4. $\angle Q$ **5.** $\angle 1$

6. $\angle RPM$ **7.** $\angle LMN$

8. $\angle PMQ$ **9.** $\angle PML$

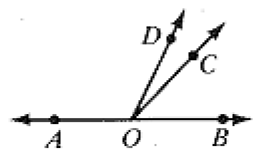
Angle Addition Postulate **If a point Y lies in the interior of $\angle XOZ$, then $m\angle XOY + m\angle YOZ = m\angle XOZ$.**



Example 3

Given: $m\angle AOD = 4y - 8; m\angle DOC = y - 11;$
$m\angle COB = y + 13$

Find the measure of $\angle AOD$.



Solution

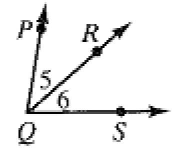
$m\angle AOD + m\angle DOC + m\angle COB = 180$ (by the Angle Addition Postulate)

$$4y - 8 + y - 11 + y + 13 = 180$$
$$6y - 6 = 180$$
$$6y = 186$$
$$y = 31$$

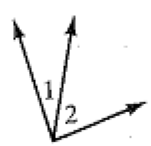
$m\angle AOD = 4y - 8 = 4(31) - 8 = 116$

congruent angles Two angles with equal measures are congruent. If $m\angle 5 = m\angle 6$, then $\angle 5 \cong \angle 6$.

bisector of an angle The ray that divides an angle into two congruent angles is the angle bisector. If $\overrightarrow{QR}$ bisects $\angle PQS$, then $\angle 5 \cong \angle 6$, or $m\angle 5 = m\angle 6$.



adjacent angles Coplanar angles with a common vertex and a common side but no common interior points are adjacent angles. $\angle 1$ is adjacent to $\angle 2$.



Complete.

10. $\angle 2$ and $\angle 3$ are adjacent. Name their common vertex and common side.

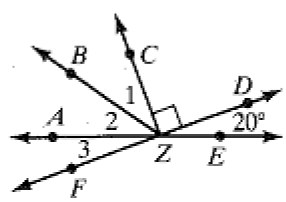
11. $\angle 1$ is adjacent to acute $\angle$____.

12. $m\angle DZE =$ ____, $m\angle CZD =$ ____, $m\angle AZC =$ ____

13. If $\overrightarrow{ZB}$ bisects $\angle AZC$, then $m\angle$____ $= m\angle$____ $=$ ____.

14. $m\angle 1 + m\angle 2 + m\angle 3 =$ ____

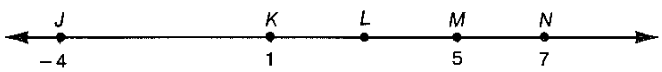
15. If $m\angle 3 = 20, m\angle 2 = 3x - 5$, and $m\angle 1 = 2x + 10$, find the value of x.



Practice 2
Supplementary Practice

Lessons 1-3, 1-4

In Exercises 1–8, L is the midpoint of $\overline{KM}$.



1. The ray opposite to $\overrightarrow{KN}$ is ____________.

2. Another name for $\overrightarrow{LM}$ is ____________.

3. The coordinate of L is ____________.

4. The length of $\overline{LN}$ is ____________.

5. $MJ =$ ____________

6. A segment congruent to $\overline{KM}$ is ____________.

7. The point on $\overrightarrow{LM}$ whose distance from L is 2 is ____________.

8. The point on $\overrightarrow{LK}$ whose distance from L is 2 is ____________.

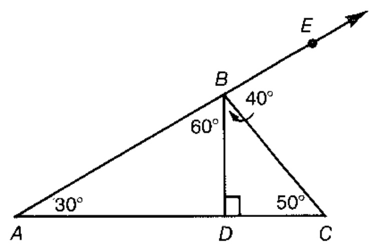
In Exercises 9–12, refer to the diagram and classify each angle as acute, right, obtuse, or straight.

9. $\angle A$ ____________

10. $\angle ABC$ ____________

11. $\angle BDC$ ____________

12. $\angle ADC$ ____________



Exs. 9–19

13. An angle adjacent to $\angle ADB$ is ____________.

14. Can you conclude from the diagram that A, B, and E are collinear? ____________

15. Can you conclude from the diagram that $\overline{BE} \cong \overline{BD}$? ____________

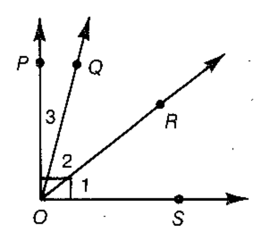
16. Name the postulate that allows you to conclude that $m\angle ABD + m\angle DBC = m\angle ABC$. ________________________

17. $\overrightarrow{CB}$ is a side of angle ____________.

18. $m\angle CBE =$ ____________

19. $m\angle ADB =$ ____________

In Exercises 20 and 21, $\angle POS$ is a right angle and $\overrightarrow{OR}$ bisects $\angle QOS$. Find the value of x.



Exs. 20–21

20. If $m\angle 1 = 2x + 15$ and $m\angle 2 = 5x - 18$, then $x =$ ____________.

21. If $m\angle 1 = x + 7$ and $m\angle 3 = 2x$, then $x =$ ____________.

Segments and Distance; Angles

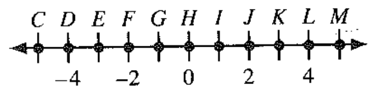
For use after Section 1–4

The numbers given are the coordinates of two points on a number line. State the distance between the points.

1. -3 and 5 ________ **2.** -15 and -8 ________

3. -1 and 9 ________ **4.** -11 and -27 ________

Name each of the following.



Exs. 5–10

5. The point on $\overrightarrow{GC}$ whose distance from G is 3 ________

6. Two points whose distance from I is 4 ________

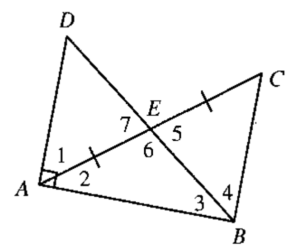
7. The midpoint of $\overline{DJ}$ ________ **8.** The coordinate of the midpoint of $\overline{CG}$ ________

9. The ray opposite to $\overrightarrow{DF}$ ________ **10.** A segment congruent to $\overline{DL}$ ________________

***R* is the midpoint of $\overline{PS}$. Find the value of *x*.**

11. $PR = 3x + 2$, $RS = 5x - 4$ ________ **12.** $PR = 6x - 1$, $PS = 8x$ ________

Name each of the following.



Exs. 13–27

13. The vertex of $\angle 1$ ____ **14.** The sides of $\angle 5$ ________________

State another name for the given angle.

15. $\angle 7$ ________________ **16.** $\angle CBE$ ________________

State whether the angle appears to be acute, right, obtuse, or straight.

17. $\angle 2$ ________________ **18.** $\angle DEC$ ________________

19. $\angle AEC$ ________________ **20.** $\angle CBA$ ________________

Complete.

21. $\angle DEC$ and ________________ are adjacent angles.

22. $m\angle 1 + m\angle 2 = m\angle$ ________________

23. If $m\angle 5 = 3x - 6$, and $m\angle 6 = 4x + 4$, then $x =$ ________.

Tell whether you can reach the conclusion shown based on the diagram. Write *Yes* or *No*.

24. $\overline{DB}$ bisects $\overline{AC}$. ________ **25.** $m\angle DAB = 90$ ________

26. E is on $\overleftrightarrow{AC}$. ________ **27.** $\overrightarrow{AC}$ bisects $\angle DAB$. ________

Section 1-5: Postulates and Theorems Relating Points, Lines, and Planes

Recall that we have accepted, without proof, the following four basic assumptions.

______________________ ___________________________

______________________ ___________________________

These postulates deal with segments, lengths, angles, and measures. The following five basic assumptions deal with the way points, lines, and planes are related.

Postulate 5
A line contains at least _________ points; a plane contains at least ___________ points not all in one line; space contains at least __________ points not all in one plane.

Postulate 6
Through any two points there is exactly __________ line.

Postulate 7
Through any three points there is at least __________ plane, and through any three noncollinear points there is exactly _________ plane.

Postulate 8
If two points are in a plane, then the _________ that contains the points is in that plane.

Postulate 9
If two planes intersect, then their intersection is a ____________.

Important statements that are ___________ are called ________________. In classroom Exercise 1 you will see how Theorem 1-1 follows from postulates. In Written Exercise 20 you will complete an argument that justifies Theorem 1-2. You will learn about writing proofs in the next chapter.

Theorem 1-1
If two lines interest, then they intersect in exactly ______ point.

Theorem 1-2
Through a line and a point not in the line there is exactly one __________.

Theorem 1-3
If two lines intersect, then exactly one __________ contains the lines.

The phrase "exactly one" appears several times in the postulates and theorems of this section. The phrase "one and only one" has the same meaning. For example, here is another correct form of Theorem 1-1;

> If two lines intersect, then they intersect in one and only one __________.

The theorem states that a point of intersection __________ (there is *at least one* point of intersection) and the point of intersection is __________ (*no more than one* such point exists).

Examples:

Classify each statement as true or false.

1. A postulate is a statement assumed to be true without proof.
2. The phrase "exactly one" has the same meaning as the phrase "one and only one."
3. Three points determine a plane.
4. Through any two points there is exactly one plane.
5. Through a line and a point not on the line there is one and only one plane.

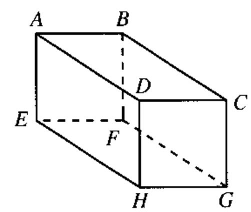
Postulates and Theorems Relating Points, Lines, and Planes

For use after Section 1-5

Classify each statement as true or false.

1. Two points can lie in each of two different lines. ________
2. Three noncollinear points can lie in each of two different planes. ________
3. Three collinear points lie in only one plane. ________
4. Two intersecting lines are contained in exactly one plane. ________
5. If two lines intersect, then they intersect in exactly one point. ________
6. If two planes intersect, then their intersection is a line. ________

Name each of the following.



Exs. 7–18

7. The plane that contains $\overleftrightarrow{BF}$ and $\overleftrightarrow{FG}$ ________________
8. The plane that contains points B, F, and H ________________
9. The plane that intersects $ADHE$ in $\overleftrightarrow{AE}$ ________________
10. The plane that doesn't intersect $ABCD$ ________________
11. The intersection of planes $ADHE$, $DCGH$, and $ABCD$ ____________
12. The plane that doesn't contain $\overleftrightarrow{DG}$ and doesn't intersect $\overleftrightarrow{DG}$ ________________
13. Two lines that don't intersect plane $EFGH$ ________________________________
14. Three planes that don't intersect $\overleftrightarrow{CG}$ and don't contain $\overleftrightarrow{CG}$ ____________________________

Write the postulate or theorem that justifies the statement about the diagram.

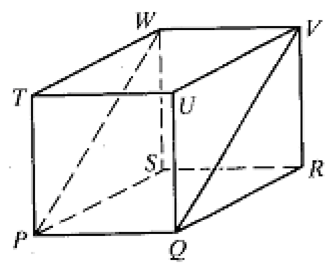
15. Plane $BCGF$ is the only plane containing $\overleftrightarrow{FG}$ and point C. ______________________________
____
16. Lines $\overleftrightarrow{BF}$ and $\overleftrightarrow{FG}$ intersect in only one point. ______________________________
____
17. $\overleftrightarrow{FH}$ is contained in the plane $FGHE$. ______________________________
____
18. Planes $ADHE$ and $EFGH$ intersect in only one line. ______________________________
____

1–5 Postulates and Theorems Relating Points, Lines, and Planes *(continued)*

Draw a figure to represent each of the following:

1. Three coplanar lines that do not intersect
2. Three coplanar lines that intersect in exactly one point
3. A line that intersects each of two coplanar non-intersecting lines
4. Three planes that do not intersect
5. Three planes that intersect in one line
6. A plane that intersects two non-intersecting planes
7. Three planes that intersect in exactly one point

In Exercises 8–15 you will have to visualize certain lines and planes not shown in the diagram. When you name a plane, name it by using four points, no three of which are collinear. Often, more than one answer is possible.



8. Name a plane that contains $\overleftrightarrow{PR}$.
9. Name a plane that contains $\overleftrightarrow{PR}$ but is not shown in the diagram.
10. Name a plane that contains $\overleftrightarrow{PQ}$ and $\overleftrightarrow{WV}$.
11. Name a plane that contains $\overleftrightarrow{TW}$ and $\overleftrightarrow{RQ}$.
12. Name the intersection of plane *TWRQ* and plane *PSWT*.
13. Name five lines in the diagram that don't intersect plane *UVRQ*.
14. Name one line that is not shown in the diagram that does not intersect plane *UVRQ*.
15. Name three planes that don't intersect $\overleftrightarrow{SR}$ and don't contain $\overleftrightarrow{SR}$.

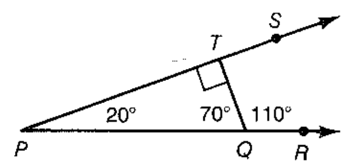
Classify each statement as true or false.

16. The intersection of a line and a plane may be the line itself.
17. Three noncollinear points determine exactly one line.
18. Two points can determine two lines.
19. Two lines can intersect in exactly one point.
20. Postulates are statements to be proved.
21. Two points determine a plane.
22. A line and a point not on it determine one plane.
23. A plane contains at least three noncollinear points.
24. Line *l* always has at least two points on it.
25. Theorems are statements to be proved.
26. Any three points are always coplanar.
27. It is possible that points *P* and *Q* are in plane *M* but $\overleftrightarrow{PQ}$ is not.
28. Two intersecting lines determine a plane.
29. Two planes can intersect in two lines.
30. If points *A*, *B*, *C*, and *D* are noncoplanar, then no one plane contains all four of them.
31. Two planes can intersect in exactly one point.
32. Three planes can intersect in exactly one point.
33. A line and a plane can intersect in exactly one point.

Practice 3
Definitions and Postulates

Lessons 1-3 through 1-5

Refer to the diagram and name each of the following.



Exs. 1–8

1. An angle adjacent to $\angle PQT$ ____________
2. The ray opposite to $\overrightarrow{TS}$ ____________
3. An obtuse angle ____________
4. The sides of $\angle TQR$ ____________ and ____________
5. Two right angles ____________ and ____________
6. A point on $\overrightarrow{PQ}$ that is not on $\overline{PQ}$ ____________
7. The vertex of the 20° angle ____________
8. The point between P and R ____________

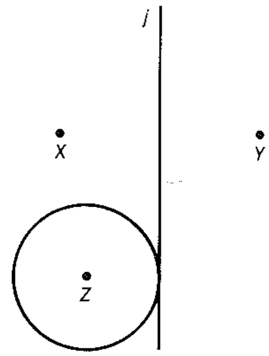
Classify each statement as true or false.

9. Through any two points there is exactly one line. ____________
10. Through any three points there is exactly one line. ____________
11. Through any three points there is exactly one plane. ____________
12. Two lines intersect in exactly one point. ____________
13. Two planes intersect in exactly one point. ____________
14. Two planes intersect in a line. ____________
15. A line and a plane can intersect in a point. ____________

Complete each statement with the word *always*, *sometimes*, or *never*.

16. Adjacent angles are ____________ congruent.
17. If points A and B are in plane R and point C is on $\overleftrightarrow{AB}$, then C is ____________ in R.
18. Two intersecting lines ____________ lie in exactly one plane.
19. A line and a point not on the line ____________ lie in more than one plane.
20. A line ____________ contains at least two points.

Practice 4
Chapter 1 Practice



In Exercises 1–3, answer on the basis of what appears to be true.

1. Describe the points that are equidistant from X and Y.

   ____

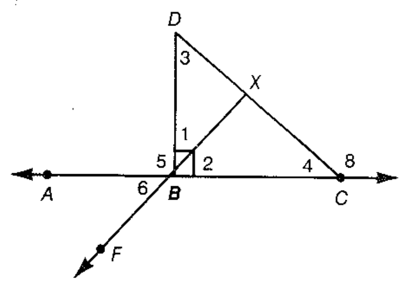
2. Describe the points that are 1 cm from Z.

   ____

3. How many points are 1 cm from Z and equidistant from X and Y?

   ____

Refer to the diagram at the right.



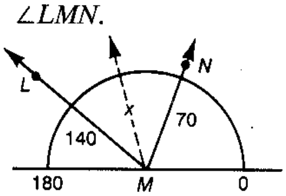
Exs. 4–16

4. Name an obtuse angle. __________
5. Name a straight angle. __________
6. Name two lines that intersect at X. __________
7. Name the ray opposite to $\overrightarrow{BA}$. __________
8. Name the sides of $\angle 2$. __________
9. Name three noncollinear points. __________
10. How many planes contain $\overleftrightarrow{AB}$ and $\overleftrightarrow{BD}$? __________
11. How many planes contain points A, B, and C? __________
12. How many planes contain points A, B, and D? __________
13. If $m\angle 2 = 50$, then $m\angle FBC =$ __________ and $m\angle 1 =$ __________.
14. Can you conclude from the figure that $\angle 1 \cong \angle 2$? __________
15. Name the postulate that allows you to conclude that $CX + XD = CD$.

    ____

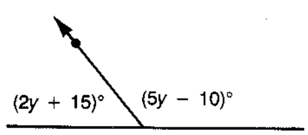
16. If $\overrightarrow{BX}$ bisects $\angle DBC$, then ______ $\cong$ ______.

17. x is the number paired with the bisector of $\angle LMN$.



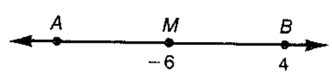
$x =$ __________

18. Find the value of y.



$y =$ __________

19. M is the midpoint of $\overline{AB}$.

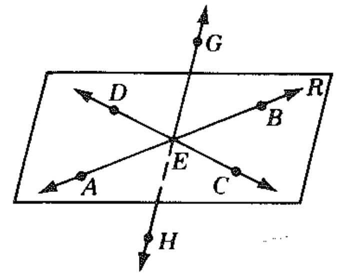


The coordinate of A is __________.

Points, Lines, Planes, and Angles

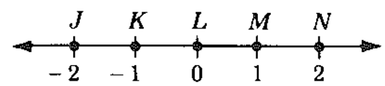
For use after Chapter 1

Complete.



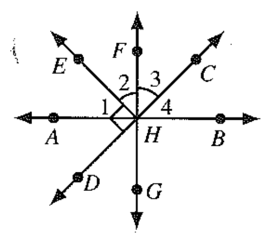
Exs. 1–4

1. $\overleftrightarrow{GH}$ intersects plane R at point ________.
2. D, E, and ________ are collinear.
3. $m\angle AEC + m\angle CEB =$ ________________.
4. If E is the midpoint of $\overline{AB}$, $AE = 21$, and $EB = 2x - 3$, then the value of x is ________.



Exs. 5–8

5. What is the coordinate of K? ________
6. What is the point with coordinate -2? ________
7. What is the distance JM? ________
8. Which ray is opposite to $\overrightarrow{LM}$? ________



Exs. 9–19

9. State another name for $\angle 1$. ________
10. $m\angle AHE + m\angle EHC =$ ________
11. State whether $\angle CHG$ appears to be acute, right, obtuse, or straight. ________

Write the name of the definition or postulate that justifies the statement about the diagram.

12. $m\angle 1 + m\angle 2 = m\angle AHF$ ____________________________
13. If H is the midpoint of $\overline{CD}$, then $DH = CH$. ____________________________
14. If $\overrightarrow{HC}$ bisects $\angle BHF$, then $\angle 3 \cong \angle 4$. ____________________________
15. $CH + HD = CD$ ____________________________

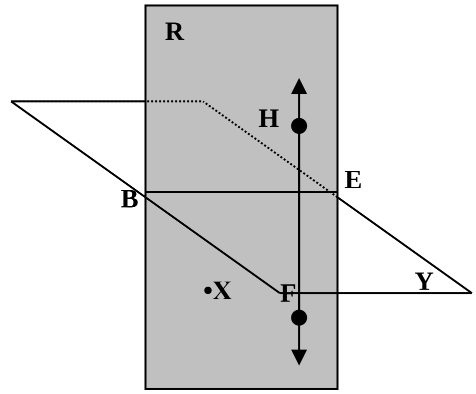
Name each of the following.

16. The sides of $\angle EHB$ ________________
17. A right angle ________________
18. An angle bisector ________________
19. Two congruent adjacent angles ________________

Classify each statement as true or false.

20. Two planes intersect in exactly one point. ________
21. Two intersecting lines are always coplanar. ________
22. Three collinear points lie in exactly one plane. ________
23. There is exactly one line through two points. ________

Review for Chapter 1 Test



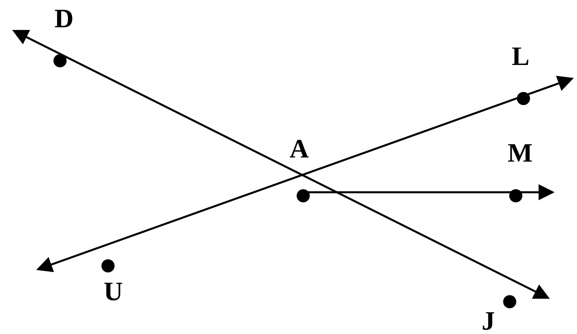
1. Name a plane that contains $\overleftrightarrow{HF}$.
2. Name the intersection of planes R and Y.
3. How many lines can contain points X and F?
4. How many planes can contain points B, E, and X?
5. How many planes can contain points B and E?

Complete each statement with a number and/or the words line, point, or plane.

6. If *h* is a line and P is a point not on the line, then *h* and P are contained in exactly _____ ____________.
7. If two lines intersect, then their intersection is a _________.
8. Space contains at least ______ noncoplanar points.
9. Any line contains at least _______ points.
10. If two planes intersect, then their intersection is a _________.
11. Given any three noncollinear points, there is exactly _______ _________ containing them.
12. Given any two points, there is exactly ________ _________ containing the two points.

A is the midpoint of $\overline{DJ}$ and $\angle$LAM $\cong$ $\angle$MAJ.

13. Name two congruent segments.



14. Name a ray opposite to $\overrightarrow{AJ}$.

15. UA + AL = ____. (letters)

16. The sides of $\angle$DAU are ____.

17. A is the _____ of $\angle$DAU.

18. Name an angle bisector.

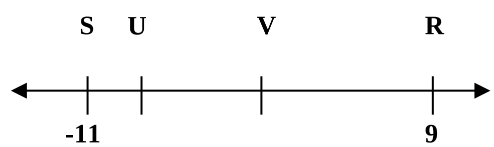
19. If m$\angle$UAD = 60, then m$\angle$DAL = _____.

20. m$\angle$DAL + m$\angle$LAM = m$\angle$_____.

21. What type of angle is $\angle$DAL?

22. If m$\angle$LAJ = 50, then m$\angle$MAJ = _____.

V is the midpoint of $\overline{SR}$ and SU = 2.



23. VR = _____.

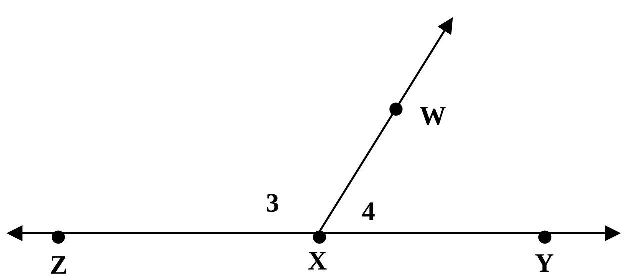
24. UV = _____.

25. Find the coordinate of the midpoint of $\overline{SV}$.

---

26. K is the midpoint of $\overline{PQ}$. If PK = 5x + 9, KQ = 8x – 6, then x = _____.

27. If m$\angle$3 = 8x + 7 and m$\angle$4 = 2x + 13, then x = _____.



Fill in the Blank

28. ___________ are points all in one plane.

29. ___________: If B is between A and C, then AB + BC = AC. (True or False)

30. A ___________ angle is an angle that measures exactly 90 degrees.

31. ___________ are two angles in the same plane that have a common vertex and a common side but no common interior points.