

MATHEMATICS 1009

COORDINATE GEOMETRY

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MATHEMATICS 1009

COORDINATE GEOMETRY

Studying geometry with the use of coordinates is a relatively new approach. Geometry has been known and used even before the time of Christ. However, only in recent times (the 17th century) did Rene Descartes (1596-1650) publish the first book on analytical geometry. He showed how a

systematic use of coordinates helps to attack problems. In coordinate geometry, geometric figures are studied by means of algebraic equations. The equations that are used involve numbers, called coordinates, which serve to locate points.

Note to Student: You will need $\frac{1}{4}$ -inch graph paper, a straightedge and a circle compass.

OBJECTIVES

Read these objectives. The objectives tell you what you will be able to do when you have successfully completed this LightUnit.

When you have finished this LightUnit, you should be able:

1. To plot points on the coordinate axes.
2. To identify a figure as having point, line, or plane symmetry.
3. To graph equations.
4. To graph inequalities.
5. To solve problems using the distance formula.
6. To find the equation of a circle.
7. To solve problems using the midpoint formula.
8. To find the slope of a line.
9. To identify parallel and perpendicular lines using slope.
10. To write the equation of a line.
11. To write geometric proofs by coordinate methods.

Survey the LightUnit. Ask yourself some questions about this study. Write your questions here.

SECTION OBJECTIVES

Read these objectives. When you have completed this section, you should be able:

I. ORDERED PAIRS

1. To plot points on the coordinate axes.
2. To identify a figure as having point, line, or plane symmetry.
3. To graph equations.
4. To graph inequalities.

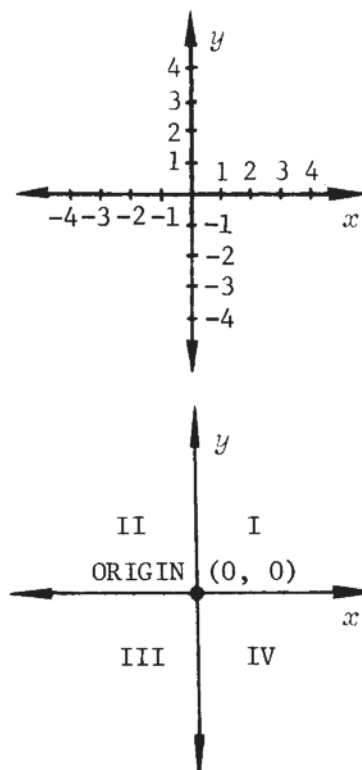
To begin our study of coordinate geometry, we must set up a method of picturing points, lines, circles, and other figures in a plane.

To set up a system so that we might picture figures in a plane will require two number lines. We

POINTS IN A PLANE

place them so that they are perpendicular to each other and intersect at their zero points. We usually name the horizontal line the x -axis and the vertical line the y -axis.

The two lines, called *coordinate axes*, separate the plane into four regions, called *quadrants*, which are numbered as shown. The point where the two lines intersect is called the *origin* and its location is given by the pair of numbers $(0, 0)$. The positive numbers are to the right and above the origin. The negative numbers are to the left and below the origin.



DEFINITIONS

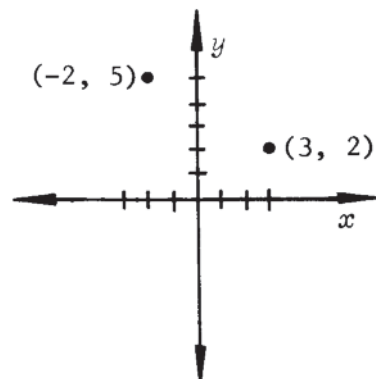
x -axis: the horizontal line.

y -axis: the vertical line.

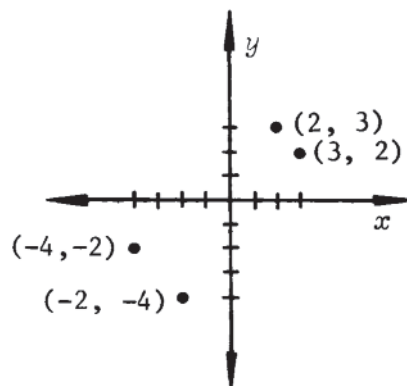
coordinate axes: the x -axis and y -axis together.

origin: the intersection of the coordinate axes at $(0, 0)$.

To locate a point on the coordinate axes, we need to know its x -coordinate and its y -coordinate: its distance from the origin along each number line. These numbers are given as an ordered pair, (x, y) . The point $(3, 2)$ is located 3 units to the right of the origin and 2 units above the origin. The point $(-2, 5)$ is located 2 units to the left of the origin and 5 units above the origin.



The order in which the coordinates are given is important: $(3, 2)$ and $(2, 3)$ are different points, as are $(-4, -2)$ and $(-2, -4)$. Remember that the first number given in the pair is the x -coordinate and the second number is the y -coordinate.



Model 1: Locate the following points.

A $(2, 4)$ D $(-4, -1)$

B $(-3, 7)$ E $(4, -3)$

C $(0, 4)$ F $(-3, 0)$

Solution: Start at the origin and move 2 units to the right along the x -axis, then 4 units up parallel to the y -axis. This location is point A.

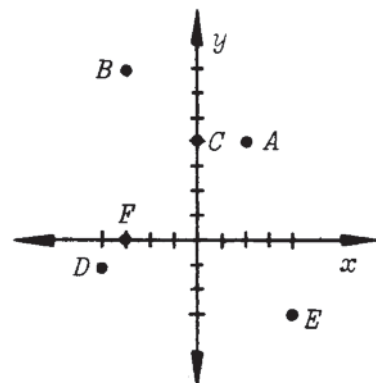
Start at the origin and move 3 units to the left (-3) , then 7 units up to locate point B.

Start at the origin; do not move right or left; then move 4 units up to locate point C.

Start at the origin and move 4 units to the left; then move 1 unit down to locate point D.

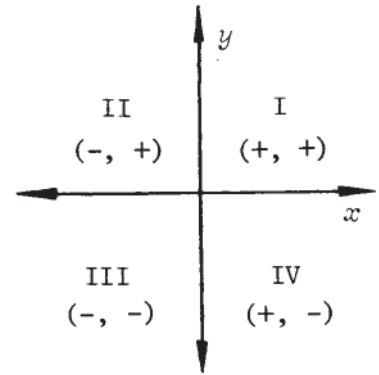
Start at the origin and move 4 right, then move 3 down to locate point E.

Start at origin and move 3 left; then do not move up or down to locate point F.



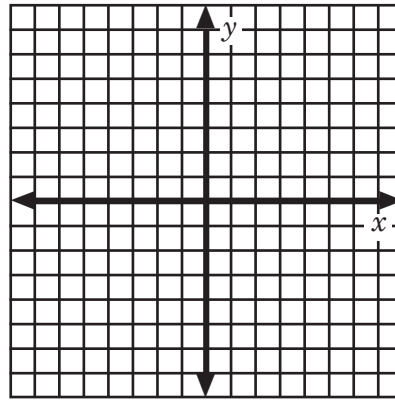
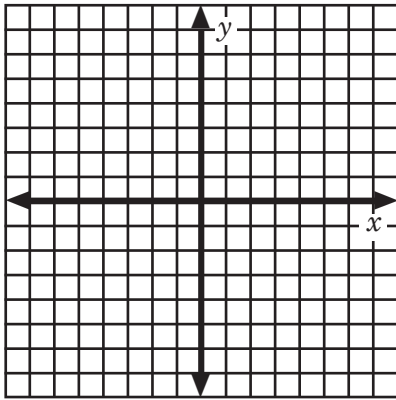
Notice that any point that has both coordinates positive would be in Quadrant I. If the first coordinate is negative and the second is positive, then the point will be in the second quadrant. A point in the third quadrant would have both coordinates negative. A point with the first coordinate positive and the second negative will be in Quadrant IV.

If the first coordinate is zero, the point lies on the y -axis.
If the second coordinate is zero the point is on the x -axis.



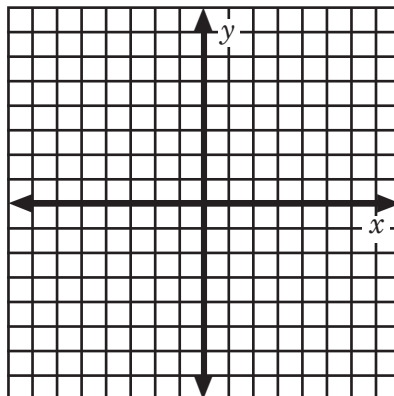
→ Graph the points using one set of axes. Label the points.

- 1.1 $A(1, 1)$, $B(-3, 0)$, $C(-4, -1)$, $D(3, -2)$ 1.2 $R(2, 0)$, $S(2, -3)$, $T(-2, 3)$, $U(0, -4)$

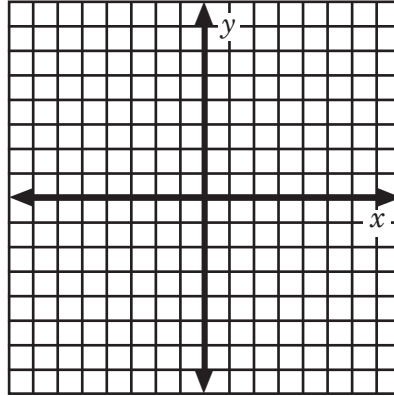


→ Complete the following activities.

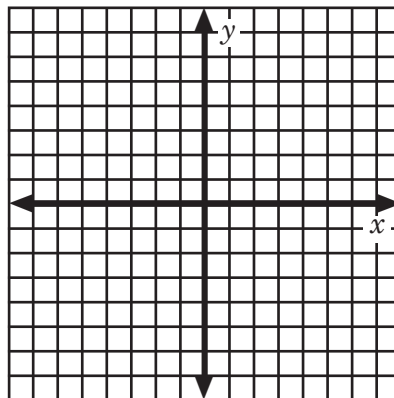
- 1.3 Graph these points on one set of axes: $A(0, 0)$, $B(3, 4)$ and $C(4, 2)$. Connect the points making segments. What geometric figure is formed? _____



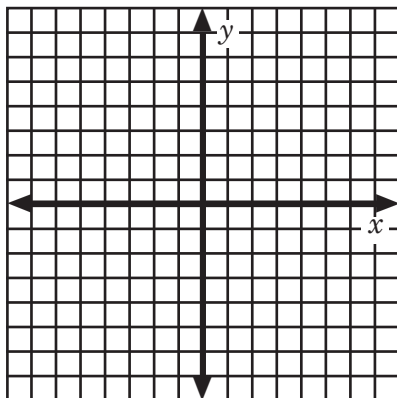
- 1.4 Graph these points on one set of axes: $M(-3, 4)$, $N(4, 4)$, $O(4, -2)$, and $P(-3, -2)$. Connect the points to form quadrilateral $MNOP$. What special figure is formed? _____



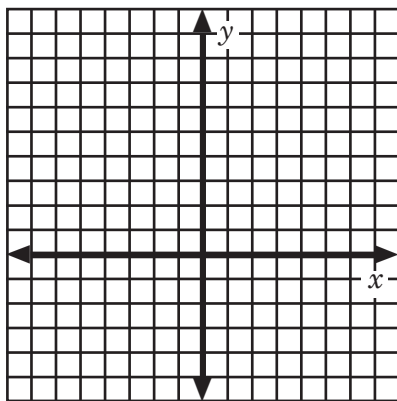
- 1.5 Graph these points on one set of axes: $R(-1, 2)$, $S(3, 2)$, $T(5, -2)$, and $U(-2, -2)$. Connect the points to form quadrilateral $RSTU$. What special quadrilateral is formed? _____



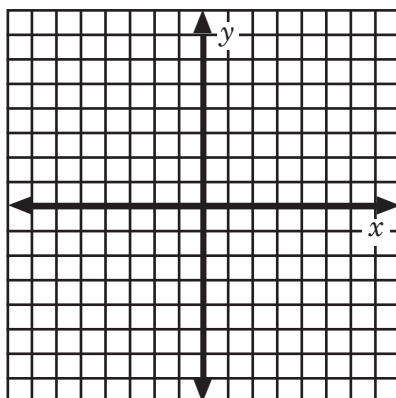
- 1.6 Graph these points on one set of axes: $A(0, 0)$, $B(0, 6)$, $C(-6, 6)$, and $D(-6, 0)$. Connect the points. What special quadrilateral is formed?
-



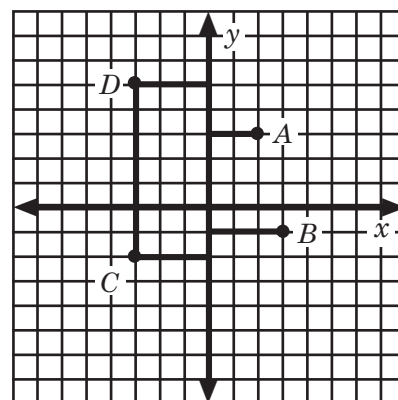
- 1.7 Graph these points on one set of axes: $A(4, -6)$, $B(4, 3)$, $C(8, 3)$, $D(8, 5)$, $E(4, 5)$, $F(4, 10)$, $G(2, 10)$, $H(2, 5)$, $I(-2, 5)$, $J(-2, 3)$, $K(2, 3)$, and $L(2, -6)$. Connect these points in alphabetical order.



- 1.8 Graph these points on one set of axes and connect them in the order given: $(-2, -1)$, $(-5, -1)$, $(0, 4)$, $(5, -1)$, $(2, -1)$, $(2, 1)$, $(-2, 1)$, $(-2, -1)$, $(0, 5)$, $(2, -1)$, $(0, 1)$, $(-2, -1)$.



To find the ordered pair when we have the graph, we count to the axes. From the point count units perpendicular to the x -axis to find the y -coordinate. Also from the point count units perpendicular to the y -axis to find the x -coordinate. Point A has x -coordinate of 2 and y -coordinate of 3. Therefore, the ordered pair that is associated with point A is $(2, 3)$. The coordinates of B are $(3, -1)$; of C , $(-3, -2)$; and of D , $(-3, 5)$.



➔ Find the coordinates of the following points.

- 1.9 A () E ()
 B () F ()
 C () G ()
 D () H ()

