Chapter P  Prerequisites

Section P.1  Graphical Representation of Data

Objective: In this lesson you learned how to plot points in the coordinate plane and use the Distance and Midpoint Formulas.

I. The Cartesian Plane  (Pages 2−3)

An ordered pair is . . . a pair of two real numbers x and y, written (x, y), which represents a point in the Cartesian plane.

On the Cartesian plane, the horizontal real number line is usually called the _____ x-axis _____, and the vertical real number line is usually called the _____ y-axis ____. The origin is the _____ point ____ of intersection ____ of these two axes, and the two axes divide the plane into four parts called _____ quadrants ____.

On the Cartesian plane shown below, label the x-axis, the y-axis, the origin, Quadrant I, Quadrant II, Quadrant III, and Quadrant IV.

```
  y-axis
  ↑
  5
  3
  1
  origin
  -5 -3 -1 1 3 5

Quadrant II
Quadrant I

Quadrant III
Quadrant IV
```

Important Vocabulary

Rectangular coordinate system  A plane (Cartesian plane) used to graphically represent ordered pairs of real numbers.

Cartesian plane  A plane formed by using two real number lines intersecting at right angles, named after the French mathematician René Descartes.

What you should learn

How to plot points in the Cartesian plane
Example 1: Explain how to plot the ordered pair \((3, -2)\), and then plot it on the Cartesian plane provided.

Imagine a vertical line through 3 on the x-axis and a horizontal line through \(-2\) on the y-axis. The intersection of these two lines is the point \((3, -2)\).

To shift a figure plotted in the rectangular coordinate system by \(a\) units to the left and \(b\) units upward, . . . subtract \(a\) from the x-coordinate of each point in the figure and add \(b\) to the y-coordinate of each point in the figure.

If \((x, y)\) is an original point on a graph, \((-x, y)\) is a reflection of this original point in the y-axis. If \((x, y)\) is an original point on a graph, \((x, -y)\) is a reflection of the original point in the x-axis. If \((x, y)\) is an original point, \((-x, -y)\) is a reflection of the original point through the origin.

II. Representing Data Graphically (Pages 4–5)

To sketch a scatter plot of paired data given in a table, . . . represent each pair of values by an ordered pair and plot the resulting points.

To create a bar graph of paired data given in a table, . . . begin by drawing a vertical axis to represent amount and a horizontal axis to represent categories. For each category along the horizontal axis, draw a vertical bar whose height corresponds to the amount.
To create a line graph of paired data given in a table, . . .
represent each pair of values by an ordered pair and plot the
resulting points. Finally, connect the points with line segments.

III. The Distance Formula  (Pages 5–6)
The **Distance Formula** states that . . .
the distance $d$ between
the points $(x_1, y_1)$ and $(x_2, y_2)$ in the plane is
$$d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}.$$

**Example 2:** Explain how to use the Distance Formula to find
the distance between the points $(4, 2)$ and $(5, -1)$.
Then find the distance and round to the nearest hundredth.
Explanations will vary. Let $x_1 = 4$ and $y_1 = 2$, and
let $x_2 = 5$ and $y_2 = -1$. Then substitute these values
into the Distance Formula and simplify.
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**Example 3:** Explain how to use a graphical solution to find the
distance between the points $(4, 2)$ and $(5, -1)$.
Use centimeter graph paper to plot the two points.
Carefully sketch a line segment between the points
and use a centimeter ruler to measure the length of
the segment.

IV. The Midpoint Formula  (Page 7)
The **midpoint** of a line segment is the point that subdivides the
segment into two portions of equal length.
The **Midpoint Formula** gives the midpoint of the segment
joining the points $(x_1, y_1)$ and $(x_2, y_2)$ as . . .

$$
\text{Midpoint} = \left( \frac{x_1 + x_2}{2}, \frac{y_1 + y_2}{2} \right)
$$

**Example 4:** Explain how to find the midpoint of the line segment with
endpoints at $(-8, 2)$ and $(6, -10)$. Then find the
coordinates of the midpoint.
Explanations will vary. Find the average of the
two $x$-coordinates and find the average of the two
$y$-coordinates. These averages form the
coordinates of the midpoint, $(-1, -4)$. 
V. The Equation of a Circle  (Page 8)

A circle of radius \( r \) in the plane consists of . . . all points \((x, y)\) that are a given positive distance \( r \) from a fixed point \((h, k)\).

The standard form of the equation of a circle with center \((h, k)\) and radius \( r \) is \((x - h)^2 + (y - k)^2 = r^2\).

The standard form of the equation of a circle with radius \( r \) and its center at the origin is \(x^2 + y^2 = r^2\).

Example 5: For the equation \((x + 2)^2 + (y - 1)^2 = 4\), find the center and radius of the circle and then sketch the graph of the equation.

Center: \((-2, 1)\)
Radius: \(2\)

Additional notes

Homework Assignment

Page(s)

Exercises