8.5 Graphing on a Coordinate Grid

Identify and plot points in four quadrants of a coordinate grid.

You have plotted points with whole-number coordinates on a grid.
Point A has coordinates (3, 2).
What are the coordinates of point B? Point C? Point D?

A vertical number line and a horizontal number line intersect at right angles at 0.
This produces a grid on which you can plot points with integer coordinates.

You will need grid paper and a ruler. Copy this grid.

- Plot these points: A(14, 0), B(6, 2), C(8, 8), D(2, 6), E(0, 14)
  - Join the points in order.
  - Draw a line segment from each point to the origin.
- Reflect the shape in the vertical axis.
  - Draw its image.
  - Write the coordinates of each vertex of the image.
- Reflect the original shape and the image in the horizontal axis.
  - Draw the new image.
  - Write the coordinates of each vertex of the new image.

Your design should be symmetrical about the horizontal and vertical axes.
Describe the design. What shapes do you see?

Reflect & Share
Compare your design and its coordinates with those of another pair of classmates.
Describe any patterns you see in the coordinates of corresponding points.
A vertical number line and a horizontal number line that intersect at right angles at 0 form a **coordinate grid**. The horizontal axis is the **x-axis**. The vertical axis is the **y-axis**. The axes meet at the **origin**, (0, 0). The axes divide the plane into four **quadrants**. They are numbered counterclockwise.

In Quadrant 1, to plot point A, start at 4 on the x-axis and move up 6 units. Point A has coordinates (4, 6).

In Quadrant 2, to plot point B, start at −4 on the x-axis and move up 6 units. Point B has coordinates (−4, 6).

In Quadrant 3, to plot point C, start at −4 on the x-axis and move down 6 units. Point C has coordinates (−4, −6).

In Quadrant 4, to plot point D, start at 4 on the x-axis and move down 6 units. Point D has coordinates (4, −6).

**History**
René Descartes lived in the 17th century. He developed the coordinate grid. It is named the Cartesian plane in his honour. There is a story that René was lying in bed and watching a fly on the ceiling. He invented coordinates as a way to describe the fly’s position.
Example

a) Write the coordinates of each point.

   i) Q
   
   ![Graph showing point Q](image)

   ii) S
   
   ![Graph showing point S](image)

b) Plot each point on a grid.

   i) F(0, −15)
   
   ![Graph showing point F](image)

   ii) G(−40, 0)
   
   ![Graph showing point G](image)

A Solution

a) Start at the origin each time.

   i) To get to Q, move 0 units right and 30 units down.
      So, the coordinates of Q are (0, −30).

   ii) To get to S, move 25 units left and 0 units down.
      So, the coordinates of S are (−25, 0).

   ![Graph showing point Q](image)

   ![Graph showing point S](image)

b) i) F(0, −15)
   
   Since there is no movement left or right,
   point F lies on the y-axis.
   Start at the origin.
   Move 15 units down the y-axis. Mark point F.
   It is halfway between −10 and −20.

   ![Graph showing point F](image)

ii) G(−40, 0)
   
   Start at −40 on the x-axis.
   Since there is no movement up or down,
   point G lies on the x-axis. Mark point G.

   ![Graph showing point G](image)
1. What is the scale on each axis? Write the coordinates of each point from A to K.

2. Use the coordinate grid to the right. Which points have:
   a) $x$-coordinate 0?
   b) $y$-coordinate 0?
   c) the same $x$-coordinate?
   d) the same $y$-coordinate?
   e) equal $x$- and $y$-coordinates?
   f) $y$-coordinate 2?

3. Draw a coordinate grid. Look at the ordered pairs below. Label the axes. How did you choose the scale? Plot each point.
   a) A(30, −30)    b) B(25, 0)    c) C(−10, 35)
   d) D(−15, 40)   e) E(15, 5)   f) F(0, −20)
   g) O(0, 0)      h) H(−20, −5)  i) I(−40, 0)
Which point is the origin?

4. How could you use the grid in question 3 to plot these points?
   a) K(3, 5)    b) P(−10, 2)   c) R(−7, −8)

5. Which quadrant has all negative coordinates? All positive coordinates? Both positive and negative coordinates?

6. a) Plot these points: A(0, 5), B(−1, 4), C(−1, 3), D(−2, 3), E(−3, 2), F(−2, 1), G(−1, 1), H(−1, 0), J(0, −1), K(1, 0), L(1, 1), M(2, 1), N(3, 2), P(2, 3), R(1, 3), S(1, 4)
   b) Join the points in order. Then join S to A.
   c) Describe the shape you have drawn.

7. Draw a design on a coordinate grid. Each vertex should be at a point where grid lines meet. List the points used to make the design, in order. Trade lists with a classmate. Use the list to draw your classmate’s design.
8. Use a 1-cm grid.
   a) Plot the points $A(-3, 2)$ and $B(5, 2)$.
      Join the points to form line segment $AB$.
      What is the horizontal distance between $A$ and $B$?
      How did you find this distance?
   b) Plot the points $C(3, -4)$ and $D(3, 7)$.
      Join the points to form line segment $CD$.
      What is the vertical distance between $C$ and $D$?
      How did you find this distance?

9. Use question 8 as a guide.
    Plot 2 points that lie on a horizontal or vertical line.
    Trade points with a classmate.
    Find the horizontal or vertical distance between your classmate's points.

10. **Assessment Focus** Use a coordinate grid.
    How many different parallelograms can you draw that have area 12 square units?
    For each parallelogram you draw, label its vertices.

11. a) Plot these points: $K(-15, 20), L(5, 20), M(5, -10)$
    b) Find the coordinates of point $N$ that forms rectangle $KLMN$.

12. a) Plot these points on a grid: $A(16, -14), B(-6, 12), C(-18, -14)$.
    Join the points.
    What scale did you use? Explain your choice.
    b) Find the area of $\triangle ABC$.

13. **Take It Further** The points $A(-4, 4)$ and $B(2, 4)$ are two vertices of a square.
    Plot these points on a coordinate grid.
    What are the coordinates of the other two vertices?
    Find as many different answers as you can.

How did your knowledge of integers help you plot points on a Cartesian plane?