Focus | Identify and plot points in four quadrants of a coordinate grid.
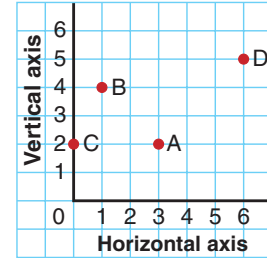
You have plotted points with whole-number coordinates on a grid.
Point A has coordinates (3, 2).
What are the coordinates of point B? Point C? Point D?

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.

Explore

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.
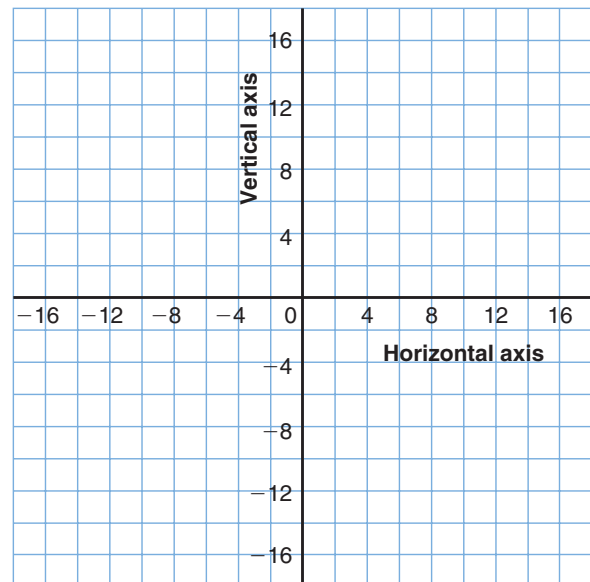   Draw a line segment from each point to the origin.
➤ Reflect the shape in the vertical axis.
   Draw its image.
   Write the coordinates of each vertex of the image.
➤ Reflect the original shape and the image in the horizontal axis.
   Draw the new image.
   Write the coordinates of each vertex of the 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**.
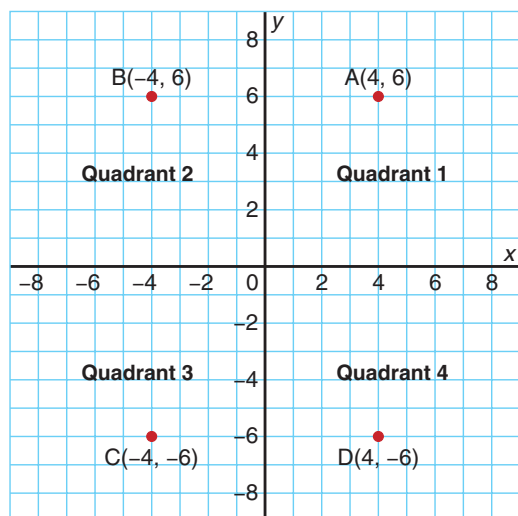The horizontal axis is the **x-axis**.
The vertical axis is the **y-axis**.
The axes meet at the **origin**, (0, 0).
The axes divide the plane into four **quadrants**.
They are numbered counterclockwise.

> This coordinate grid
> is also called a
> *Cartesian plane*.

> We do not need arrows
> on the axes.

> A pair of coordinates is
> called an *ordered pair*.

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).

> We do not have
> to include a
> + sign for a
> positive
> coordinate.
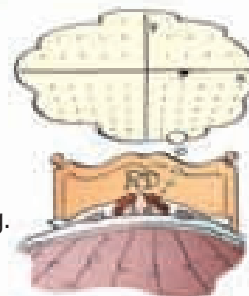
Math Link

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.
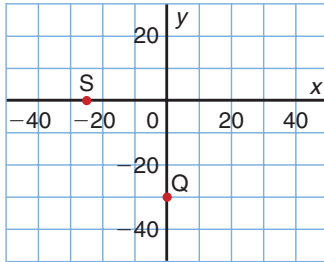He invented coordinates as a way to describe the fly's position.

Example

a) Write the coordinates of each point.

   i) Q   **ii)** S

> Notice that each grid square represents 10 units.

b) Plot each point on a grid.

   i) F(0, −15)   **ii)** G(−40, 0)

A Solution

a) Start at the origin each time.
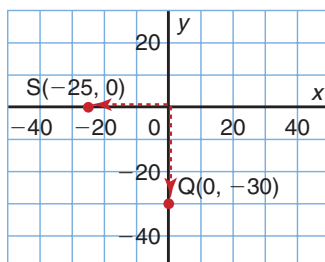
   i) To get to Q, move 0 units right and 30 units down.
      So, the coordinates of Q are (0, −30).

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

> Remember, first move left or right, then up or down.

> Point S is halfway between −20 and −30 on the *x*-axis.

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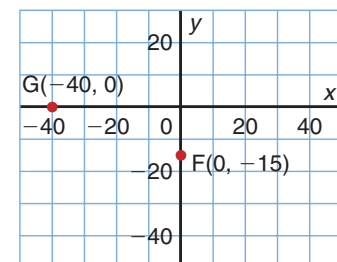   Start at the origin.
      Move 15 units down the *y*-axis. Mark point F.
      It is halfway between −10 and −20.
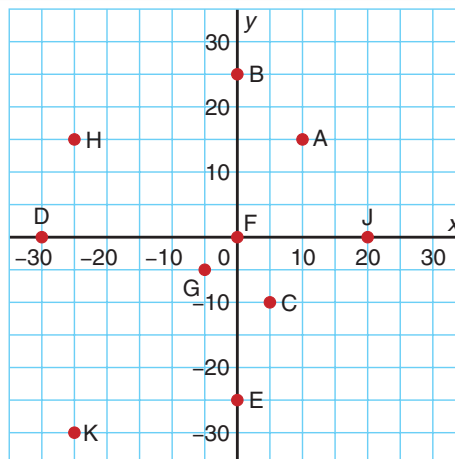

   ii) G(−40, 0)
      Start at −40 on the *x*-axis.
      Since there is no movement up or down,
      point G lies on the *x*-axis. Mark point G.

Practice

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.
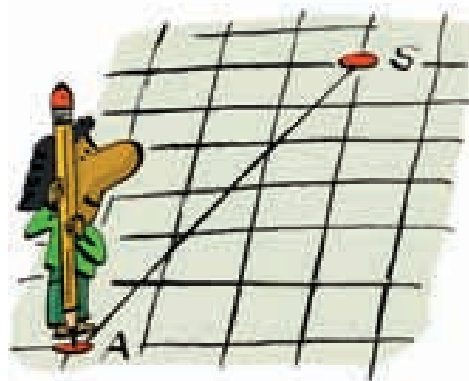
7. Draw a design on a coordinate grid.
   Each vertex should be at a point where grid lines meet.
   List the points used to make the design, in order.
   Trade lists with a classmate.
   Use the list to draw your classmate's design.

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), and C(−18, −14).
      Join the points.
      What scale did you use? Explain your choice.
   b) Find the area of △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.

Reflect

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