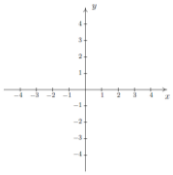
Section 1.1

Part B: The Cartesian Coordinate Plane

Cartesian Coordinate Plane

- Two real number lines crossing at a right angle at 0
- The horizontal number line is usually called the x-axis
- The vertical number line is usually called the y-axis

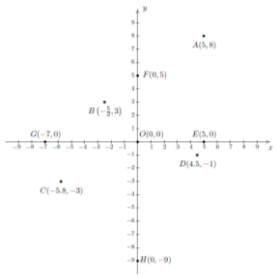


Cartesian Coordinates of Point

- Imagine dropping a vertical line from the x-axis to P and extending a horizontal line from the y-axis to P
- We describe the point P using the ordered pair (2,-4)
  - The first number is called the abscissa or x-coordinate
  - The second is called the ordinate or y-coordinate
- The ordered pair (2,-4) comprise the Cartesian coordinates of the point P

Example

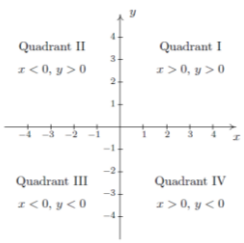
- Plot the following points:
  - A(5,8)
  - B(5/2, 3)
  - C(-5.8, -3)
  - D(4.5, -1)
  - E(5,0)
  - F(0,5)
  - G(-7,0)
  - H(0, -9)
  - O(0,0)



Important Facts about the Cartesian Coordinate Plane

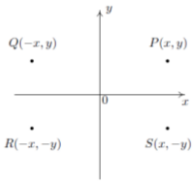
- (x,y) lies on the x-axis if and only if y = 0 → (x,0)
- (x,y) lies on the y-axis if and only if x = 0 → (0,y)
- The origin is the point (0,0). It is the only point common to both axes.

Four Quadrants



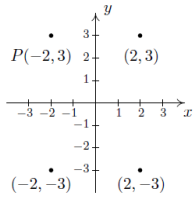
Symmetry

- P and S are symmetric about the x-axis, as are Q and R
- P and Q are symmetric about the y-axis, as are R and S
- P and R are symmetric about the origin, as are Q and S



Example

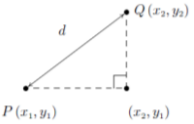
- Let P be the point (-2, 3)
- Find the points which are symmetric to P about the:
  - x-axis → (-2, -3)
  - y-axis → (2, 3)
  - origin → (2, -3)



Reflections

- To reflect a point (x,y) about the:
  - x-axis replace y with –y
  - y-axis replace x with –x
  - origin replace x with -x and y with -y

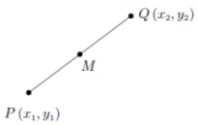
Distance in Plane



$$d^2 = (x_2 - x_1)^2 + (y_2 - y_1)^2$$

$$d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$$

Midpoint Formula



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