Graphs

2.1 Distance and Midpoint

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- The cartesian plane is a two dimensional region on which we define two perpendicular real number lines.
- The horizontal line is known as the **x-axis** whereas the vertical line is known as the **y-axis**.
- The axes divide the plane into four **quadrants**
- Points in the plane are represented by **ordered pairs**, denoted $(\mathbf{x}, \mathbf{y})$.

We want to determine the distance between any two points in the plane.

Example 2

Find the distance between the points (-2,-1) and (1,3).

Definition

Distance Formula

The **distance d** between two points $P_1 = (x_1, y_1)$ and $P_2 = (x_2, y_2)$ is given by

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

Example (3)

Find the distance between (-3,7) and (5,-2). $d = \sqrt{145}$

Example

Find the distance between $(\frac{7}{5}, \frac{1}{9})$ and $(\frac{1}{2}, -\frac{7}{3})$.

Example

Find the distance between $(3\sqrt{5}, -3\sqrt{3})$ and $(-\sqrt{5}, -\sqrt{3})$.

Definition

The **midpoint**, (x_m, y_m), of the line segment with end points (x_1, y_1) and (x_2, y_2) is given by

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

Example

Find the midpoint of the line segment joining the points (2,6) and (-4,-2).

$(x_m, y_m) = (-1, 2)$