In a two-dimensional space, the midpoint, M, of the line segment joining points A (x_1, y_1) and B(x_2, y_2), is

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

Example 1: The points A(-3, 5) and B(0, 8) lie on the diameter of a circle. Find the coordinates of the centre of the circle.

$$M = \left(\frac{-3 + 0}{2}, \frac{5 + 8}{2} \right)$$

$$= (-1.5, 6.5)$$

Example 2: Find the value of x if M(-3, 1.5) is the midpoint between A(x, 5) and B(-1, 10).

$$\frac{x + (-1)}{2} \longrightarrow 3$$

$$x - 1 = -6$$

$$x = -5$$

In 3D, the distance between two points A(x_1, y_1, z_1) and B(x_2, y_2, z_2) is

$$AB = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2 + (z_2 - z_1)^2}$$

Example 3: Find the distance between these points:

a. (8, 9) and (9, 3)   b. (-6, 7) and (3, -5)

$$d = \sqrt{(9-8)^2 + (3-9)^2}$$

$$= \sqrt{1 + 36}$$

$$= \sqrt{37}$$

$$= 6.08$$

$$d = \sqrt{(-6-3)^2 + (7-5)^2}$$

$$= \sqrt{225}$$

$$= 15$$