Coordinates

This week we discussed how one can introduce coordinates in a plane, so that every point is described by a pair of numbers. To do this, we need to choose:

- The origin (usually denoted O)
- Unit length
- Two perpendicular axes (usually called x and y)
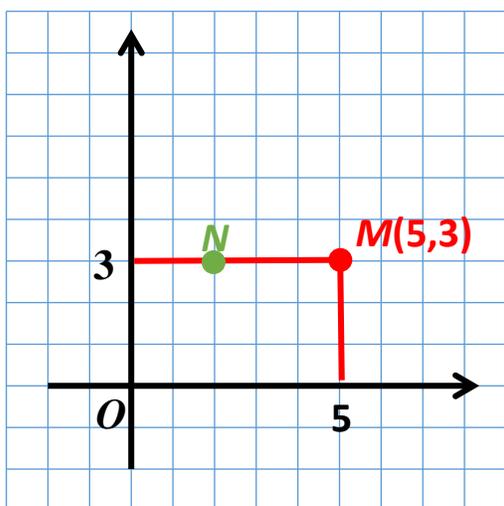
For point $M(5,3)$, the x-coordinate is 5, the y-coordinate is 3. Order matters:

$$x_M = 5,$$

$$y_M = 3$$

To find the distance along x between two points, at the same y, you need to subtract their x-coordinates and take the absolute value: The size of MN or distance is:

$$MN(x) = |x_M - x_N|$$

$$MN(x) = |5 - 2| = 3$$

In this case, similarly: the distance along y is:

$$MN(y) = |y_M - y_N|$$

$$MN(y) = |3 - 3| = 2$$

Homework

1. A point B is 5 units above and 2 units to the left of $A(7,5)$. What are the coordinates of point B?

2. Plot on the coordinate plane the following, and connect each dot to the next one. If you did everything correctly, you will get a picture…
   (0,2); (0,0); (1,3); (2,3); (3,2); (3,0); (1,-1); (2,-1); (1,-3); (0,-1);
   (-1,-3); (-2,-1); (-1,-1); (-3,0); (-3,2); (-2,3); (-1,3); (0,0).

3. Find the coordinates of the midpoint of the segment AB, where $A=(3,11)$ and $B=(7,5)$

4. Draw points $A(4,1)$, $B(3,5)$, $C(-1,4)$. If you did everything correctly, you will have 3 vertices of a square. What are the coordinates of the fourth vertex? What is the area of the square?

5. Find the missing coordinates:
    (a) 3 points $A(0,0)$, $B(1,3)$, $D(5,-2)$ are vertices of a parallelogram $ABCD$. What are the coordinates of C?
    (b) 3 points $A(0,0)$, $B(2,3)$, $D(4,1)$ are vertices of a parallelogram $ABCD$. What are the coordinates of C?
    (c) 3 points $A(0,0)$, $B(1,5)$, $D(3,-2)$ are vertices of a parallelogram $ABCD$. What are the coordinates of C?
    (d) Can you guess the general rule: if $A(0,0)$, $B(b_1,b_2)$, $D(d_1,d_2)$ are vertices of a parallelogram $ABCD$. What are the coordinates of C?

6. Point M has coordinates (5,7)
    (a) Find the coordinates of the point M_1 obtained from M by reflection about the x-axis.
    (b) Find the coordinates of the point M_1 obtained from M by reflection about the y-axis.
    (c) Find the coordinates of the point M_1 obtained from M by reflection about the diagonal line $x=y$.