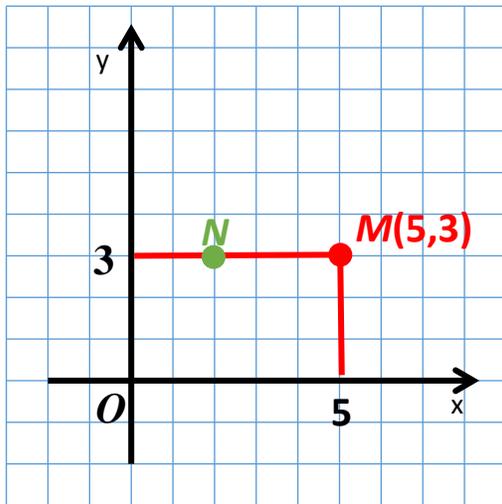


## MATH 6: ASSIGNMENT 12. CARTESIAN PLANE and COORDINATES

### *Coordinates, linear function*

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:

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

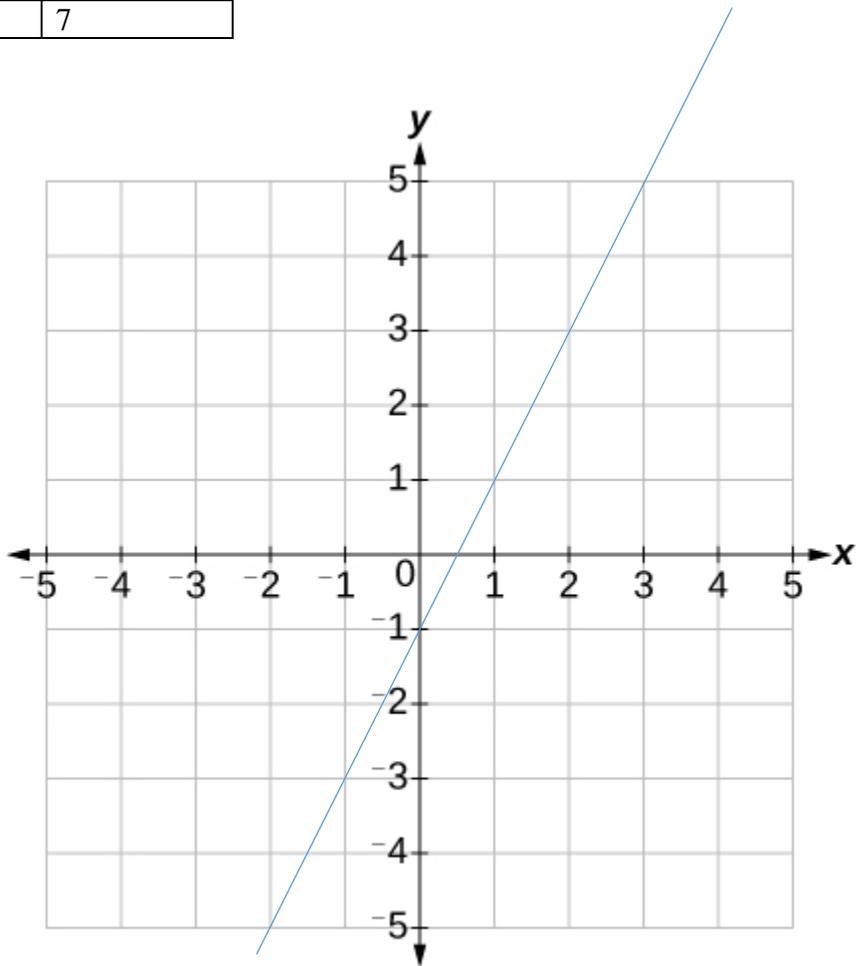
$$MN(y) = |3 - 3| = 0$$

Function  $y = f(x)$  :

- For every  $x$  there is a  $y$  or
- $\forall x \exists y$

$y = kx + b$  is called linear function because  $y$  changes linearly, e.g. proportionally to  $x$ .

$x$	$y = 2x - 1$
0	-1
1	1
2	3
3	5
4	7



## *Homework*

1. 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  $M_I$  obtained from  $M$  by reflection about the  $x$ -axis.
  - (b) Find the coordinates of the point  $M_I$  obtained from  $M$  by reflection about the  $y$ -axis.
  - (c) Find the coordinates of the point  $M_I$  obtained from  $M$  by reflection about the diagonal line  $x=y$ .
7. Draw the following linear functions on the same graph:
  - a.  $y = x$
  - b.  $y = 3x$
  - c.  $y = \frac{1}{3}x$
8. Draw the following linear functions on the same graph:
  - a.  $y = 2x$
  - b.  $y = 2x + 3$
  - c.  $y = 2 - 3$