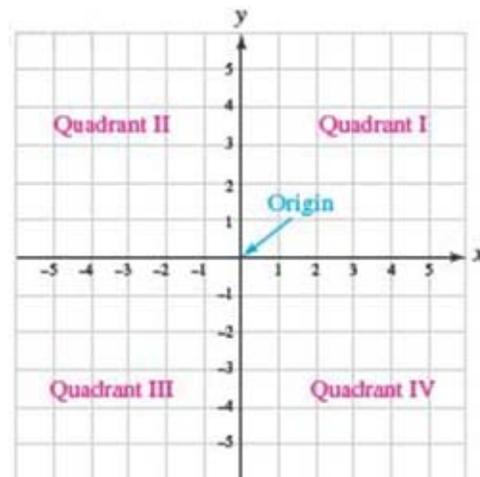


3.1 System of Coordinates, Linear Equations and the Midpoint Formula

rectangular (Cartesian) coordinate system – two perpendicular number lines, called **axes**, intersecting at the **origin** (0,0), and allowing to identify each point on the plane with the **ordered pair** of numbers (x,y) representing its horizontal **x-coordinate** and vertical **y-coordinate**.

The two axes cut the plane into four **quadrants** numbered counterclockwise from the upper right quadrant.



Practice: Plot the following points:

$(0,3)$, $(3,2)$, $(-4,-3)$, $(-5,0)$, $(2,-1)$, $(0,-5)$

Note: If different than x and y letters are used, the alphabetical order applies. The horizontal axis represents the variable that appears first in the alphabet.

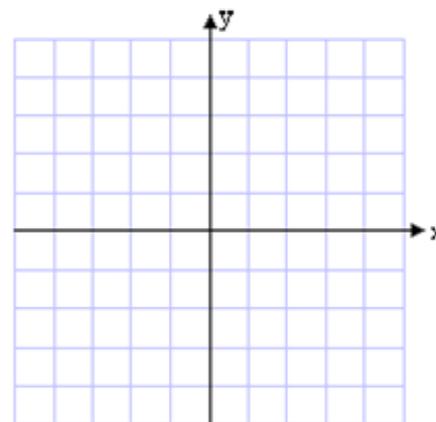
graph of an equation in two variables – the set of all points on a plane with coordinates that satisfy the equation

Methods of graphing a linear equation:

➤ **table of values**

Example 1: Graph $3x - 2y = 1$

x	y
-1	
1	
3	
	-4

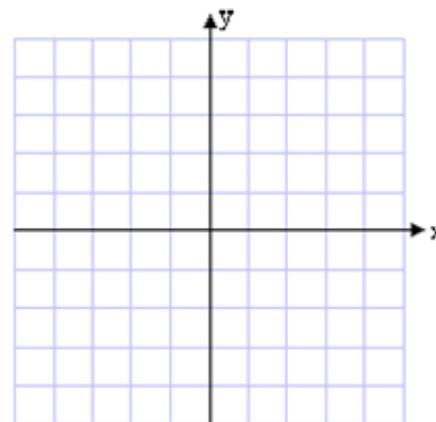


➤ **x- and y-intercepts**

This is very useful if the line is given in **standard form $Ax + By = C$** .

Example 2: Graph $5x + 2y = 10$

x	y
	0
0	



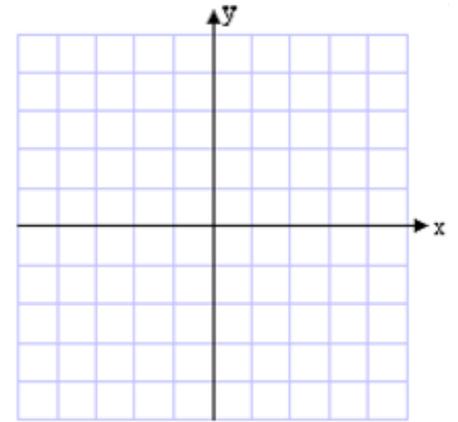
Remember: To find **x**-intercept, set $y = 0$.

To find **y**-intercept, set $x = 0$.

➤ **slope-intercept**

This is the best method if the line is given in the **slope-intercept form** $y = mx + b$.

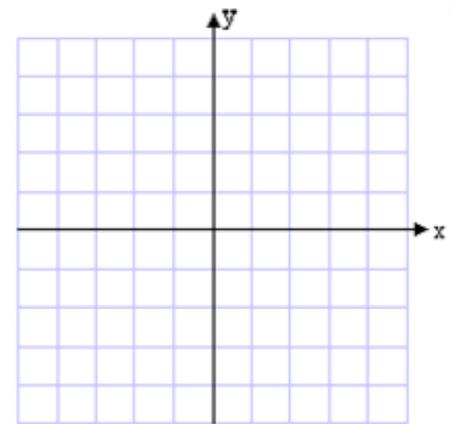
Example 2: Graph $y = \frac{1}{2}x + 1$.



Recall: In **slope-intercept form** of a line $y = mx + b$, $m = \frac{\text{rise}}{\text{run}}$ represents **slope** and b represents **y-intercept**.

Notice: Any line of the form **$y = mx$** passes through the origin.

Example 3: Graph $y = -\frac{3}{4}x$.

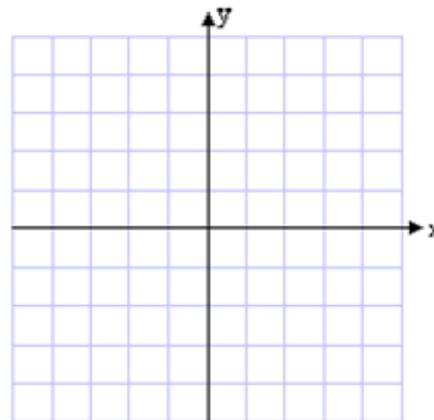
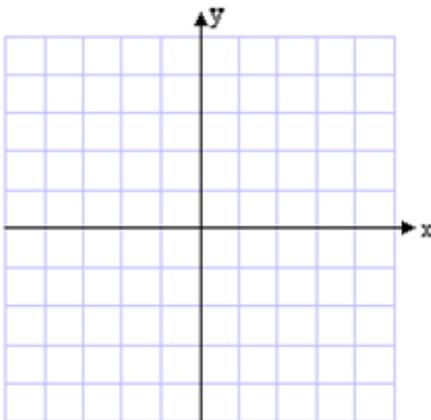


Special Cases:

Example 4: Graph.

a) $y = 2$

b) $x = 1$



Generally, any line of the form **$y = \text{constant}$** is a **horizontal** line with slope =

and any line of the form **$x = \text{constant}$** is a **vertical** line with slope.

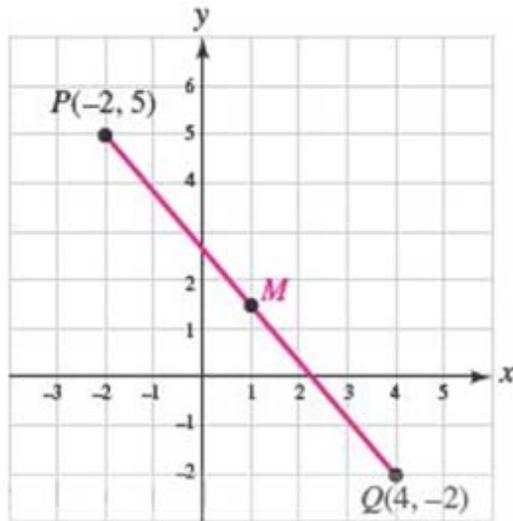
Midpoint Formula

midpoint of a segment \overline{AB} – a point M equidistant from the endpoints A and B of the segment



How to find the exact location of the midpoint of a given segment in the system of coordinates?

Example 5: Let $P(-2,5)$ and $Q(4,-2)$. Find the coordinates of the midpoint of the segment \overline{PQ} .



Generally, the midpoint of a segment with the endpoints (x_1, y_1) and (x_2, y_2) is the point with coordinates $\left(\frac{x_1+x_2}{2}, \frac{y_1+y_2}{2}\right)$.

Practice: 1. Find the midpoint of segment \overline{PQ} , if $P(-2, -8)$ and $Q(3,4)$.

2. If $(6, -5)$ is the midpoint of segment \overline{PQ} and $Q(-5, -8)$, find the coordinates of P .

