2.1 Graphs
- On a number line, each point corresponds to a **number**
- On a plane, each point corresponds to an **ordered pair**
- We use two perpendicular number lines, called **axes** to identify points on a plane
- The variable x usually represented by on the horizontal axis and the variable y on the vertical axis, so we often call such a plane an **x,y coordinate system.**
- to label a point on the x, y coordinate system, we use a pair of numbers in the form (x,y). the number in the pair are called **coordinates**
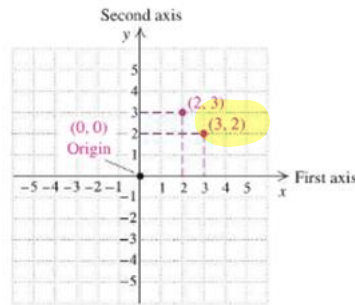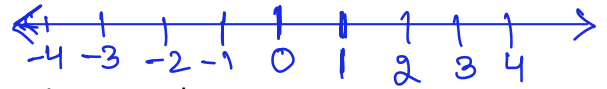
Example 1: Plot the points $(-4,3)$, $(-5,-3)$, $(0,4)$, $(4,-5)$ and $(2.5,0)$
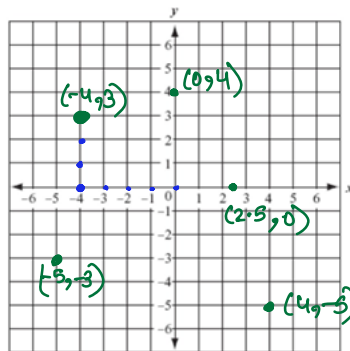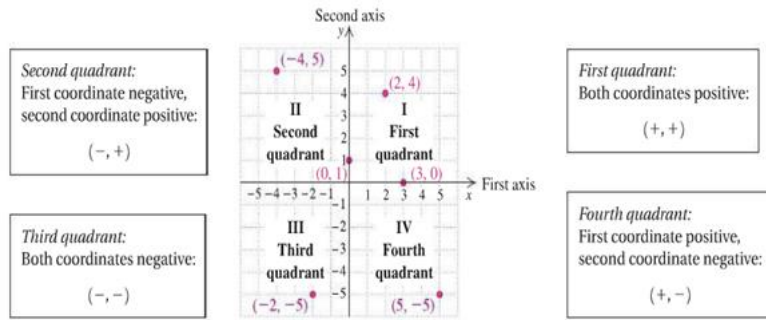

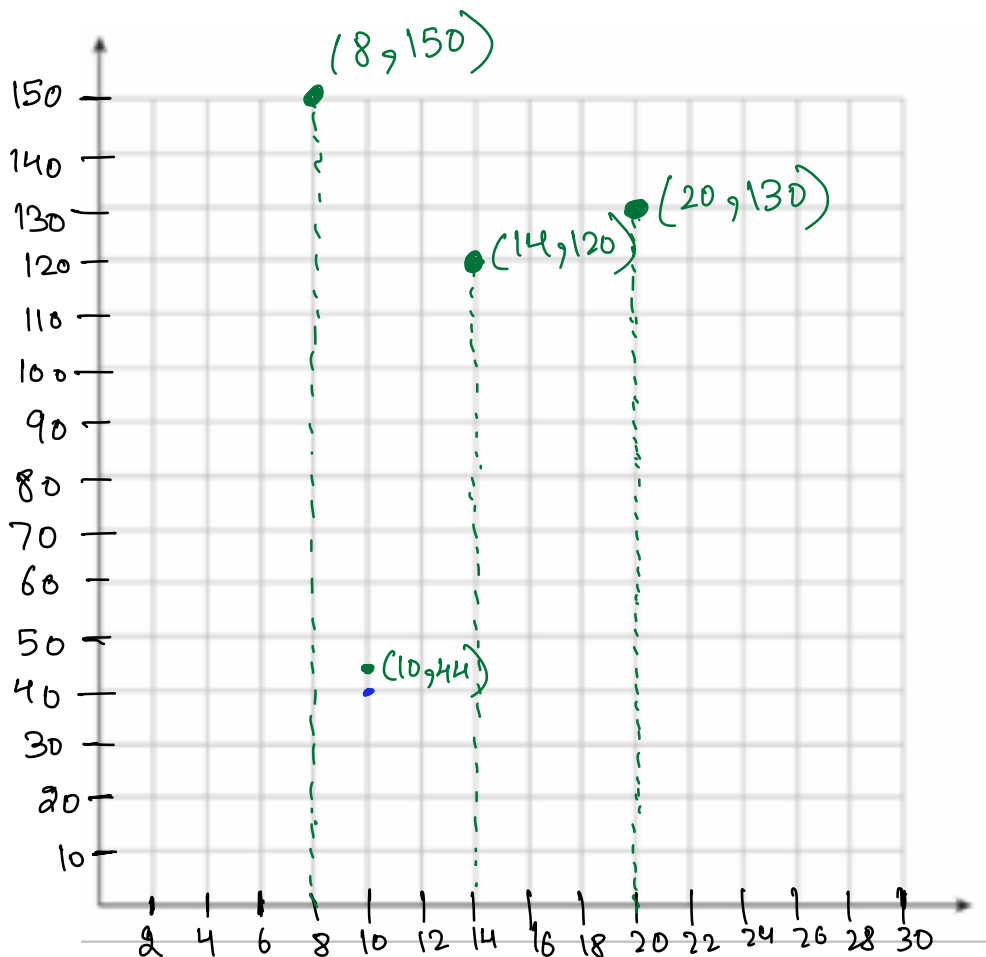**Example 2:** Plots the points $(-2,5)$, $(3,-1)$, $(0,-1)$, $(-2,-4)$, and $(4,0)$
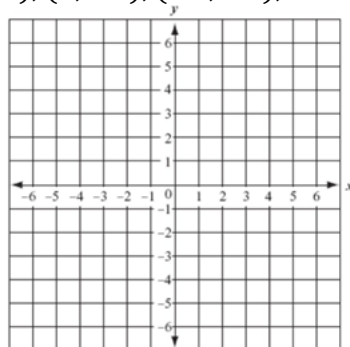
Quadrants and Scales

- The horizontal axis and the vertical axis divide the plane into four regions or **quadrants**.

Second quadrant: First coordinate negative, second coordinate positive: (−, +)		First quadrant: Both coordinates positive: (+, +)

Second axis
y

(−4, 5)   5
                4   (2, 4)
    II   3   I
  Second   2 First
  quadrant (0, 1) quadrant
              1   (3, 0)
-5 -4 -3 -2 -1   1 2 3 4 5   x   → First axis
            -1
    III   -2   IV
  Third   -3 Fourth
  quadrant -4 quadrant
            -5
(−2, −5)   (5, −5)

Third quadrant: Both coordinates negative: (−, −)		Fourth quadrant: First coordinate positive, second coordinate negative: (+, −)

Example 3: Plots $(10,44), (14,120), (20,130),$ and $(8,150)$

Solution of Equations

Example 4: Determine whether $(4,2), (-1,-4), and (2,5)$ are solutions of $y = 3x - 1$

$(4,2):$ $\quad y = 3x - 1 \quad \Rightarrow \quad 2 = 3(4) - 1 \Rightarrow 2 = 11 \Rightarrow (4,2)$ is
$\qquad \qquad \underset{2}{\uparrow} \quad \underset{4}{\uparrow}$ $\qquad \qquad \qquad \qquad \qquad \qquad$ not a soln.

$(-1,-4):$ $\quad -4 = 3(-1) - 1 \Rightarrow -4 = -3 - 1 \Rightarrow -4 = -4 \Rightarrow (-1,-4)$ is
$\qquad \qquad \qquad \qquad \qquad \qquad \qquad \qquad \qquad \qquad$ a soln.

$(2,5):$ $\quad 5 = 3(2) - 1 \Rightarrow 5 = 6 - 1 \Rightarrow 5 = 5 \Rightarrow (2,5)$ is a
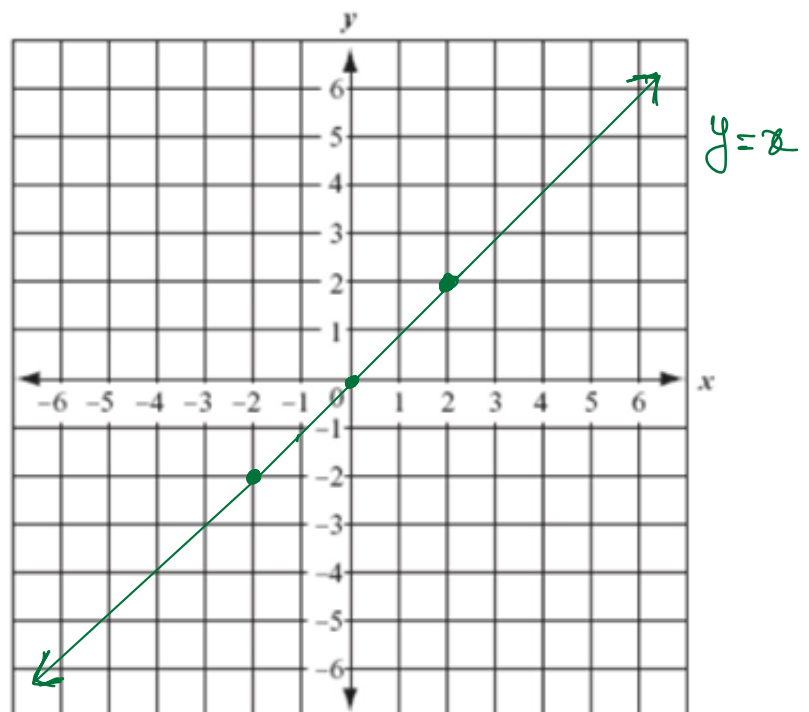$\qquad \qquad \qquad \qquad \qquad \qquad \qquad \qquad \qquad \qquad$ soln.

Example 5: Determine whether $(7, -1)$ is a solution of $x - y = 6$

$$7 - (-1) = 6 \quad \Rightarrow \quad 8 = 6 \quad \Rightarrow (7, -1) \text{ is}$$
$$\qquad \qquad \qquad \qquad \qquad \qquad \qquad \qquad \text{not a}$$
$$\qquad \qquad \qquad \qquad \qquad \qquad \qquad \qquad \text{soln.}$$

Example 6: Graph $y = x$, using a table of values

Plot all the solns.
of the given equation

x	y	
0	0	$(0,0)$
2	2	$(2,2)$
-2	-2	$(-2,-2)$

$y = x$

Example 7: Graph $y = x + 1$, using a table of values

x	y	
0	0+1	$(0, 1)$
-2	-2+1	$(-2, -1)$
2	2+1	$(2, 3)$

$y = x + 1$
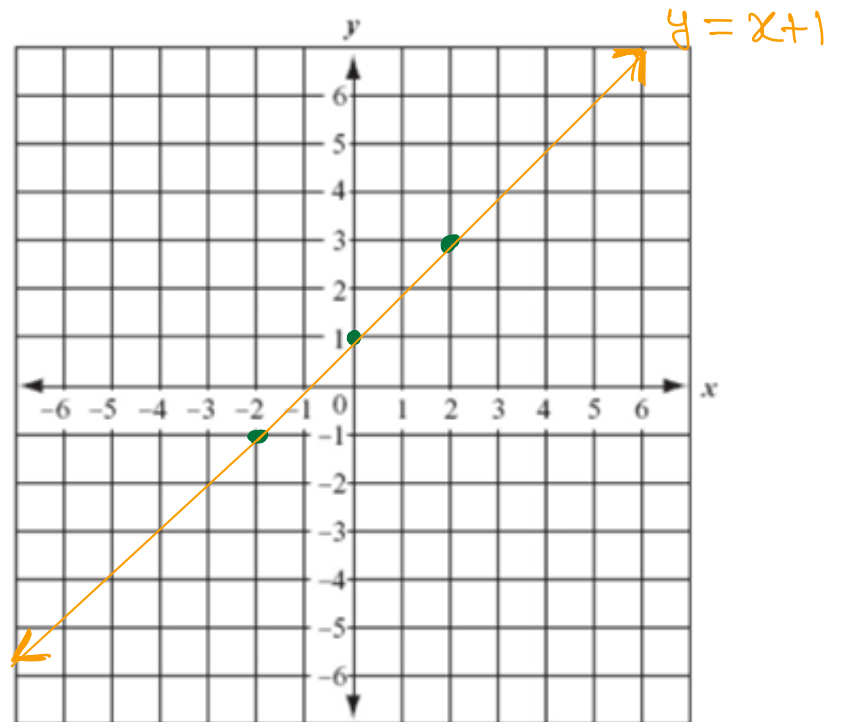
Example 8: Graph $y = 2x - 1$, using a table of values.

x	y	
0	2(0)-1	$(0, -1)$
-3	2(-3)-1	$(-3, -7)$
3	2(3)-1	$(3, 5)$

$y = 2x - 1$
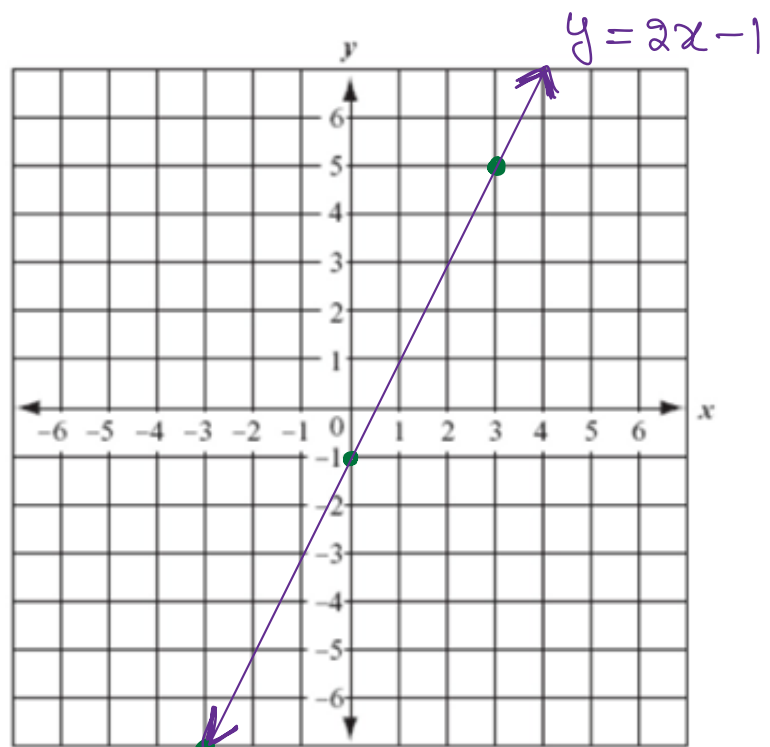
Example 9: Graph

$$y = -12x$$

$y = -12x$

x	y
0	$-12(0) = 0$ $(0, 0)$
-0.5	$-12(-0.5) = 6$ $(-0.5, 6)$
0.5	$-12(0.5) = -6$

$(0.5, -6)$

$(-0.5, 6)$

$(0.5, -6)$
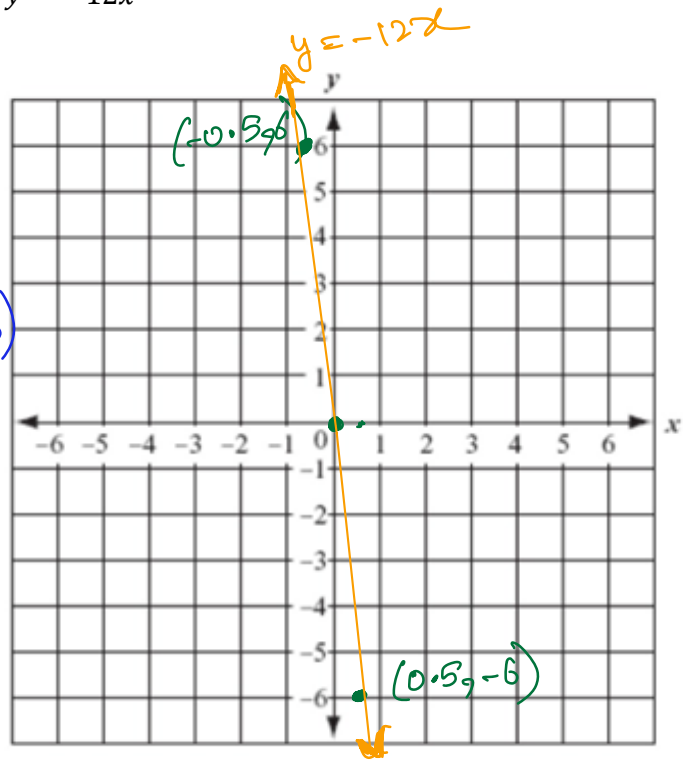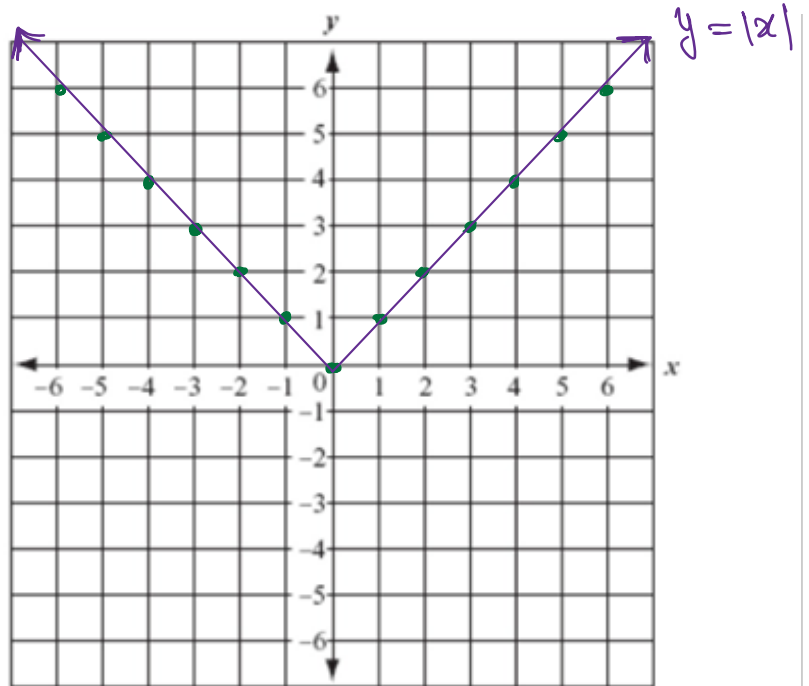
Example 10: Graph

$$y = -13x$$
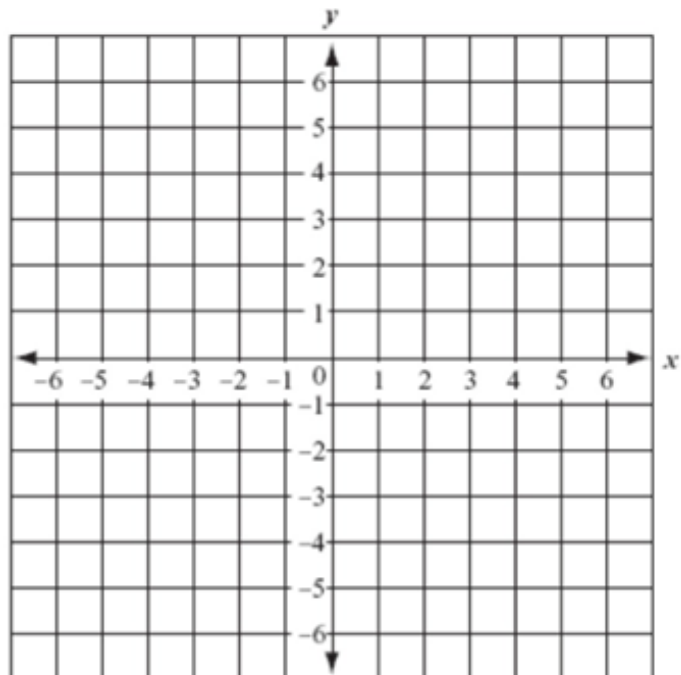
<u>Linear equations</u>: $ax + by + c = 0$ or $y = mx + c$
$$(straight\ lines)$$

Nonlinear Equations

- For many equations, the graph is not a straight line. Graphing these **nonlinear equations** require plotting many points in order to see the general shape of the graph.

Example 11: Graph using a table of values $y = |x|$

x	y
0	0
-1	1
-2	2
-3	3
1	1
2	2
3	3

$y = |x|$

Example 12: Graph using a table of values.

$$y = x^2 + 5$$

x	y	
0	$0^2 + 5$	$(0, 5)$
1	$1^2 + 5$	$(1, 6)$
2	$2^2 + 5$	$(2, 9)$
-1	$(-1)^2 + 5$	$(-1, 6)$
-2	$(-2)^2 + 5$	$(-2, 9)$

$(-2, 9)$ $(2, 9)$

$y = x^2 + 5$ (Parabola)

$(-1, 6)$ $(1, 6)$