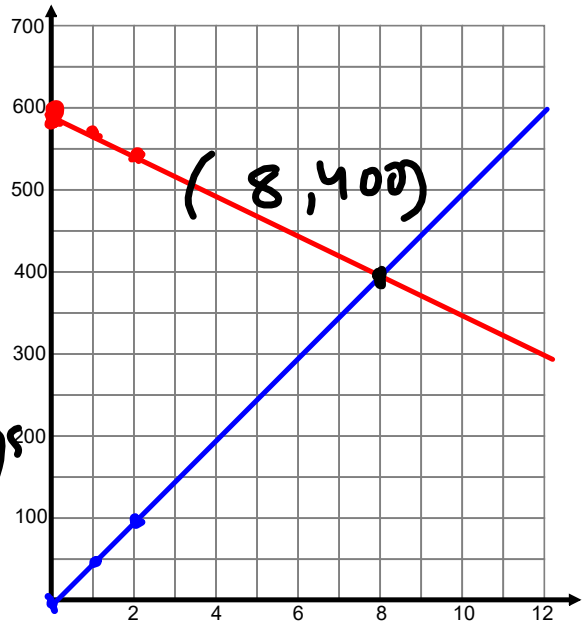
Systems of equations

The current price of the phone is 600$, but it decreases by 25$ a month.

I can set aside 50$ per month for the phone.

When and for what price will I be able to buy it?

Month	Price	Savings
0	600	0
1	575	50
2	550	100



Systems of equations

The **solution** of a system of equations is the point (x,y) where the two lines intersect.

A system of two equations can have:

- **1** solution if the lines are perpendicular or intersecting.
- **0** solutions if the lines are parallel distinct.
- **Infinitely many** solutions if the lines are parallel coincident.

Solving graphically:

Steps: 1. Graph the two lines on a cartesian plane.

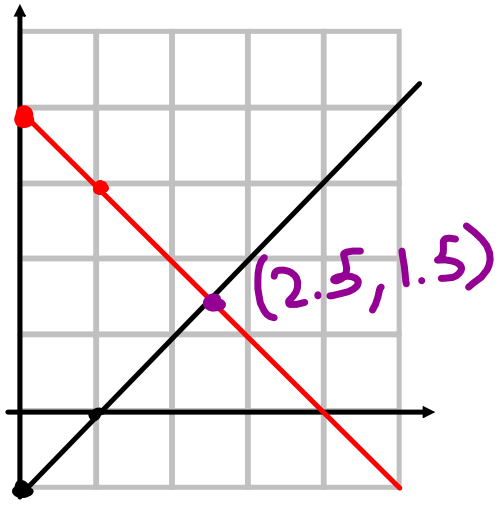
2. Read the coordinates of the intersection.

Ex. 1: See the phone problem.

Ex. 2: $\begin{cases} y=x-1 \\ y=-x+4 \end{cases}$

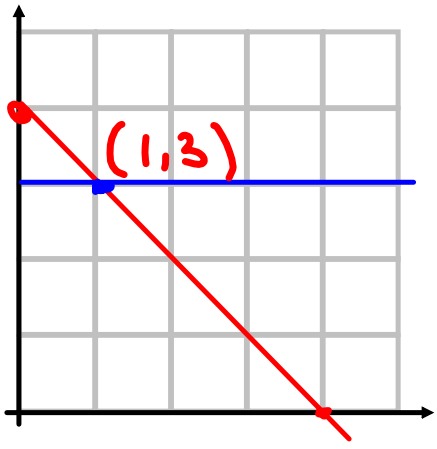
x	y
0	-1
1	0

x	y
0	4
1	$-1+4=3$



Ex. 3: $\begin{cases} x+y=4 \\ y=3 \end{cases}$

x	y
0	4
4	0



Solving by comparison:

If we have a system with lines in slope-intercept form:

$$\begin{cases} y=ax+b \\ y=ax+b \end{cases}$$

It is easiest to solve by **comparison.**

Steps: 1. Make sure both equations have y isolated

2. Make y=y $ax+b=ax+b$

3. Solve for x

4. Replace x in either equation to find y.

- To check, replace x in the second equation

5. Write solution as a point (x,y).

ex.1: $\begin{cases} y=4x-3 \\ y=2x+1 \end{cases}$

$y=y$

$4x-3=2x+1$ (-2x, +3)

$4x-2x=1+3$

$2x=4$

$x=2$

$y=2(2)+1=4+1=5$

$(2,5)$

ex.2: The phone problem

$\begin{cases} y=600-25x \\ y=50x \end{cases}$

$600-25x=50x$ (+25x)

$\frac{600}{75}=\frac{75x}{75}$

$x=8$

$y=50(8)=400$

$(8,400)$

ex.3: $\begin{cases} y=7x-2 \\ 2y=8x+2 \end{cases}$

$\frac{2y}{2}=\frac{8x}{2}+\frac{2}{2}$

$y=4x+1$

$\begin{cases} y=7x-2 \\ y=4x+1 \end{cases}$

$4x+1=7x-2$ (×2)

$4x+3=7x$ (-4x)

$\frac{3}{3}=\frac{3x}{3}$

$x=1$

$y=7(1)-2=5$

$(1,5)$

Bonus example:

$\begin{cases} x=y-1 \\ x=3y-7 \end{cases}$

$y-1=3y-7$ (-y)

$+7 \quad -1=3y-y-7$

$7-1=3y-y$

$6=2y$

$2=3$

$x=y-1$

$=3-1=2$

$(2,3)$