1) **Review of elementary functions (Part 1)** :

Examples - Equations - Graphs - Exercises
Use of Mathematical software.

a) *Linear functions vs Affine functions*
$y = ax$ vs $y = ax + b$

b) *Graphing inequalities :* $ax + by \le c$

c) *Graphing linear systems of inequalities* $\begin{cases} ax + by \le c \\ a'x + b'y \le c' \end{cases}$

d) *Word problems (Kinematics / Economics)*

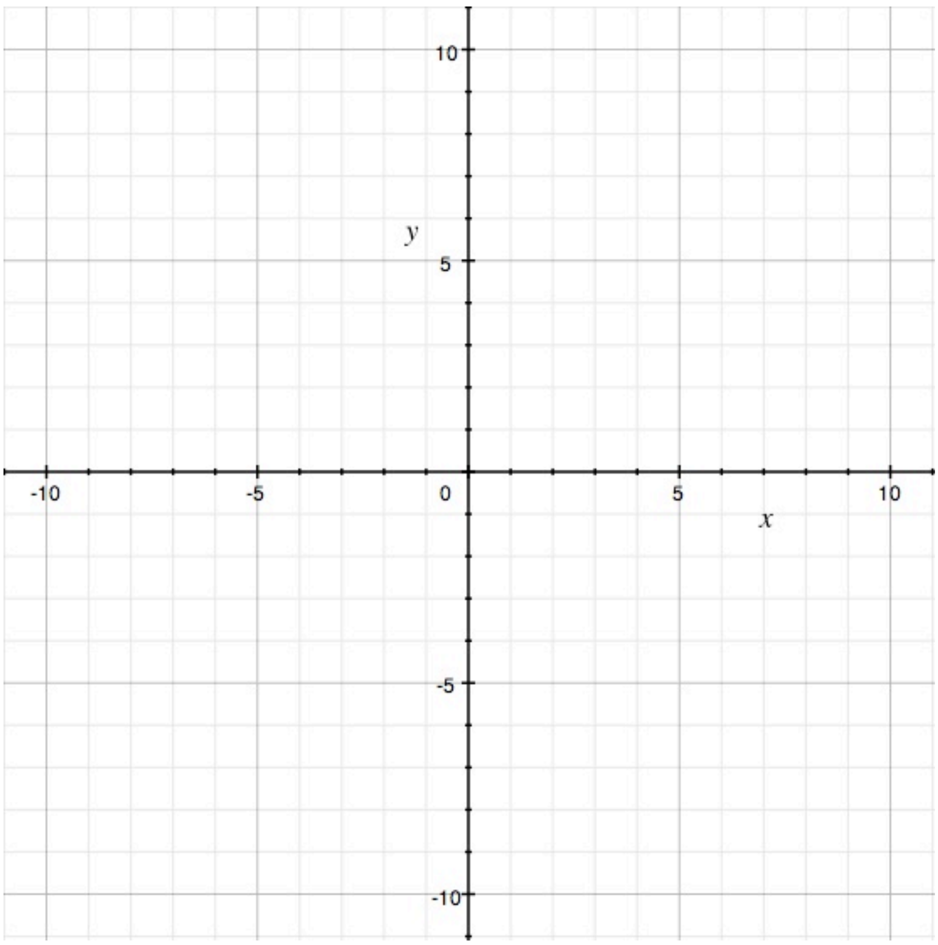
I .1 Draw the lines defined by the given equations below (show which is which) :

(1) $y = \frac{1}{2}x + 5$

(2) $y = -\frac{1}{2}x + 5$

(3) $y = \frac{1}{2}x - 5$

(4) $y = -\frac{1}{2}x - 5$



I .2 Shade the area defined by the system of inequalities below :

$$\begin{cases} (1) \quad y \le \frac{1}{2}x + 5 \\ (2) \quad y \le -\frac{1}{2}x + 5 \\ (3) \quad y \ge \frac{1}{2}x - 5 \\ (4) \quad y \ge -\frac{1}{2}x - 5 \end{cases}$$

I.3 What's the measure of the shaded area (in square units).

II.1. **Movements of two cars moving in opposite directions from A to B.**

The distance between A and B is 450 Km.

Car U leaves the city A at 12:am at an average speed of 90 km/h towards B

Car V leaves the city B at 12:00 am at an average speed of 45 Km/h towards A

a) At what time will U arrive in B ?

b) At what time will V arrive in A ?

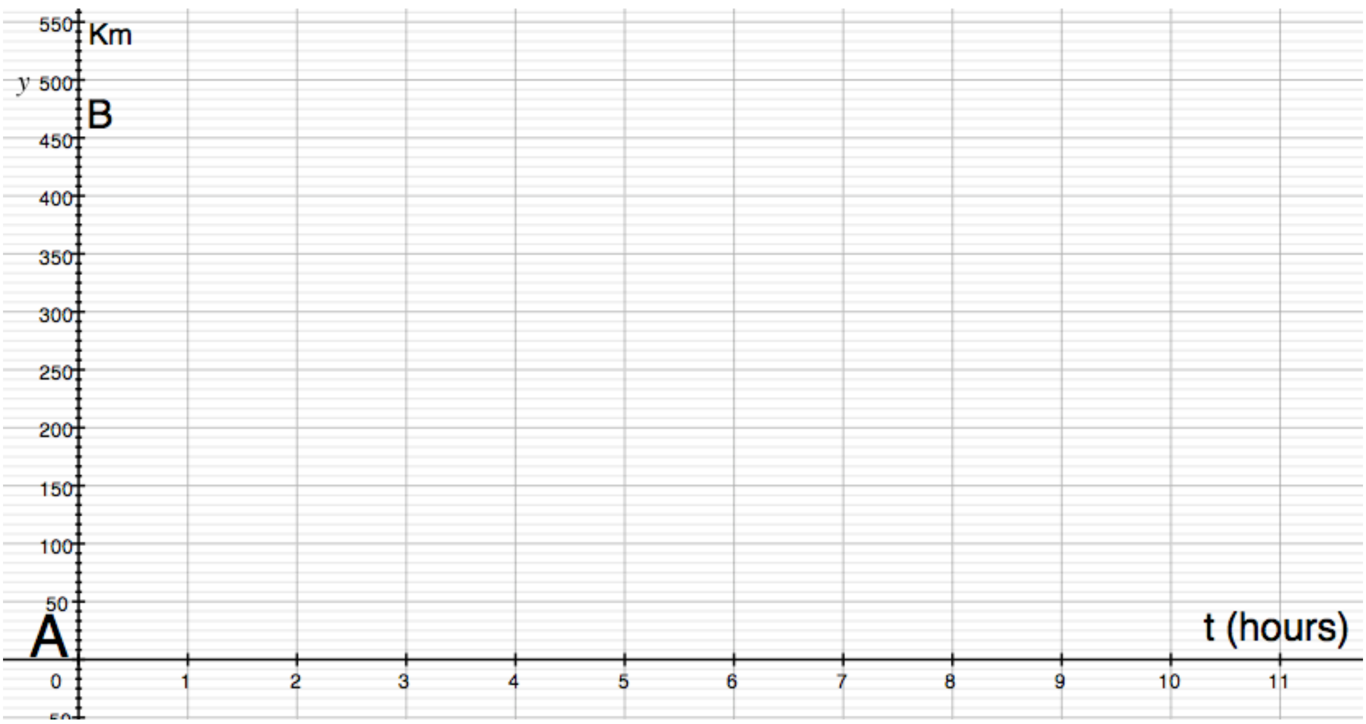
c) Guess at what time they should cross ?

d) Draw the lines representing the movements of each car. in the rectangular coordinates system below.

e) Use the graphic to determine at what time U and V cross on the road ?

f) Let u be the distance run by U, and t be the time corresponding to that distance. Let v be the distance run by V, and t be the time corresponding to that distance. Write the equations of the movement of the two cars.

g) Solve the system and check that your answers match the picture.



III. **Problem of economics optimization in a factory / Linear Programming.**

An industrial plant is producing 2 different organic materials X and Y by means of 2 machines A and B. But that production is limited by environmental questions.

a. Through the machine A, the material X is rejecting 5 m^3 of CO_2 per ton, and the material Y is rejecting 1 m^3 of CO_2 per ton. But altogether the machine A is not allowed to reject more than 150 m^3 of CO_2 per day.
b. Through the machine B, the material X is rejecting 2 m^3 of CO_2 per ton, and the material Y is rejecting 1 m^3 of CO_2 per ton. But altogether the machine B is not allowed to reject more than 120 m^3 of CO_2 per day.

This plant is selling the products X at 320 Rmb per ton and Y at 180 Rmb per ton.

Let's x and y be the numbers of tons of these materials to be produced by the two machines A & B each day.

The question is how many tons of each material should be produced per day, to comply with the environmental constraints and make a maximum profit.

1. Explain (back page) why the constraints are represented by the following system:

$$\begin{cases} x \geq 0\,;\, y \geq 0 \\ 5x + y \leq 150 \\ 2x + y \leq 120 \end{cases}$$

and Profit : P = 320 x + 180 y (Rmb)

2. Graph the above inequalities below, and explain (back page) why the maximum profit would be made for the values of x and y corresponding to the vertex of the domain corresponding to the allowed production.