1) Review of elementary functions (Part 1) :

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

a) *Linear functions vs Affine functions*
$f : x \mapsto y = mx$ *vs* $g : x \mapsto y = mx + p$

b) *General equation of straight lines : ax + by +c =0*

c) *Graphing inequalities : ax + by ≤ c*

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

e) *Word problems (Kinematics & Economics)*

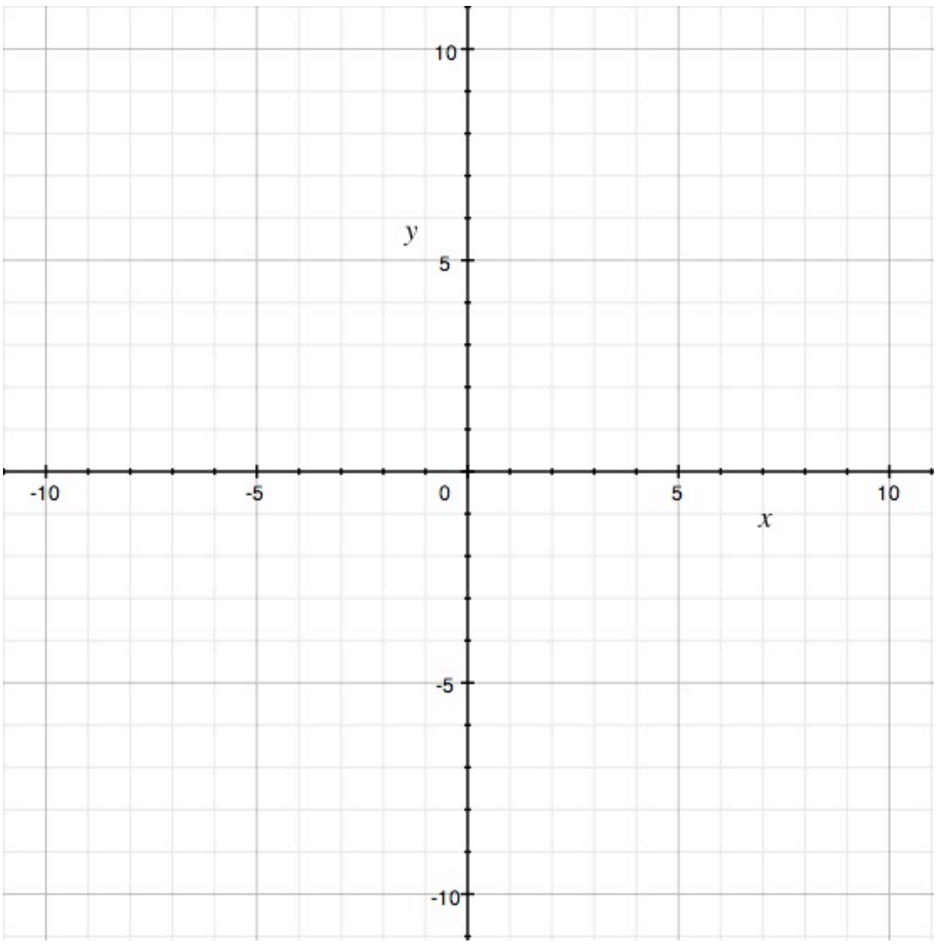
I .1 **Draw** the lines defined by the given equations below (show which is which) :

(1) $x - 2y + 10 = 0$

(2) $x + 2y - 10 = 0$

(3) $2y - x + 10 = 0$

(4) $2y + x + 10 = 0$



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

$$\begin{cases} (1) \quad x - 2y \ge -10 \\ (2) \quad x + 2y \le 10 \\ (3) \quad x - 2y \le 10 \\ (4) \quad x + 2y \ge -10 \end{cases}$$

I.3 From the graph, determine 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 ?

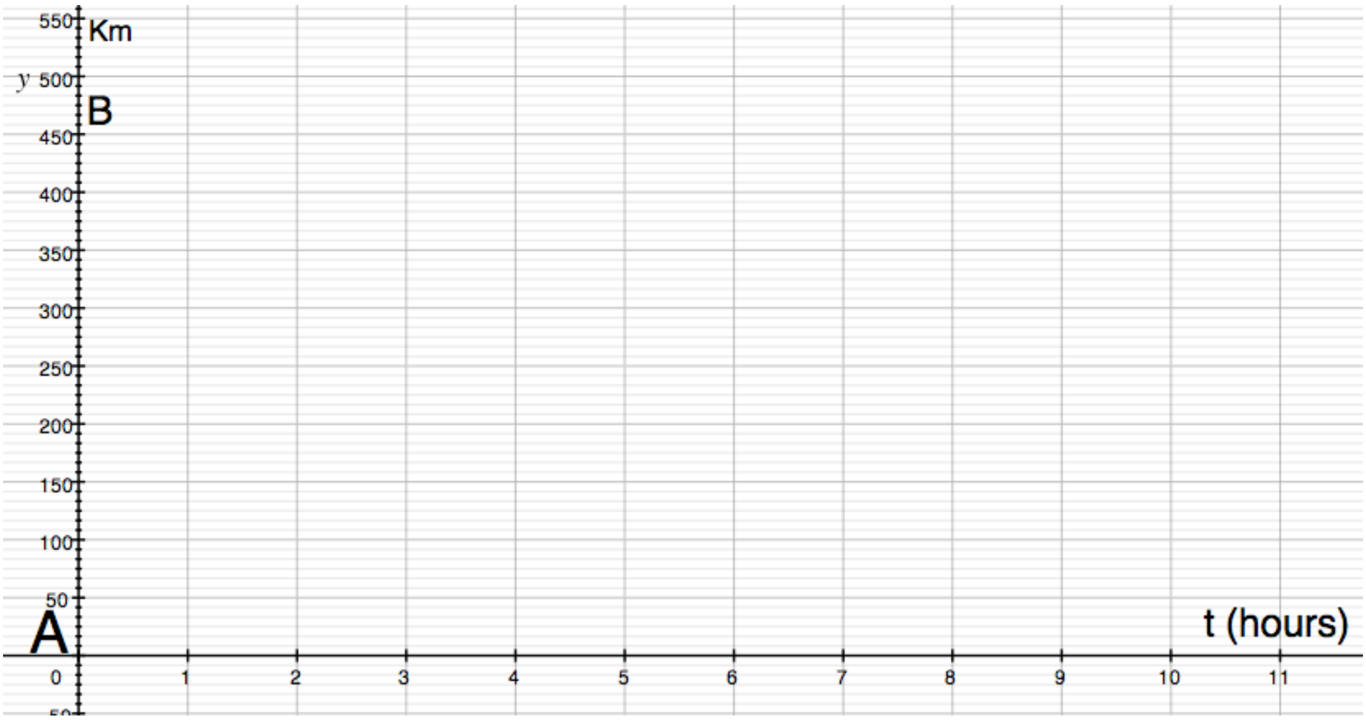
c) At what time should they meet ? Explain your answer on back of page.

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.