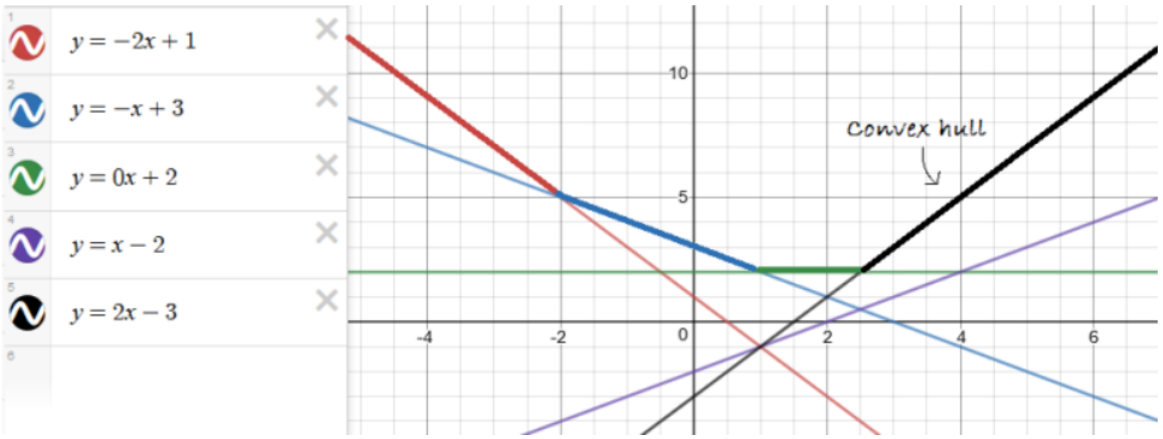
Convex hull trick

Example problem(appears in the contest)

Byteland consists of n + 1 cities located along a straight road. Cities are numbered from 0 to n in order of increasing coordinates. The capital is city 0 and it is located at the point with the coordinate 0. City i is located at xi . Phones have not yet been invented, therefore, in case of emergency in each city there is a special runner. If an emergency occurs, a runner in city i will prepare for ai seconds, after that he will run towards the capital, spending bi seconds for one kilometer. When a runner reaches another city, he can either run past it or go into the city and give the message to the local runner (in this case, the second runner also prepares, and then runs towards the capital). For each city find the minimum time for a message from it to be delivered to the capital.

(Upper convex hull of lines)



Pseudocode

```
add(x, y):
    new_line(x, y)
    while (size(all_lines) >= 2 &&  can_delete(all_lines[-2], all_lines[-1], new_line)):
        all_lines.pop()
    all_lines.push(new_line)


get(x):
    l = -1
    r = size(all_lines) - 1
    while (r - l > 1) {
        int m = (l + r) / 2;
        if (get(all_lines[m], x) > get(all_lines[m + 1], x)) {
            r = m;
        }
        else l = m;
    }
    return get(all_lines[r], x)
```

Additional read

https://codeforces.com/blog/entry/63823

https://cp-algorithms.com/geometry/convex_hull_trick.html