Bulldozer (Solution)

In the following, we consider rock as gold of negative value.

Subtask 1

First, we consider the case where all spots lie on a line (Subtask 1). We sort the spots according to their x-coordinates. Let $W_1, W_2, \ldots, W_N$ be the value of gold obtained at each spot, in order.

We put $S_0 = 0$ and $S_i = W_1 + W_2 + \cdots + W_i$. Then the maximum profit is $\max\{ S_j - S_i \mid 0 \leqq i < j \leqq N \}$.

Subtask 2

We consider the general case. If we choose the slope a of a line, by taking the projections of all spots to a line of slope $-1/a$, the problem is reduced to the case where all spots lie on a line. (The case of a line parallel to the y-axis is the same as the case of a line of sufficiently large slope.)

Let us consider how the order of spots are changed when a varies. If we change the value of a from $-\infty$ to $+\infty$, the order is changed only when $aX_i - Y_i = aX_j - Y_j$ is satisfied for some $i \neq j$.

Therefore, since there are at most $N(N-1)/2$ candidates of a, we can solve Subtask 2.

Subtasks 3–5

We consider Subtask 3. Note that, if we change the value of a from $-\infty$ to $+\infty$, when the order is changed, only two adjacent spots are interchanged at one moment. Hence this subtask is solved if we can manage the maximum, the minimum, and $\max\{ S_j - S_i \mid j > i \}$ of the intervals of the sequence $\{ S_i \}_{0 \leq i \leq N}$. We can implement it using a **segment tree**.

We can solve Subtask 4 if we refer the segment tree for $\max\{ S_j - S_i \mid 0 \leq i < j \leq N \}$ only when all changes of the same slopes are done.

If more than three points lie on a line, we can similarly solve the task if we devise the order to change the spots. Then we get full score.