Problem H

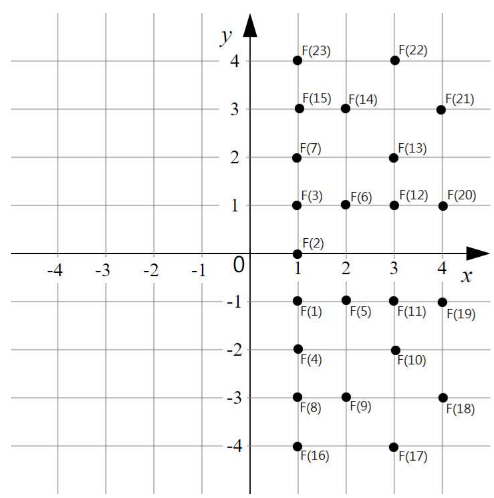
Countable Rational Numbers

(Time Limit: 3 seconds)

The set of rational numbers is described as $Q = \left\{ \frac{y}{x} \mid x, y \in Z, x > 0, \gcd(x, y) = 1 \right\}$ where Z is the set of integers and $\gcd(x, y)$ is the greatest common divisor of x and y. For examples, $\frac{1}{2}, \frac{-1}{2}, \frac{3}{1}, \frac{-3}{1}, \ldots$ are rational numbers while $\frac{2}{4}, \frac{1}{-2}, \frac{8}{2}, \frac{-3}{-2}, \ldots$ are syntactically not rational numbers since they violate the constraints $x > 0$ or $\gcd(x, y) = 1$. It is well-known that the cardinality of rational numbers is countable infinity. However how to prove that is to find a bijection from natural numbers N to rational numbers Q.

Consider two rational numbers, $\frac{y_1}{x_1}$ and $\frac{y_2}{x_2}$. Let $m_1 = \max(x_1, abs(y_1))$, $m_2 = \max(x_2, abs(y_2))$. We define $\frac{y_1}{x_1} \lhd \frac{y_2}{x_2}$ if one of following constraints is satisfied.

1. $m_1 < m_2$
2. $m_1 = m_2$ and $y_1 < y_2$
3. $m_1 = m_2$ and $y_1 = y_2$ and $x_1 \times y_1 > x_2 \times y_2$



According to the ordering $\lhd$, we can build a bijection F from N to Q by enumerating elements of Q from the smallest to larger as $\frac{-1}{1} \lhd \frac{0}{1} \lhd \frac{1}{1} \lhd \frac{-2}{1} \lhd \frac{-1}{2} \lhd \frac{1}{2} \lhd \frac{2}{1} \lhd \frac{-3}{1} \lhd \frac{-3}{2} \lhd \frac{-2}{3} \lhd \frac{-1}{3} \lhd \frac{1}{3} \lhd \frac{2}{3} \lhd \frac{3}{2} \lhd \frac{3}{1} \ldots$, that is $F(1) = \frac{-1}{1}, F(2) = \frac{0}{1}$, $F(3) = \frac{1}{1}$, $F(4) = \frac{-2}{1}, \ldots$. For each rational number $F(n) = \frac{y}{x}$, we can plot it at (x, y) on $x - y$ plane as the above picture. On the picture, we can see that there is no rational numbers on the left part since the value of x has to be larger than zero. We can also understand that there is no rational number at (4,2) since $\frac{2}{4}$ is not a rational number because $\gcd(4,2) = 2 \neq 1$.

For any given integers y and x, can you find an integer n such that $F(n) = \frac{y}{x}$.

Input Format

The first line is a number indicating the number of test cases. Each test case has two integers y and x. (Remark: "+" and "−0" do not appear in test cases.)

Output Format

For each test case, please output n if there exists an integer n such that $F(n) = \frac{y}{x}$ and please output 0 if $\frac{y}{x}$ is syntactically not a rational number.

Technical Specification

- There are at most 10 test cases.
- $-1{,}000{,}000 < x < 1{,}000{,}000$
- $-1{,}000{,}000 < y < 1{,}000{,}000$

Example

Sample Input:	Sample Output:
5 4 2 -1 3 2 3 1 -3 4 1	0 11 13 0 23