Project Euler #207: Integer partition equations

This problem is a programming version of Problem 207 from projecteuler.net

For some positive integers k, there exists an integer partition of the form $4^t = 2^t + k$, where 4^t, 2^t and k are all positive integers and t is a real number.

The first two such partitions are $4^1 = 2^1 + 2$ and $4^{1.5849625\ldots} = 2^{1.5849625\ldots} + 6$.

Partitions where t is also an integer are called $perfect$.
For any $m > 1$ let $P(m)$ be the proportion of such partitions that are perfect with $k \leq m$.
Thus $P(6) = 1/2$.

In the following table are listed some values of $P(m)$

$P(5) = 1/1$
$P(10) = 1/2$
$P(15) = 2/3$
$P(20) = 1/2$
$P(25) = 1/2$
$P(30) = 2/5$
...
$P(180) = 1/4$
$P(185) = 3/13$

Find the smallest m for which $P(m) < a/b$.

Input Format

First line of each test file contains a single integer q that is the number of queries per test file. q lines follow, with two integers a and b separated by a single space on each.

Constraints

- $1 \leq q \leq 3 \times 10^5$
- $1 \leq a < b \leq 10^{18}$

Output Format

Print exactly q lines with an answer for the corresponding query on each.

Sample Input 0

```
2
2 3
9 20
```

Sample Output 0

```
6
30
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Explanation 0

$P(2) = P(3) = P(4) = P(5) = 1/1 > 2/3$, but $P(6) = 1/2 < 2/3$, therefore, an answer for the first query is 6.
$P(30) = 2/5$, which is the first value less than $9/20$ among all $P(m)$ where $1 < m \leq 30$.