

# Re: question regarding diofantine equations

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- *From:* [rob@xxxxxxxxxxxxxxxx](mailto:rob@xxxxxxxxxxxxxxxx) (Rob Johnson)
  - *Date:* Wed, 11 Apr 2007 01:28:39 GMT
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In article <gerry-B2C6C7.08533011042007@xxxxxxxxxxxxxxxxxxxxxx>, Gerry Myerson <gerry@xxxxxxxxxxxxxxxxxxxxxxxxxxxxxx> wrote:

In article <20070410.142106@xxxxxxxx>, rob@xxxxxxxxxxxxxxxx (Rob Johnson) wrote:

In article <1176237012.557078.287790@xxxxxxxxxxxxxxxxxxxxxxxxxxxxxx>, "laura" <laura.brandusan@xxxxxxxx> wrote:

I want to solve diofantine equations of form:

$$ax+by=c,$$

where a, b and c are real numbers and

x and y are natural numbers ( $\geq 0$ ).

Are there any methods for solving this ? I don't want to enumerate all possible pairs (x,y) and to check which ones are good.

Or, is there possible to decide if the equation has solutions without solving it?

The algorithm is called the extended euclidean algorithm, and one implementation is the Euclid-Wallis Algorithm:

<<http://www.whim.org/nebula/math/euclid-wallis.html>>

OP wants a, b, and c to be real numbers. If  $b = 1$  and  $c = 0$  then the question of whether  $ax + by = c$  has solutions is the question of whether a is rational. It's going to take a heck of an extension of Euclid's algorithm to decide whether, say, gamma is rational.

Re: question regarding diofantine equations

Yes, I missed that  $a$ ,  $b$ , and  $c$  were not necessarily integers.

With this generality, there are a couple of cases:

1.  $\{ ax + by : x,y \text{ are integers} \}$  has a smallest positive element,  $d$  (equivalently,  $a/b$  is rational).

In this case,  $a/d$  and  $b/d$  are relatively prime integers, and the equation has a solution if and only if  $c/d$  is an integer. Solutions are given by the extended euclidean algorithm.

2.  $\{ ax + by : x,y \text{ are integers} \}$  does not have a smallest positive element (equivalently,  $a/b$  is not rational).

Solutions here would require a canvassing of all values of  $x$  and  $y$ .

Rob Johnson <rob@xxxxxxxxxxxxxxxx>

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