Re: question regarding diofantine equations

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- *From*: Gerry Myerson <gerry@xxxxxxxxxxxxxxxxxxxxxxxxxx>
- *Date*: Wed, 11 Apr 2007 04:29:24 GMT

In article <20070410.175730@xxxxxxxx>, rob@xxxxxxxxxxxxxx (Rob Johnson) wrote:

> In article <gerry−B2C6C7.08533011042007@xxxxxxxxxxxxxxxxxx>, Gerry Myerson <gerry@xxxxxxxxxxxxxxxxxxxxxxxxxx> wrote:
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>> In article <20070410.142106@xxxxxxxx>, rob@xxxxxxxxxxxxxx (Rob Johnson) wrote:
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>>> In article <1176237012.557078.287790@xxxxxxxxxxxxxxxxxxxxxxxxxxx>, "laura" <laura.brandusan@xxxxxxxxx> 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 (>=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 a x + b y = 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.

> 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 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 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.

Although you could get lucky. E.g., pi x − y = sqrt 2 clearly has no
solutions in natural x, y − no canvassing required. pi x − y = pi − 1
clearly has the solution x = y = 1. pi x + y = e clearly has no
solutions in natural x, y. pi x − y = e is, I think, unknown.

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Gerry Myerson (gerry@xxxxxxxxxxxxxxx) (i −> u for email)
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