How do I find x in a polynomial when x is approximate?

GROUPS: *Mathematica* Equation Solving Wolfram Language Numerical Computation

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I have difficulty programming to find x in a polynomial. I try NSolve to set the equation to zero and solve for x.
If N = 85, x= 5, and y = 17

I have an equation:

```
y = sqrt((N * y - x^2)/x)
```

as an approximation of the larger Prime product (or any possible product)

My equation as it stands does not find x. I know there is a margin of error in the equation. This error can be subtracted to get a closer approximation. For example:
In the following equations: y = 17.2941176471 = 16.8522995464 This is the answer when subtracting the 2 equations below to find x knowing only N. Look at the Yellow.

So as the equations approach 0 (plus the margin of error). So since it is an approximation I need to find those values that are less than 1 and greater than 0. But 16.9082 is the value of the equation and not the value of x which should be found.
I need help programming this. So if anyone can help it would be much appreciated.

```
y = sqrt[((85/x) * 85 - x^2)/ x) ]= ((85^2/x) + x^2)/ 85

p = ((((85^2/x) + x^2)/ 85 ) ^2)- (((85/x) * 85 - x^2)/ x )^2 - 0.4418181007  ;

sol = NSolve[p 0, x]

{{x -86.8953},{x 82.8717},{x 23.3122},{x -7.50642+19.0312  },{x -7.50642-19.0312  },
{x -10.592+14.3276  },{x -10.592-14.3276  },{x 16.9082}}
```

```
y = sqrt[(N * y - x^2) / x]
y = sqrt[(7872197 * 3191 - 2467^2) / 2467]
```

You can see this work at http://www.3dbuzz.com/forum/threads/200441-New-One-Way-Function/page2
Look at the last page first.
Also my website is www.constructorscorner.net

POSTED BY: Bobby Joe Snyder 1 Month ago

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The code as presented in the first web page you link to is easier to read.

The -> for Rule and I for Sqrt[-1] come across better than special characters.

Using a Mathematica built-in function name (N) as a user variable name is asking for trouble.

It wasn't clear from the code above or the link if "sqrt" is your own function or
a mis-capitalized Sqrt.

POSTED BY: Bruce Miller 1 Month ago

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Have you tried Interval?

```
In[1]:= soln = Solve[ y == Sqrt[(n*y - x^2)]/x, x]

                  Sqrt[n] Sqrt[y]           Sqrt[n] Sqrt[y]
Out[1]= {{x -> -(---------------)}, {x -> ---------------}}
                           2                         2
                  Sqrt[1 + y ]              Sqrt[1 + y ]

In[2]:= soln //. {n -> 85, y -> 17} // N

Out[2]= {{x -> -2.23221}, {x -> 2.23221}}

In[3]:= ?Interval
Interval[{min, max}] represents the range of values between min and max.

In[4]:= soln  //. {n -> 85, y -> Interval[{16.8523, 17.294}]}

Out[4]= {{x -> Interval[{-2.27109, -2.18484}]}, {x -> Interval[{2.18484, 2.27109}]}}
```

POSTED BY: Bruce Miller 1 Month ago

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Sorry for the delay. I much value your opinion. I have been trying for 6+ years in my spare time to find a pattern of Prime numbers in a logarithmic spiral. This here is not a pattern in Prime numbers, but a description of multiplication.

The N = p *e

I am saying knowing N I can find p the smaller product. My example is 85 = 5 * 17

The trouble is it is a polynomial which means that the equation is difficult if not impossible to solve. Better methods of solving polynomials need to be found. I have not learned higher mathematics beyond linear algebra, so I rely on Mathematica which crunches numbers.

The trouble is both sides of the equation are equal. That is, they both equal 17. But my equation when solving for x = 17 for the single case of 85 = 5 * 17. What I don't know is why I plug 5 in for x and 85 for N it equals (with a margin of error) 17.

Is my method of programming Mathematica wrong? Why can't I solve for x?

I hope this clears up my question, but if it is still unclear let me know. The code is posted below.

BTW I am looking at interval now. Thanks for the direction.

POSTED BY: Bobby Joe Snyder 1 Month ago

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y = sqrt[(((85/x) * 85 - x^2)/ x)] = ((85^2/x) + x^2)/ 85

p = ((((85^2/x) + x^2)/ 85) ^2) - (((85/x) * 85 - x^2)/ x)^2 -
  0.4418181007 ;

```
sol = NSolve[p == 0, x]

{{x -> -86.8953}, {x -> 82.8717}, {x ->
  23.3122}, {x -> -7.50642 + 19.0312 I}, {x -> -7.50642 -
   19.0312 I}, {x -> -10.592 + 14.3276 I}, {x -> -10.592 - 14.3276 I}, {x ->
  16.9082}}
```

This is still an approximation. In the above example 9 solves the equation better than 5. That is where 5 should be the desired answer. N = 85; x = 5; and y = 17 . So there still isn't a perfect solution just estimated. But take:

y = sqrt[(N * y - x^2) / x]

y = sqrt[(7872197 * 3191 - 2467/^2) / 2467]

POSTED BY: Bobby Joe Snyder 1 Month ago

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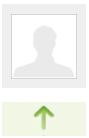

```
In[14]:= soln = Solve[y == Sqrt[(n*y - x^2)/x], x]

soln //. {n -> 85, y -> 16.85229955} // N

Out[14]= {{x -> 1/2 (-y^2 - Sqrt[4 n y + y^4])}, {x ->
   1/2 (-y^2 + Sqrt[4 n y + y^4])}}

Out[15]= {{x -> -288.957}, {x -> 4.95729}}
```

Bruce I am in your debt. You helped show the equation works. I moved a parenthesis to correct.

But the equation works. Unfortunately there is still the difficult task of solving the polynomial only knowing N. I isolated x, but does that help knowing only N?

The problem is this. I know N, I don't know that we can solve polynomials. Because I know N and say if 17 where tried it would equal 5.

I have an equation with x unknown, but the only variable in the equation is x. So interval proves those values are true. But can we solve the polynomial for x only knowing N?

POSTED BY: Bobby Joe Snyder 1 Month ago

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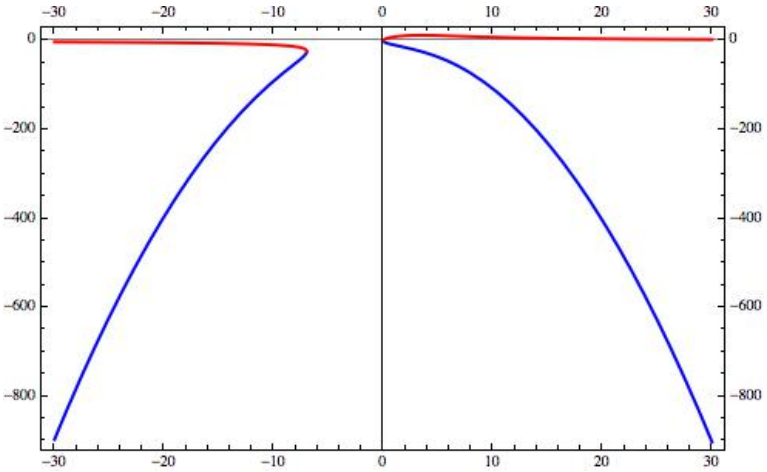
To get a value for x, you need y. With just n, you can get a relationship between x and y.

```
In[1]:= soln = Solve[y == Sqrt[(n*y - x^2)/x], x]
Out[1]=
       1    2                  4           1    2                  4
{{x -> - (-y  - Sqrt[4 n y + y ])}, {x -> - (-y  + Sqrt[4 n y + y ])}}
       2                                   2

In[2]:= soln /. {n -> 85, y -> 16.85229955}
Out[2]= {{x -> -288.957}, {x -> 4.95729}}

In[3]:= soln /. n -> 85

Out[3]=
       1    2                  4           1    2                  4
{{x -> - (-y  - Sqrt[340 y + y ])}, {x -> - (-y  + Sqrt[340 y + y ])}}
       2                                   2

In[4]:= $Version
Out[4]= "9.0 for Mac OS X x86 (64-bit) (January 24, 2013)"
```

In this plot, y is the horizontal axis and x is the vertical axis.

```
In[5]:= Plot[Evaluate[x /. soln /. n -> 85], {y, -30, 30},
     PlotStyle -> {{Blue, Thick}, {Red, Thick}},
 Frame -> True, GridLines -> {None, {0}}, FrameTicks -> All]
```



POSTED BY: Bruce Miller 1 Month ago

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Bruce can you work your Mathematica magic on this?

Sqrt[((85*(85/x)) - x^2)/x] - ((85^2/((85^2/x) + x^2)) ^2) = 0

Plugged into Wolfram Alpha this yields for x : x is approximately 4.42297

Getting pretty close to 5 not knowing y!

This is a margin of error in the 2 equations that are subtracted about 0.599

Is this any closer to solving knowing only N?

POSTED BY: Bobby Joe Snyder 22 Days ago

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If the goal really is to find the integer factors, perhaps one could just use Solve or FactorInteger.

```
In[17]:= Solve[x y == 85 && 1 < x < y, {x, y}, Integers]
Out[17]= {{x -> 5, y -> 17}}
In[18]:= FactorInteger[7872197]
Out[18]= {{2467, 1}, {3191, 1}}
```

POSTED BY: Ilian Gachevski 22 Days ago

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Using vector addition I have another equation. I can keep making these and maybe I will find a helpful relationship. But it does no good to find an equation in polynomial form if I cannot solve for x in the polynomial.

This time I keep it simple. My question is does this accomplish anything?

Abs[tan(y / (2*Pi))]*x+x=(y／((2*Pi)))

POSTED BY: Bobby Joe Snyder 12 Days ago

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http://www.wolframalpha.com/input/?i=Abs%28tan%2885+%2F+%282*Pi%29%29%29+*++x+%2B+x+%3D+85%2F%282*Pi%29

Abs(tan(85 / (2*Pi))) * x + x = 85/(2*Pi)

comes to 5.5 in wolframalph.

Is this anything?

POSTED BY: Bobby Joe Snyder 11 Days ago

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Looks like a reasonable approximation to a root.

```
In[13]:= FindRoot[Abs[Tan[(85/(2*Pi))]]*x + x - 85/(2*Pi) == 0, {x, 2}]
Out[13]= {x -> 5.55835870667}
```

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POSTED BY: Daniel Lichtblau 10 Days ago

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Daniel,

This solution is deceiving. The angle is in radians of course. But does it work for other values of N?

The answer is not exactly. There is some range of error. Also I made a algebraic mistake in the simplification.

But if this is fixed and there are test values it does seem to have some use. But solving for N proves difficult.

My question is does the following show any benefit from my effort?

y = sqrt[(((85/x) * 85 - x^2)/ x)] = ((85^2/x) + x^2)/ 85

In[27]:=
p = ((85/x) * 85 - x^2)/ x - ((85^2/((85^2/x) + x^2)) ^2);

sol = NSolve[p == 0, x]

Out[28]= {{x -> -36.2894}, {x -> 27.7376 + 21.7226 I}, {x ->
27.7376 - 21.7226 I}, {x -> -10.093 + 32.5167 I}, {x -> -10.093 -
32.5167 I}, {x -> 9.44493}, {x -> 0.257048 + 9.23565 I}, {x ->
0.257048 - 9.23565 I}, {x -> -8.95875}}

This is still an approximation. In the above example 9 solves the equation better than 5. That is where 5 should be the desired answer. N = 85; x = 5; and y = 17 . So there still isn't a perfect solution just estimated. But take:

In[31]:= y = sqrt[(N * y - x^2) / x]

y = sqrt[(7872197 * 3191 - 2467^2) / 2467]

Out[31]= sqrt[(-x^2 + N sqrt[(-x^2 + N sqrt[(-x^2 + 1/85 N (7225/x + x^2))/x])/x])/x]

Out[32]= sqrt[10180014]

So sqrt of 10180014 = 3190.613421 which is approx y or 3191.

The above substitution shows it works for larger values of N. Can it be programmed to factor the product of 2 large Prime Numbers?

POSTED BY: Bobby Joe Snyder 2 Minutes ago

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