An equation that can't be solved with algebra

The equation 2^z = z+4 looks pretty easy. But it turns out that it can't be solved by usual algebraic methods.

One thing to do is just start plugging in different numbers on the left and right hand sides of the equation until you get the two sides to be approximately equal. This is straightforward, but tedious. The good news is that computers are very good at doing this sort of thing. Here's how to do it in Maple.

```
> solve( 2^x=x+4,x);
```

$$-\frac{\mathrm{LambertW}\left(-\frac{1}{16}\ln(2)\right)+4\ln(2)}{\ln(2)},\ -\frac{\mathrm{LambertW}\left(-1, -\frac{1}{16}\ln(2)\right)+4\ln(2)}{\ln(2)}$$

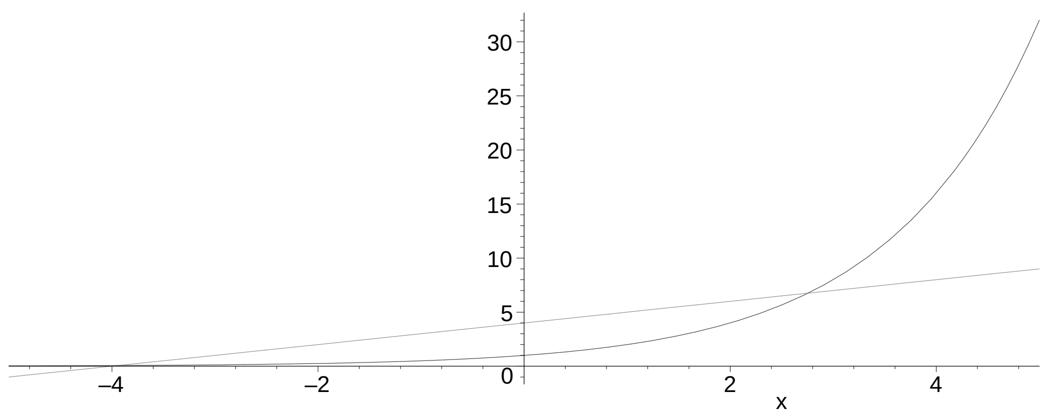
```
> evalf(%);
```

-3.934601635, 2.756215304

In the first line, Maple solved the equation but left it in some weird symbolic form. What we'd really like to know is the actual numbers that make the equation true. To convert to numbers, I used the evalf function. eval stands for EVALuate as a Floating point. (A floating point number is just a decimal number.) The "%" is shorthand for whatever Maple most recently output. It's like "Ans" on your calculator.

A more illuminating method for solving this is to just plot the two functions and see where they intersect.

```
> plot( {2^x, x+4},x=-5..5);
```



One can see that the two lines intersect around 2.8 and -3.9. This agrees nicely with the numerical results we obtained above.

The main point here is that there are equations (and later integrals) that make perferctly good sense and which have solutions, but that those solutions can't always be obtained by algebra.

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>
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