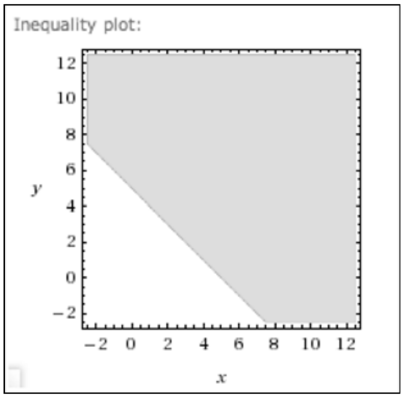
Here's what you'll see:



Of course, you can only see part of the graph—it goes on forever in all directions.
In this case, you're looking at all the points that are ***on or above*** the graph of $x + y = 5$.
Also, be careful—they're not showing the x-axis and the y-axis in this view:
the bottom line ***isn't*** isn't the x-axis, and the left vertical line ***isn't*** the y-axis.

EXAMPLE (A MORE COMPLICATED EQUATION IN TWO VARIABLES)

The sentence $x^2 - 3xy + y^2 + 3x - 5y + 7 = 0$ is an equation in two variables.
The variables can appear ***any number of times***;
there just can't be more than two different variables.

If you graph it at wolframalpha.com, type it in like this:
`x^2 - 3xy + y^2 + 3x - 5y + 7 = 0`
(You can just cut-and-paste, if you want.)

EXAMPLE (A TRICKY TYPE OF EQUATION IN TWO VARIABLES—AN 'INVISIBLE' VARIABLE)

One tricky type of 'sentence in two variables' is where you don't actually ***see*** two different variables, since one of them has a coefficient of 0.
What does this mean, exactly?

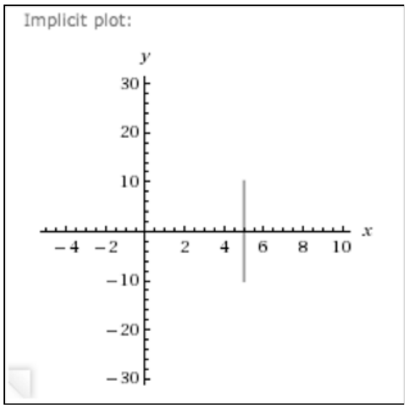
Consider the equation $x = 5$. It looks like there's only one variable, x.
Viewed as an equation in one variable, there's only one solution— the number 5.
In this case, the graph is very, very boring—a single dot, at location 5, on a number line.

However, the sentence $x = 5$ can also be viewed as an equation in two variables: $x + 0y = 5$.
We don't bother to write the $0y$, since it's just zero—but it changes the solution set completely.
Now, since it's an equation in two variables,
a solution is an ordered pair—a choice for x and a choice for y—that make the equation true.

What you notice pretty quickly is that x must be 5, but y can be anything:

$(5, 1)$ is a solution, since substituting 5 for x and 1 for y in '$x + 0y = 5$'
gives this true statement: $5 + 0(1) = 5$
Similarly, $(5, \frac{1}{2})$ is a solution, since $5 + 0(\frac{1}{2}) = 5$.
Indeed, $(5, \text{anything})$ is a solution, since $5 + 0(\text{anything}) = 5$.

Thus, the solutions are ordered pairs of the form $(5, y)$, for all real numbers y.
What does this graph look like?
To get to any of these points, you start at the origin and move 5 units to the right.
Then, you can move up/down to your heart's content.
The graph is the vertical line that crosses the x-axis at 5.



Wolfram Alpha has a bit of trouble with this one.
Give it a break—it's a bit hard to see invisible things.
But, we can get a great approximation to the graph by being a bit clever.
Cut-and-paste the following into wolframalpha.com:

```
x + 0.00000001y = 5, -10 <= y <= 10
```

Notice that we've put a number really close to 0 in front of the y.
We're also specifying that we only want to see points whose y-values are between -10 and 10.
(Leave off the last part and see if you can figure out what's happening!)

By the way, wolframalpha.com can ***plot*** it easily with just one word's help:
```
plot x = 5
```
Try it!

So, what's a person to do when they see an equation like '$x = 5$'?
Treat it as an equation in one variable? In two variables? (In three variables!?)
Context, context, context.
If someone says 'graph $x = 5$' in high school,
then they're probably treating it as an equation in two variables.
If there's any doubt, just ask for clarification.

SOLUTIONS OF EQUATIONS/INEQUALITIES IN TWO VARIABLES

Let S denote an equation or inequality in two variables (x and y).
Then, the following are equivalent:

- (a, b) lies on the graph of S
- (a, b) satisfies S
- substitution of a for x, and b for y, makes the sentence S true

EXAMPLES:

Question: Does the point $(1,-2)$ lie on the graph of $2x+3y=-4$?
Solution: Yes, since the equation ' $2(1)+3(-2)=-4$ ' is true.

Question: Does the point $(0,-1)$ satisfy the equation $2x+3y=-4$?
Solution: No, since the equation ' $2(0)+3(-1)=-4$ ' is false.

Question: Does the point $(3,-1)$ lie on the graph of $x=3$?
Solution: Yes, since substitution of 3 for x makes the equation true.
Observe that the equation $x=3$ is being treated as an equation in two variables: $x+0y=3$
Here, we can ignore the y-value; all we care about is if x is equal to 3.

Question: Does the point $(3,5)$ satisfy the inequality $y>4$?
Solution: Yes, since substitution of 5 for y makes the inequality true.
Observe that the inequality $y>4$ is being treated as an inequality in two variables: $0x+y>4$
Here, we can ignore the x-value; all we care about is if y is greater than 4.

Question: Does the point $(3,5)$ satisfy the inequality $x>4$?
Solution: No, since substitution of 3 for x makes the inequality false.
Observe that the inequality $x>4$ is being treated as an inequality in two variables: $x+0y>4$
Here, we can ignore the y-value; all we care about is if x is greater than 4.