A Look at Some Tree Mathematics

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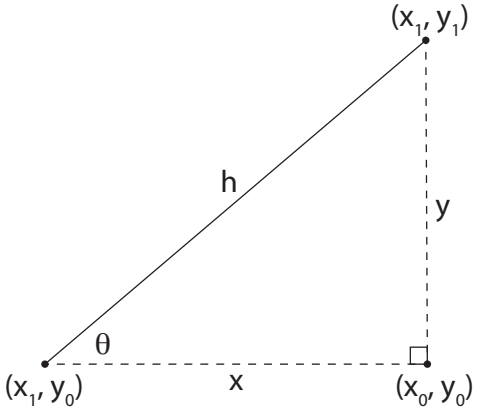
When the user clicks in two points (x_0, y_0) and (x_1, y_1) this determines the angle and length of the trunk of a tree. How do you find the length of the trunk, and its angle or slope?

This right triangle to shows the relationships between edge length h, angle θ, and the points (x_0, y_0) and (x_1, y_1). The horizontal span x of the line is obtained by subtracting the x coordinates of the points, and the vertical span y by subtracting their y coordinates:



$$x = x_1 - x_0$$

$$y = y_1 - y_0$$

Then the length h is obtained using the Pythagorean theorem:

$$h = \sqrt{x^2 + y^2}$$

The angle θ can be computed by taking the arctangent of the ratio of y to x:

$$\theta = tan^{-1}\frac{y}{x}$$

Also the horizontal span x and vertical span y of the line can be recalculated using sine and cosine if all you know is the length h of the line:

$$x = h \cos\theta$$

$$y = h \sin\theta$$

In C, the math library, which you get the definitions for with #include <math.h>, contains the functions `sqrt()`, `sin()`, `cos()`, and `atan2()` that you can use to do the calculations. All angles are considered to be in radians, so if you want to print them out in degrees you must first convert them by multiplying by $180/\pi$. Note also, that the `atan2()` function is called with 2 arguments, y and x, like this: `angle = atan2(y, x);`