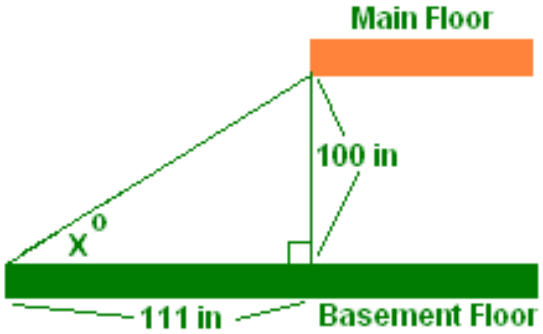
Using Trigonometry to Design a Staircase

This is an example of using trigonometry that I have actually used myself.
When building my house I had a right triangle formed when trying to build my inside stairs. I had a drop of 100 inches, and I had to have the stairways hit the basement floor within 111 inches. The reason for this, was that I was building the stairs along the outside wall of the basement, which was a decagon. I did not want to have to build a bend in the stairs, since I was not a great carpenter. In order to pass the building codes, the angle of elevation of the stairs from the floor had to be between 35° and 40°. The picture below illustrates the problem.



Here is the working for the problem:

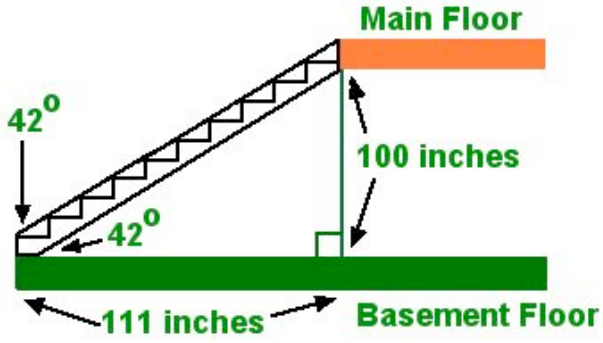
$$\tan x = \frac{\textit{opposite}}{\textit{adjacent}}$$

$$\tan x = \frac{100}{111} = 0.9009009$$

$$x = \tan^{-1}(0.9009009)$$

$$x = 42.02^{o}$$

Thus $\tan^{-1}(100/111)$ would give you 42.02°, and so I met the building code! In addition, I could find the angle to cut each stairway, for it would be the same. Looking at the diagram below:



The angles that I cut the board to make each stair are corresponding angles all equal to 42.02°. Since my saw does not get that accurate, I cut them all at 42°. Using Pythagoras, I found the length was:

$$\textit{Length} = \sqrt{100^2 + 111^2}$$

$$\textit{Length} = 149.4021419 \text{ inches, or}$$

$$149.4021419 \div 12 = 12.45017849 \text{ feet}$$

Thus, I should buy a 14 foot board (2 by 12) to make my stairways. (And of course I would need 2 of these).
So, you can see, grade 9 geometry and trigonometry has some useful applications!!