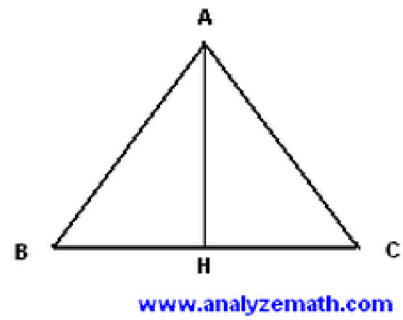
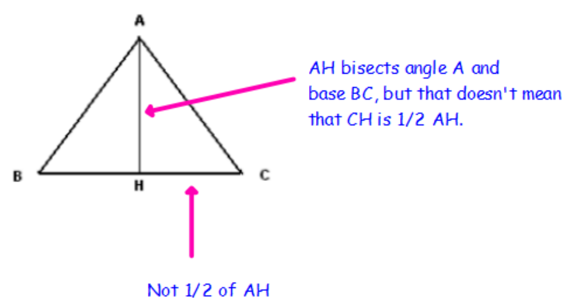
16. In the figure below ABC is an equilateral triangle. AH is perpendicular to BC and has a length of 2√3 inches. What is the area, in square inches, of triangle Δ ABC.

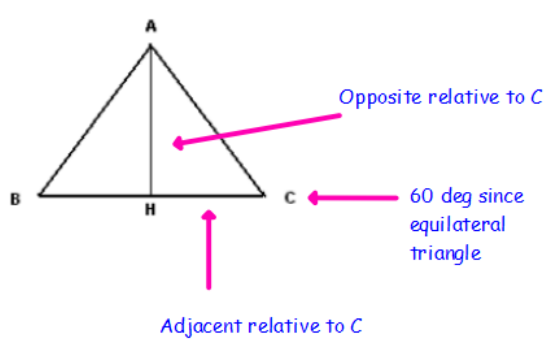


Although the area formula for a triangle is very straightforward A = bh/2, finding the base of this triangle requires a little work. We might assume that since the given altitude AH bisects angle A and therefore bisects base BC, that CH is ½ of AH, but that's not true:

In the figure below ABC is an equilateral triangle. AH is perpendicular to BC and has a length of 2√3 inches. What is the area, in square inches, of triangle Δ ABC.



One way to solve it is to use Trigonometry. Since ABC is an equilateral triangle, angles A, B, and C are all 60 degrees. Therefore the Sine value for 60 degrees is $\frac{\sqrt{3}}{2}$ and the Cosine value is $\frac{1}{2}$. You should know (have memorized) this from your study of the Unit Circle.



We are given AH, which is the Opposite side relative to angle C in the 'right hand' triangle AHC. We want to know the base of this triangle HC, which is the Adjacent side relative to angle C in AHC.

Since we are given the Opposite side as $2\sqrt{3}$ and know angle C is 60 degrees, we can find the Adjacent side using Tangent.

$$\tan 60 = \frac{2\sqrt{3}}{x}$$

Multiply both sides by x and then divide by Tan(60) to get:

$$x = \frac{2\sqrt{3}}{\tan 60}$$

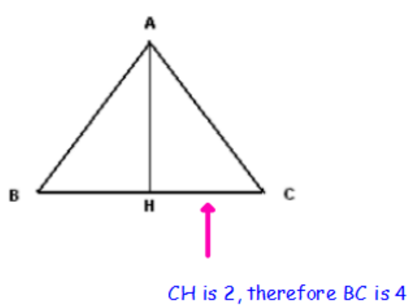
If you do not have a calculator on this particular section, you're going to have to solve Tan(60) by knowing that $\mathrm{Tan}\ 60 = \frac{\sin 60}{\cos 60}$ and knowing that $\sin 60 = \frac{\sqrt{3}}{2}$ and $\cos 60 = \frac{1}{2}$.

Then,

$$\tan 60 = \frac{\frac{\sqrt{3}}{2}}{\frac{1}{2}} = \frac{\sqrt{3}}{2} * \frac{2}{1} = \sqrt{3}$$

Therefore

$$x = \frac{2\sqrt{3}}{\sqrt{3}} = 2$$



Finally, area of ABC =

$$Area_{ABC} = \frac{bh}{2} = \frac{2\sqrt{3} * 4}{2} = 4\sqrt{3}, \text{which is answer C}$$