In like manner, we can make use of an equilateral triangle — one having all sides equal and each angle 60° — to find the values of the functions of 30° and 60° (see figure 10). To avoid fractions let us ~~take~~ take each side of the triangle equal to 2b units in lenght. The perpendicular from B to the base and the angle at B, producing right triangles having acute angles equal to 60° and 30°. The altitude, h, is found as follows:

$$h^2 + b^2 = (2b)^2$$ P65

Transposing and combining like terms:

$$h^2 = 4b^2 - b^2 = 3b^2$$

Taking the square root of both sides:

$$h = b\sqrt{3}$$

Hence the functions have the following values:

$$\sin 30° = \frac{b}{2b} = \frac{1}{2} = 0.5000$$

$$\cos 30° = \frac{b\sqrt{3}}{2b} = \frac{1\sqrt{3}}{2} = \frac{1.7321}{2} = 0.8660^+$$

$$\tan 30° = \frac{b}{b\sqrt{3}} = \frac{1\sqrt{3}}{\sqrt{3}\sqrt{3}} = \frac{\sqrt{3}}{3} = \frac{1.7321}{3} = 0.5774$$

$$\sin 60° = \cos 30° = 0.8660^+$$

$$\cos 60° = \sin 30° = 0.5000$$

$$\tan 60° = \frac{b\sqrt{3}}{b} = \frac{\sqrt{3}}{1} = 1.7321$$

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Now that we have learned something of the nature of the trigonometric functions, let us return to a consideration of our original problem, involving the height of a tree.

Fig 11

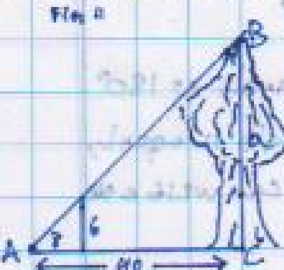
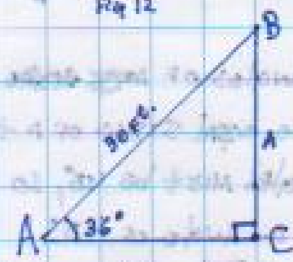


Fig 12



Using a transit (essentially the arrangement of telescope, and horizontal and vertical protractors), the surveyor would measure the angle at A (Figure 11) by sighting the foot and the top of the tree. He would find the angle to be about 36° 52'. Then he has the