

FINDING ALTITUDE WITH THE TRIGONOMETRIC SOLUTION

Using a procedure similar to that on *Water Rockets I*, students will measure the angle at apogee of the rocket. It is still important to have four observers and throw out the high and low readings and average the other two.

Knowing their distance from the pad and this angle, trigonometry can be used to find the height. This method is much quicker and more accurate than the graphical solution.

In the graphical solution, distances and angles are inscribed on the paper. Even slight variations in reproducing the recorded values can cause noticeable error.

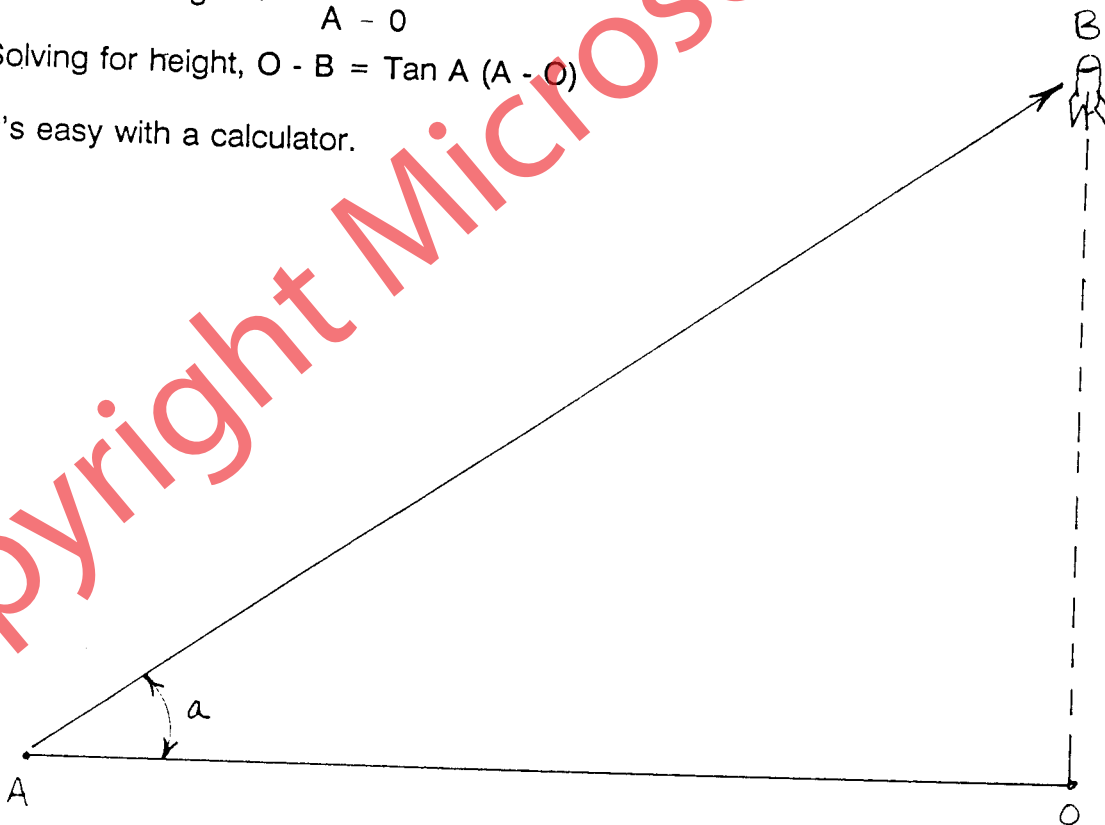
Let's refer to our example on page 33. If we inscribed a 33° angle instead of a 34° (as shown) our altitude would be 19.7 meters (instead of 21 meters), a 6% error.

Trigonometry avoids this possibility for error and the solution is as follows:

$$\text{Tangent of angle } A = \frac{O - B}{A - O}$$

$$\text{Solving for height, } O - B = \text{Tan } A (A - O)$$

It's easy with a calculator.



Example: average angle $A = 34^\circ$ distance
to pad = 30 meters

$$\text{Altitude} = \text{Tan } 34^\circ \times 30 \text{ meters} = 20.2 \text{ meters}$$