Computing Ordinates to Trajectory and Clearing the Obstacles

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Calculating ordinates

$$Y = \frac{X \times (A_r - A_x)}{1000} \tag{1}$$

Y = height of desired ordinate in yards (or meters – the answer will be in the same units)
X = horizontal distance to desired ordinate
A_r = angle of departure in mils for trajectory being computed
A_x = angle of departure in mils for the range of X

Example: you want the 1000 yard ordinate of a 2000 yard trajectory.

$A_r = 44.5$ mil $A_x = 11.1$ mil

$Y = (1000/1000) \times (44.5 - 11.1) = 33.4$ yards (using Mil = 3.375 MOA)

Note: A more accurate ratio used by DoD is 1Mil = 3.438MOA.

Another method/example: determine the 800 yard ordinate of a 1200 yard trajectory.

A_r for 1200 = 19.9 mil A_x for 800 = 9.4 mil   Value of ordinate in mils = 10.5 mil
Ordinate $Y = (800 \times 10.5)/1000 = 8.4$ yards

Calculating maximum ordinate

Maximum ordinate of a bullet is approximately at half way to target +10% of half-way. So if the target distance is R, then substitute $R/2 + 0.1 \times (R/2)$ for X in the formula 1. Or if the target distance is R, then $X = R \times 0.55$.

Example: Maximum ordinate for the 800 yards target is at 440 yards, approximately 3.4 mil elevation from the range card.

Practical solution

You need to hit a target. Between you and the target there is an obstacle, which does not obscure the line of sight. You want to know if your shot would clear the obstacle and hit the target, so you ned to know the bullet's ordinate at the distance of that obstacle. Your solution:

1. Range the target, say you get distance X; range the obstacle, get distance Y.

2. Compute trajectory using ballistic calculator for ranges X and Y. Say, vertical adjustment for X is H_{target} mil, and for Y it is H_{ord} mil.

3. Subtract H_{ord} from H_{target}, you get $H_{obstacle} = H_{target} - H_{ord}$ in mil.

4. Find on the mil-hash reticle where $H_{obstacle}$ is with regard to the obstacle when the scope is dialed H_{target} for the target, and the target is in the crosshair.

5. If the obstacle on the reticle is not at the $H_{obstacle}$ mil — you can safely take the shot. The bullet will clear this obstacle. Otherwise the target is occluded, as the trajectory brings the bullet onto the obstacle first, revenging it from reaching the target.