Table 301. *Formula for Trajectory Calculations.*

	In vacuo			In air
	Firing altitude = target altitude	Firing altitude $y_0 \neq$ target altitude, (f.i. bomb dropping)	Site angle $\gamma \neq 0$	For flat trajectories after d'Antinio[3]) Mach number $M > 1.5$
x Abscissa of any point on the trajectory	$v_0 t \cos\vartheta_0$	$v_0 t \cos\vartheta_0$	$v_0 t \cos\vartheta_0$	$\frac{v_{x0} t}{1 + a^* v_{x0} t}$ [4]), [5])
y Ordinate of any point on the trajectory	$v_0 t \sin\vartheta_0 - \frac{g}{2} t^2$	$y_0 + v_0 t \sin\vartheta_0 - \frac{g}{2} t^2$	$x \tan\vartheta_0 - \frac{g x^2}{2 v_0^2 \cos^2\vartheta_0}$	$x \tan\vartheta_0 - \frac{g}{2} t^2 \left(1 - \frac{2}{3} a^* x\right)$
t Flight time to a point on the trajectory (x, y)	$\frac{x}{v_0 \cos\vartheta_0}$	$\frac{x}{v_0 \cos\vartheta_0}$	$\frac{x}{v_0 \cos\vartheta_0}$	$\frac{x}{v_{x0}(1 - a^* x)}$
v_x Component of the velocity v in the x direction	$v_0 \cos\vartheta_0$	$v_0 \cos\vartheta_0$		$v_{x0}(1 - a^* x)^2$
v_y Component of the velocity v in the y direction	$v_0 \sin\vartheta_0 - g t$	$v_0 \sin\vartheta_0 - g t$		$v_x \tan\vartheta_0 - \frac{g}{3 a^* v_{x0}} \left(\frac{1}{1 - a^* x} + (1 - a^* x)^2\right)$
v Velocity at a point on the trajectory (x, y)	$\sqrt{v_0^2 - 2 g y}$	$\sqrt{v_0^2 - 2 g y}$		$v_0 (1 - a^* x)^2$
x_G Abscissa of the vertex of the trajectory	$\frac{v_0^2}{2g} \sin 2\vartheta_0$	$\frac{v_0^2}{2g} \sin 2\vartheta_0$		$\frac{X}{2} \frac{1 - \frac{1}{6} a^* X}{1 - \frac{1}{2} a^* X}$ [6])
y_G Ordinate of the vertex of the trajectory	$y_0 + \frac{v_0^2}{2g} \sin^2\vartheta_0$	$\frac{v_0^2}{2g} \sin^2\vartheta_0 = \frac{g}{8} T^2$		$\frac{g}{2} T^2 \frac{x_G^2}{X^2} \left(1 - \frac{a^* X}{2}\right)^2 \left(1 - \frac{a^* x_G}{3}\right)$
t_G Flight time to the vertex (x_G, y_G)	$\frac{v_0}{g} \sin\vartheta_0$	$\frac{v_0}{g} \sin\vartheta_0$		$\frac{x_G}{v_{x0}(1 - a^* x_G)}$
X Range	$\frac{v_0^2}{g} \sin 2\vartheta_0$	$\frac{v_0^2}{2g} \sin 2\vartheta_0 + \sqrt{\left(\frac{v_0^2}{2g} \sin 2\vartheta_0\right)^2 + \frac{2 v_0^2}{g} y_0 \cos^2\vartheta_0}$	$\frac{2 v_0^2}{g} \frac{\cos^2\vartheta_0}{\cos\gamma} (\tan\vartheta_0 - \tan\gamma)$ [1])	$\frac{1}{a^*} \left(1 - \sqrt{\frac{v_{xE}}{v_{x0}}}\right)$
T Total flight time	$\frac{2 v_0}{g} \sin\vartheta_0$	$\frac{1}{g} \left(\sqrt{v_0^2 \sin^2\vartheta_0 + 2 g y_0} + v_0 \sin\vartheta_0\right)$	$\frac{2 v_0}{g} \cos\vartheta_0 (\tan\vartheta_0 - \tan\gamma)$ [2])	$\frac{X}{v_{x0}(1 - a^* X)}$
v_E Final velocity	v_0	$\sqrt{v_0^2 + 2 g y_0}$		$v_0 (1 - a^* X)^2$
X_m Maximum range	$\frac{v_0^2}{g}$	$\frac{1}{g} \sqrt{v_0^2 + 2 g y_0}$	$\frac{v_0^2}{g(1 + \sin\gamma)}$	
y_m Maximum altitude (vertical)	$\frac{v_0^2}{2g}$	$y_0 + \frac{v_0^2}{2g}$		

1) Identical to Equation (12)
2) Identical to Equation (13)
3) Based on Section 3.2.2.2.3
4) $v_{x0} = v_0 \cos\vartheta_0$
5) $a^* = a / \cos\vartheta_0$; a comes from Equation (102)
6) A good approximation; to be exact: $\frac{1}{a^*} \left(1 - \sqrt[3]{\frac{(1 - a^* X)^2}{1 - \frac{a^* X}{2}}}\right)$