Standard time increment	dt	s	typically about 1 s	
Time	t	s	t_0	$t_1 = t_0 + dt$
Mass, dry	m_d	kg	obtain from vehicle specs.	
Mass, propellant	m_p	kg	m_{p0}	$m_{p1} = m_{p0} - \dot{m}*dt$
Mass, total	m_t	kg	$m_{t0} = m_d + m_{p0}$	$m_{t1} = m_d + m_{p1}$
Thrust, sea level	T_{sl}	N	obtain from vehicle specs.	
Thrust, vacuum	T_{vac}	N	obtain from vehicle specs.	
Specific impulse, vacuum	I_{sp}	s	obtain from vehicle specs.	
Propellant mass flow rate	$\dot{m}$	kg/s	$\dot{m} = T_{vac}/(9.80665*I_{sp})$	
Area of nozzle exit	A_e	m^2	$A_e = (T_{vac} - T_{sl})/101325$	
Thrust, instantaneous	T	N	$T_0 = T_{vac} - A_e*P_{a0}$	$T_1 = T_{vac} - A_e*P_{a1}$
Pitch, to horizontal (thrust angle)	θ	°	$\theta_0 = f[t_0]$	$\theta_1 = f[t_1]$
Gravitational parameter	μ	m^3/s^2	3.986005×10^{14} for Earth	
Acceleration of gravity	g	m/s^2	$g_0 = \mu/R_0^2$	$g_1 = \mu/R_1^2$
Acceleration, vertical, apparent	A_{Av}	m/s^2	$A_{Av0} = V_{h0}^2/R_0$	$A_{Av1} = V_{h1}^2/R_1$
Acceleration, vertical, thrust	A_{Tv}	m/s^2	$A_{Tv0} = T_0/m_{t0}*\sin(\theta_0)$	$A_{Tv1} = T_1/m_{t1}*\sin(\theta_1)$
Acceleration, vertical, drag	A_{Dv}	m/s^2	$A_{Dv0} = D_0/m_{t0}*\sin(\phi_{ef0})$	$A_{Dv1} = D_1/m_{t1}*\sin(\phi_{ef1})$
Acceleration, vertical, total	A_v	m/s^2	$A_{v0} = -g_0 + A_{Av0} + A_{Tv0} - A_{Dv0}$	$A_{v1} = -g_1 + A_{Av1} + A_{Tv1} - A_{Dv1}$
Acceleration, horizontal, apparent	A_{Ah}	m/s^2	$A_{Ah0} = -V_{h0}*V_{v0}/R_0$	$A_{Ah1} = -V_{h1}*V_{v1}/R_1$
Acceleration, horizontal, thrust	A_{Th}	m/s^2	$A_{Th0} = T_0/m_{t0}*\cos(\theta_0)$	$A_{Th1} = T_1/m_{t1}*\cos(\theta_1)$
Acceleration, horizontal, drag	A_{Dh}	m/s^2	$A_{Dh0} = D_0/m_{t0}*\cos(\phi_{ef0})$	$A_{Dh1} = D_1/m_{t1}*\cos(\phi_{ef1})$
Acceleration, horizontal, total	A_h	m/s^2	$A_{h0} = A_{Ah0} + A_{Th0} - A_{Dh0}$	$A_{h1} = A_{Ah1} + A_{Th1} - A_{Dh1}$

Space-fixed velocity, vertical	V_v	m/s	V_{v0}	$V_{v1} = V_{v0} + (A_{v0} + A_{v1})/2*dt$
Space-fixed velocity, horizontal	V_h	m/s	V_{h0}	$V_{h1} = V_{h0} + (A_{h0} + A_{h1})/2*dt$
Space-fixed velocity, total	V_{sf}	m/s	$V_{sf0} = (V_{v0}^2 + V_{h0}^2)^{1/2}$	$V_{sf1} = (V_{v1}^2 + V_{h1}^2)^{1/2}$
Space-fixed flight path angle	ϕ_{sf}	^{o}	$\phi_{sf0} = \text{atan}(V_{v0}/V_{h0})$	$\phi_{sf1} = \text{atan}(V_{v1}/V_{h1})$
Rotational velocity of Earth	V_r	m/s	$V_{r0} = 2\pi R_o/86164*\cos(\phi')$	$V_{r1} = 2\pi R_1/86164*\cos(\phi')$
Earth-fixed velocity, total	V_{ef}	m/s	$V_{ef0} = (V_{v0}^2 + (V_{h0}-V_{r0})^2)^{1/2}$	$V_{ef1} = (V_{v1}^2 + (V_{h1}-V_{r1})^2)^{1/2}$
Earth-fixed flight path angle	ϕ_{ef}	^{o}	$\phi_{ef0} = \text{atan}(V_{v0}/(V_{h0}-V_{r0}))$	$\phi_{ef1} = \text{atan}(V_{v1}/(V_{h1}-V_{r1}))$
Altitude	h	m	h_0	$h_1 = h_0 + (V_{v0} + V_{v1})/2*dt$
Geocentric latitude	ϕ'	^{o}	28.5^o for launch complex 39	
Radius of Earth	R_e	m	$R_e = f[\phi'] = 6{,}373{,}249$ m for $\phi'=28.5^o$	
Radius to vehicle	R	m	$R_0 = R_e + h_0$	$R_1 = R_e + h_1$
Ambient air pressure	P_a	Pa	$P_{a0} = f[h_0]$	$P_{a1} = f[h_1]$
Ambient air temperature	T_a	K	$T_{a0} = f[h_0]$	$T_{a1} = f[h_1]$
Specific gas constant	R_s	J/kg-K	287.053 for air	
Specific heat ratio	γ		1.400 for air	
Air density	ρ	kg/m^3	$\rho_0 = P_{a0}/(R_s*T_{a0})$	$\rho_1 = P_{a1}/(R_s*T_{a1})$
Speed of sound	C	m/s	$C_0 = (\gamma*R_s*T_{a0})^{1/2}$	$C_1 = (\gamma*R_s*T_{a1})^{1/2}$
Mach number	Ma		$Ma_0 = V_{ef0}/C_0$	$Ma_1 = V_{ef1}/C_1$
Drag coefficient	C_d		$C_{d0} = f[M_{a0}]$	$C_{d1} = f[M_{a1}]$
Area of vehicle normal to wind	A	m^2	compute from vehicle specs.	
Drag force	D	N	$D_0 = \rho_0*V_{ef0}^2*C_{d0}*A/2$	$D_1 = \rho_1*V_{ef1}^2*C_{d1}*A/2$