

```

%
% Problem 4.2
%
r_e = 1.496e+8;
r_m = 1.523691*r_e;
mu_e = 3.98601e+5;
mu_s = 1.32715e+11;
mu_m = 43058;
r_p = 6378 +200;
R_m = 3379;
% transfer time
T = pi*sqrt( (0.5*(r_e+r_m))^3/mu_s);
% converting in terms of days
T = T/24/3600;
disp(['Transfer time = ', num2str(T), ' days'])
%
V_p = sqrt(2*mu_s/r_e - 2*mu_s/(r_e+r_m));
disp(['V_p = ', num2str(V_p), ' km/s'])
%
V_e = sqrt(mu_s/r_e);
disp(['V_e = ', num2str(V_e), ' km/s'])
%
V_infty_e = V_p - V_e;
disp(['V_infty_e = ', num2str(V_infty_e), ' km/s'])
%
vel_p = sqrt(2*mu_e/r_p + V_infty_e^2);
disp(['v_p, hyperbola escape velocity = ', num2str(vel_p), ' km/s'])
%
vel_c = sqrt(mu_e/r_p);
disp(['v_c, parking velocity around the earth = ', num2str(vel_c), ' km/s'])
%
delta_v_e = vel_p - vel_c;
disp(['delta v at the perigee = ', num2str(delta_v_e), ' km/s'])
%
a = -mu_e/V_infty_e^2;
disp(['semimajor axis, a = ', num2str(a), ' km'])
%
e = 1 + r_p*V_infty_e^2/mu_e;
disp(['eccentricity, e = ', num2str(e), ''])
%
p = a*(1-e^2);
disp(['orbit parameter, p = ', num2str(p), ''])
%
h = sqrt(p*mu_e);
disp(['specific angular momentum, h = ', num2str(h), ' km^2/s'])
%
d = h/V_infty_e;
disp(['escape asymptotic distance, d = ', num2str(d), ' km'])
%
theta_infty = acos(-1.0/e);
theta_infty = theta_infty*360/(2*pi);
disp(['asymptotic angle measured from perigee point, d = ', num2str(theta_infty), ' angle'])
%
V_a = sqrt(2*mu_s/r_m - 2*mu_s/(r_e+r_m));
disp(['V_a = ', num2str(V_a), ' km/s'])
%
V_m = sqrt(mu_s/r_m);
disp(['V_m = ', num2str(V_m), ' km/s'])
%
V_infty_m = V_m - V_a;
disp(['V_infty_m = ', num2str(V_infty_m), ' km/s'])
%

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```
vel_p =sqrt(2*mu_m/R_m + V_infty_m^2);
disp(['v_p, hyperbola escape velocity = ', num2str(vel_p), ' km/s'])
%
delta_v_m =vel_p;
disp(['delta v at the apogee = ', num2str(delta_v_m), ' km/s'])
%
disp(['total delta v = ', num2str(delta_v_e+delta_v_m), ' km/s'])
```

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%%%%%%%%%%
%% Solution Output of Problem 4.2
%% Problem4_2
%% Transfer time = 258.8706 days
%% V_p = 32.7295 km/s
%% V_e = 29.7848 km/s
%% V_infty_e = 2.9447 km/s
%% v_p, hyperbola escape velocity = 11.3958 km/s
%% v_c, parking velocity around the earth = 7.7843 km/s
%% delta v at the perigee = 3.6114 km/s
%% semimajor axis, a = -45966.5788 km
%% eccentricity, e = 1.1431
%% orbit parameter, p = 14097.3379
%% specific angular momentum, h = 74961.41 km^2/s
%% escape asymptotic distance, d = 25455.9697 km
%% asymptotic angle measured from perigee point, d = 151.0226 angle
%% V_a = 21.4804 km/s
%% V_m = 24.1294 km/s
%% V_infty_m = 2.6489 km/s
%% v_p, hyperbola escape velocity = 5.7011 km/s
%% delta v at the apogee = 5.7011 km/s
%% total delta v = 9.3125 km/s
%%%%%%%%%%
```