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cleanup

1 - three dates to venus

```
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return a result that may be useful.
------------P1------------
My workings for this problem have the following results:
The minimum dv for the trip is 11.2931 km/s with the mission plan: Prograde -
 June 1, 2023
The all possible dvs are as follows:
    "Prograde - April 1, 2023 - 14.8392 km/s"
    "Prograde - May 1, 2023 - 12.7519 km/s"
    "Prograde - June 1, 2023 - 11.2931 km/s"
    "Retrograde - April 1, 2023 - 16.5178 km/s"
    "Retrograde - May 1, 2023 - 16.6872 km/s"
    "Retrograde - June 1, 2023 - 16.6759 km/s"

the radius of perihelion of the mission plan Retrograde - April 1, 2023 is:
 1074308.3818 km, which is 378308.3818 km under the surface of the sun, so I
 wouldn't fly that one.
H/C: Best dv happens on date closest to Hohmaan, i.e. closest to 180 degrees
 from eachother
H/C: long/retrograde method is more expensive in dv than prograde.
```
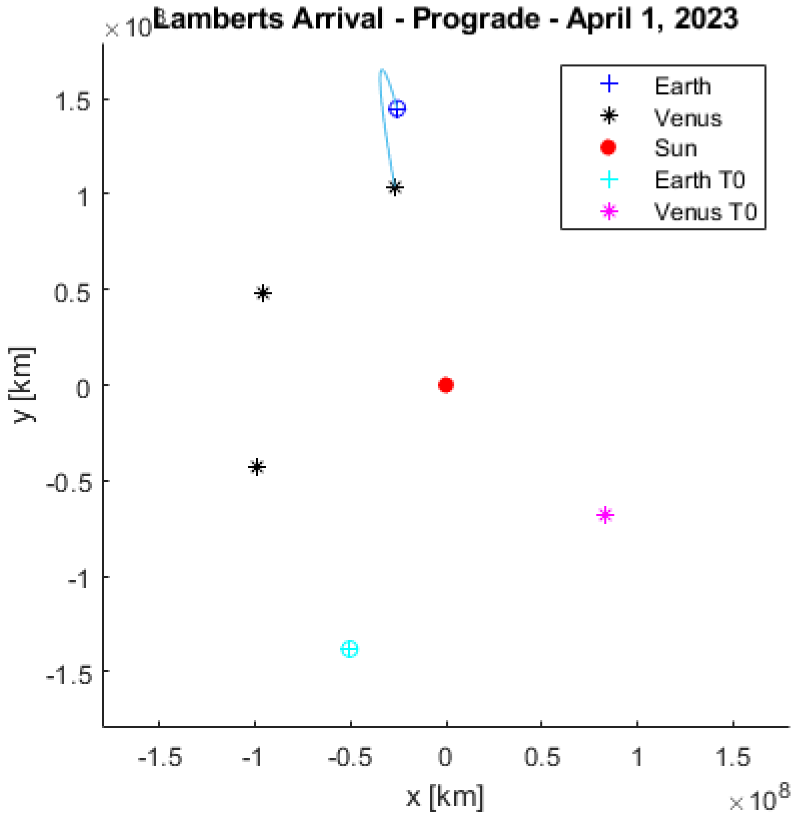
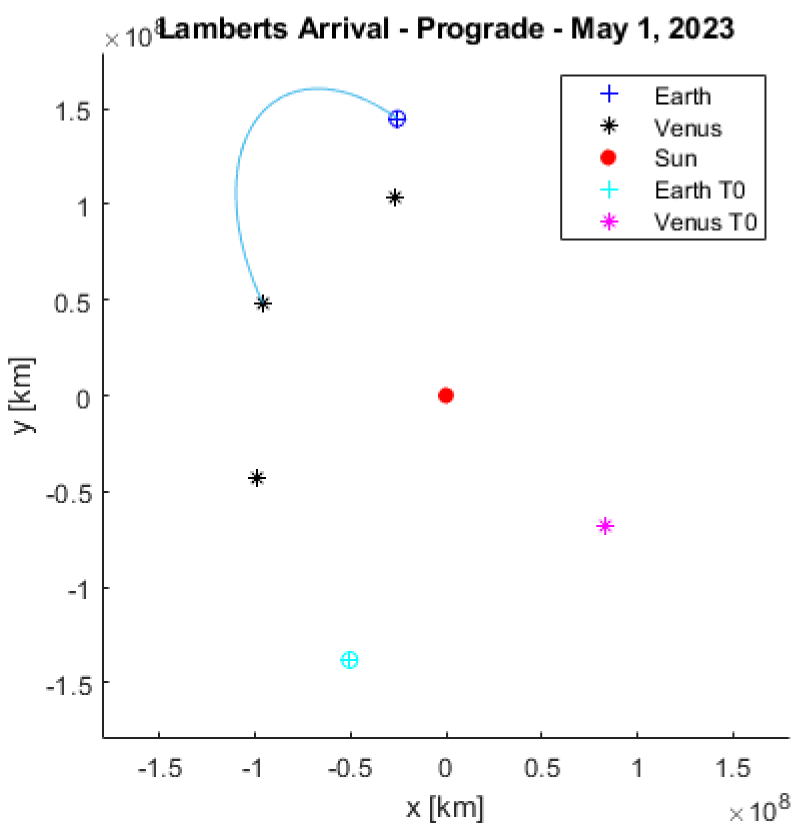
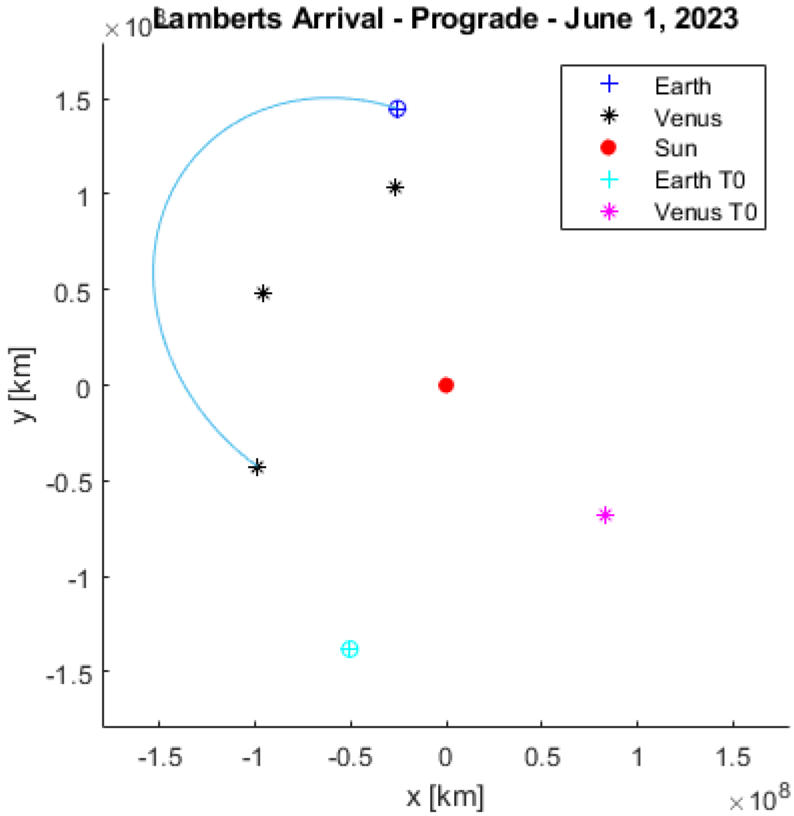
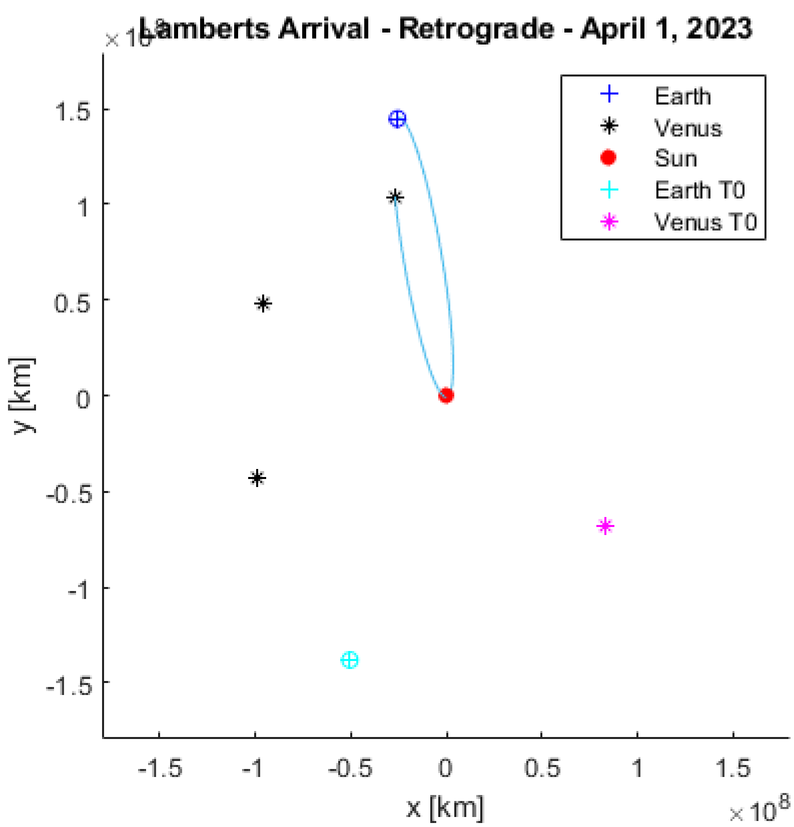


Lamberts Arrival - Prograde - April 1, 2023
Earth
Venus
Sun
Earth T0
Venus T0
y [km]
x [km]
× 10^8


Lamberts Arrival - Prograde - May 1, 2023
Earth
Venus
Sun
Earth T0
Venus T0
y [km]
x [km]
× 10^8


Lamberts Arrival - Prograde - June 1, 2023
×10^8
1.5
1
0.5
0
-0.5
-1
-1.5
y [km]
-1.5
-1
-0.5
0
0.5
1
1.5
x [km]
×10^8
Earth
Venus
Sun
Earth T0
Venus T0


Lamberts Arrival - Retrograde - April 1, 2023
×10^8
1.5
1
0.5
0
-0.5
-1
-1.5
y [km]
-1.5
-1
-0.5
0
0.5
1
1.5
x [km]
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Earth
Venus
Sun
Earth T0
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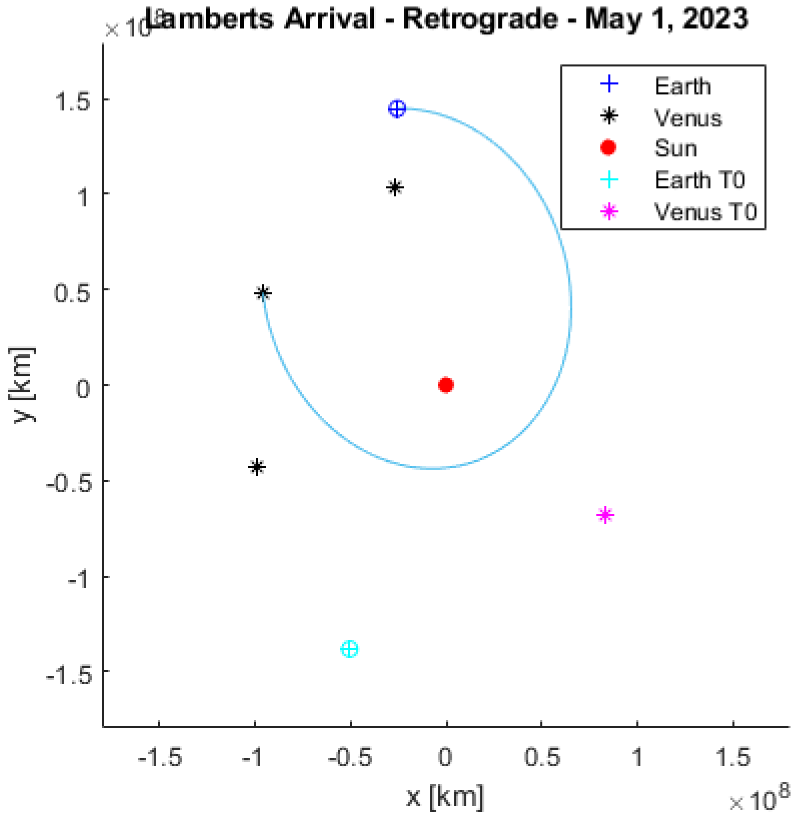
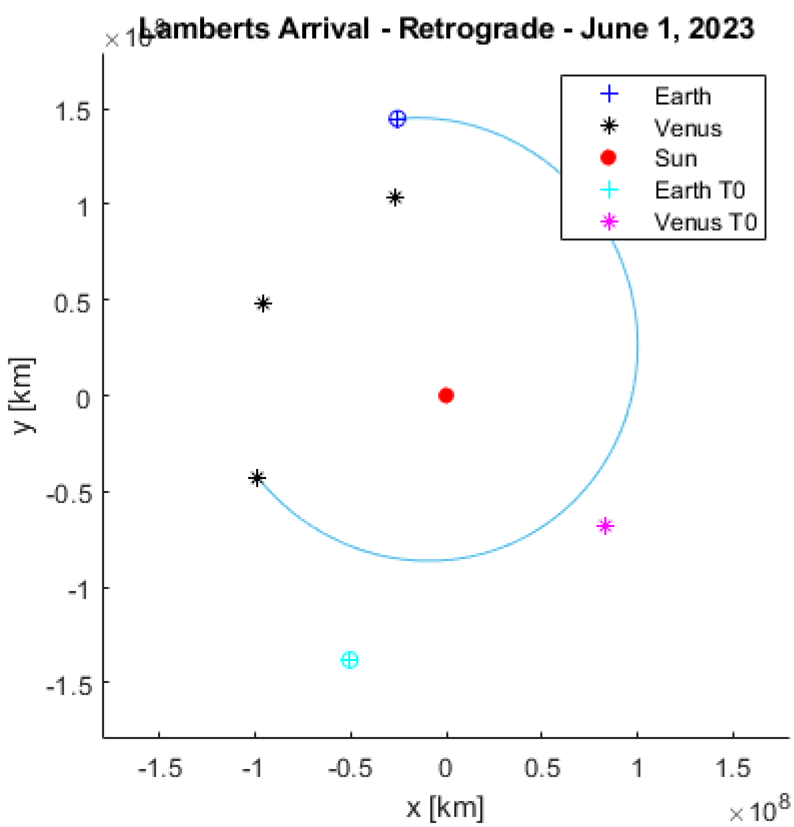
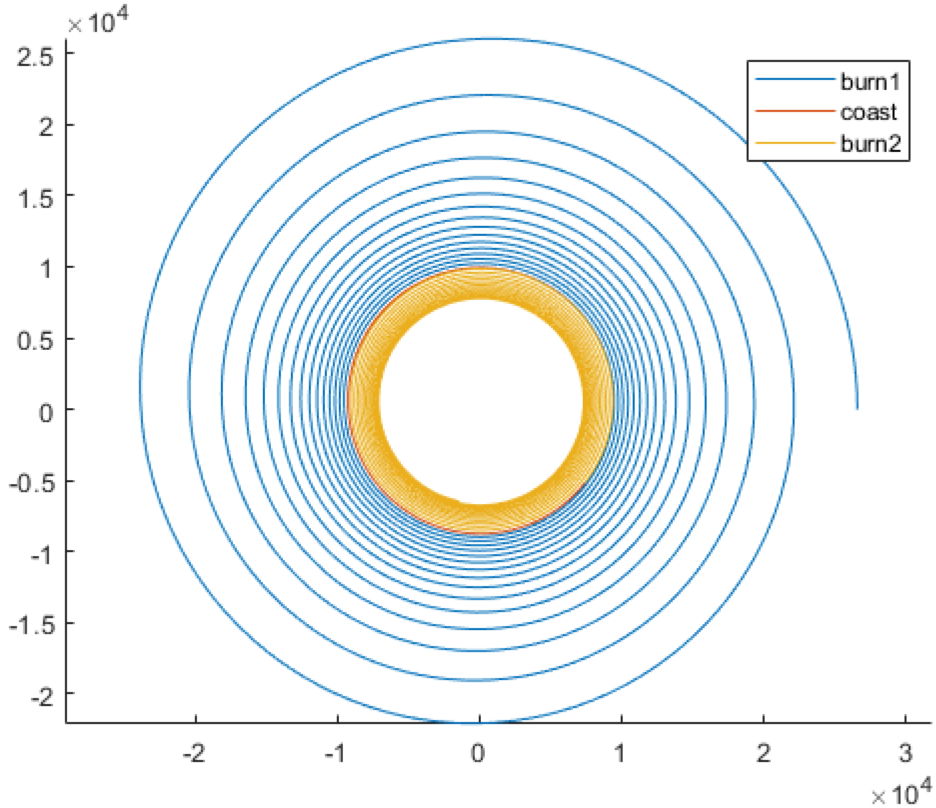

Lamberts Arrival - Retrograde - May 1, 2023
Earth
Venus
Sun
Earth T0
Venus T0
y [km]
x [km]
$\times 10^8$


Lamberts Arrival - Retrograde - June 1, 2023
Earth
Venus
Sun
Earth T0
Venus T0
y [km]
x [km]
$\times 10^8$

2 - flyby

```
------------P2------------
My workings for this problem have the following results:
The resulting heliocentric speed is: 29.7776 km/s
The dv of this this manuver is: 4.5783 km/s
The change in heliocentric speed is: 3.3286 km/s, so the s/c is going faster
 after the flyby.
H/C: increase in heliocentric speed makes sense for a trailing edge flyby
H/C: dv is within ranges we'd expect for an Earth flyby
```

3 - deorbit, nonimpulsive



4 - multiburn escape

```
Warning: joshCOE will assume that R and V are normal if the inputs are scalar
ie: the craft is in a circular orbit or is at periapse or apoapse
Warning: joshCOE will assume that R and V are normal if the inputs are scalar
ie: the craft is in a circular orbit or is at periapse or apoapse
------------P4------------
My workings for this problem have the following results:
The spacecraft will require 3 burns to escape.
The total time from the first burn to the last is: 9.011 hrs.
H/C this time seems reasonable for middle altitude orbits.
```

5 - ecc in terms of c

------------P5------------
My workings for this problem have the following results:
I used symbolic mathtoolbox to keep track of my variables.
From problem statement:

vp =

*c*va*

ecc formula:

ecc =

(ra - rp)/(ra + rp)

Solve for ra in terms of other vars from h formula:

h =

*ra*va == c*rp*va*

ra =

*c*rp*

plug ra and into rp into ecc formula:

ecc =

*-(rp - c*rp)/(rp + c*rp)*

simplify to find ecc in terms of c:

ecc =

(c - 1)/(c + 1)

H/C: ecc is only in terms of c

6 - trip to neptune Tsyn

------------P6------------
My workings for this problem have the following results:
The synodic period of Neptune relative to Eath: 367.4969 days
The transfer time for a Homaan transfer to Neptune is: 30.5819 Earth years.
The lead angle of Neptune at departure is: 112.9787 degrees
The lead angle of Neptune at arrival is: -29.3704 degrees, ie it is lagging by 29.3704 degrees

```
H/C: The transfer time seems really long but it is actually resoable
 considering the orbital period of Neptune is: 5200777912.32 Earth years.
H/C: Neptunr is leading Earth at departure which makes sense because it will
 travel some but less than half of its orbit in 30 years.
H/C: the synodic period is greater than the wait time. This makes sense
 beacuse the synodic period is an upper bound for possible wait times.
```

dependancies

```
------------Dependancies------------
My code uses the following functions:
```

funcitons

function [r,v] = prop(r0,v0,dt) X0 = [r0;v0]; options = odeset('RelTol', 1e-8,'AbsTol',1e-13); [~,X] = ode45(@orbitODEFun,[0,dt],X0,options); X = X(end,:); r = X(1:3)'; v = X(4:6)'; end

```
------------P3------------
My workings for this problem have the following results:
The final altitude of the spacecraft is: 251.4879 km/s, so it is still
 orbiting.
The final mass of the spacecraft is 557.7103 kg, which is 42.2897 kg less than
 the initial mass.
H/C: the final altitude is lower which is expected for a deorbit.
H/C: the final mass is lower which is expected for consuming fuel.
H/C: the trajectory is a fairly circular spiral which is expected for low
 thrust/long duration burns.
```

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