According to Lambert’s Theorem

$$\sqrt{\mu}(t_2 - t_1) = F(a, r_1 + r_2, c)$$

the orbit of the boundary-value problem can be transformed to a rectilinear orbit \((e = 1)\), keeping the sum of the radii \(r_1 + r_2\), the length of the chord \(c\) and the semimajor axis \(a\) all fixed in value, and the time-of-flight will be unchanged. The transformation is illustrated in the following figure:

The flight time for the rectilinear orbit is

$$\sqrt{\frac{\mu}{a^3}}(t_2 - t_1) = (\alpha - \sin \alpha) - (\beta - \sin \beta)$$

$$= (E_2 - \sin E_2) - (E_1 - \sin E_1)$$

in terms of the Lagrange parameters and the eccentric anomalies.
Transformation of the Four Basic Ellipses

We adopt the convention for assigning quadrants to the Lagrange parameters $\alpha$ and $\beta$

<table>
<thead>
<tr>
<th>Condition</th>
<th>Range</th>
<th>Condition</th>
<th>Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>$0 \leq \alpha \leq 2\pi$</td>
<td>$0 \leq \beta \leq \pi$</td>
<td>$0 \leq \alpha \leq 2\pi$</td>
<td>$-\pi \leq \beta \leq 0$</td>
</tr>
</tbody>
</table>

for $\theta \leq \pi$  

for $\theta \geq \pi$

which will include all elliptic orbits.