

## Trip to Mars

Table 1 Mass and Gravity

		A	B
		Earth	Mars
1	mass $M$ in kg	5.984E+24	6.419E+23
2	radius $r$ in m	6.371E+06	3.396E+06
3	acceleration of gravity $g$ in $\text{m/s}^2$	9.83	3.71
4	semimajor axis $a$ in AU	1.00	1.52
5	semimajor axis $a$ in m	$r_p =$ 1.496E+11	$r_a =$ 2.274E+11
6	circular velocity $v_c$ in m/s	$v_{cEarth} =$ 29,779	$v_{cMars} =$ 24,154

$G$ in $\text{N m}^2/\text{kg}^2 =$	6.67E-11
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$M_{\text{sun}}$ in kg =	1.989E+30
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Table 2 Orbital Parameters

		A
1	$GM_{\text{sun}}$ in $\text{N m}^2/\text{kg}$	1.327E+20
2	distance between Earth and Mars in AU	2.52
3	distance between Earth and Mars in m	3.770E+11
4	spacecraft orbit semimajor axis $a$ in AU	1.26
5	spacecraft orbit semimajor axis $a$ in m	1.885E+11
6	spacecraft orbit eccentricity $e$	0.206
7	spacecraft circular orbital velocity $v_c$ in m/s	26,530
8	$\sqrt{\frac{1-e}{1+e}}$	0.811
9	spacecraft orbital velocity $v_a$ in m/s at Mars	21,518
10	required change in velocity in m/s at Mars $ v_{cMars} - v_a $	2,636
11	$\sqrt{\frac{1+e}{1-e}}$	1.233
12	spacecraft orbital velocity $v_p$ in m/s at Earth	32,708
13	required change in velocity in m/s at Earth $ v_{cEarth} - v_p $	2,928
14	time for the trip $P$ in years	1.414
15	time for the trip $P$ in days	517