Prob. 86 Interplanetary Navigation.

a.) Earth to Mars: You must increase the speed of the rocket in the direction of the earth's motion.

Mars to Earth: You must decrease the speed of the rocket w.r.t. the direction of Mar's motion.

b.) $T = \frac{2\pi}{\sqrt{GM_{sun}}} a^{3/2}$ is the period of the full elliptical orbit where 1/2 of the orbit is shown in Fig. 12.37

So, $\frac{T}{2} = \frac{\pi}{\sqrt{GM_{sun}}} a^{3/2}$ where $a = (d_{earth} + d_{mars}) \div 2$

$= \frac{1.50\times10^{11} + 2.28\times10^{11}}{2} = 1.89\times10^{11}\ m$

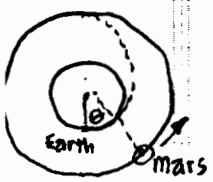
$\frac{T}{2} = \frac{\pi\ (1.89\times10^{11})^{3/2}}{\sqrt{6.67\times10^{-11}\ (1.99\times10^{30})}}$ $\frac{T}{2} = 2.24\times10^{7}\ s = 259\ days$

c.) What angle does Mars subtend during 259 days.

The period of Mars → $T = \frac{2\pi}{\sqrt{GM}} a^{3/2} = \frac{2\pi\ (2.28\times10^{11})^{3/2}}{\sqrt{6.67\times10^{-11}\ (1.99\times10^{30})}} = 5.94\times10^{7}$

$T_{Mars} = 5.94\times10^{7}$ sec

fraction = $\frac{T/2}{T_{Mars}}$ ← from part (b) $= 0.377$ $0.377 \times 360^\circ = 136^\circ$ in 259 days



$\theta = 180^\circ - 136^\circ = \underline{\underline{44^\circ}}$