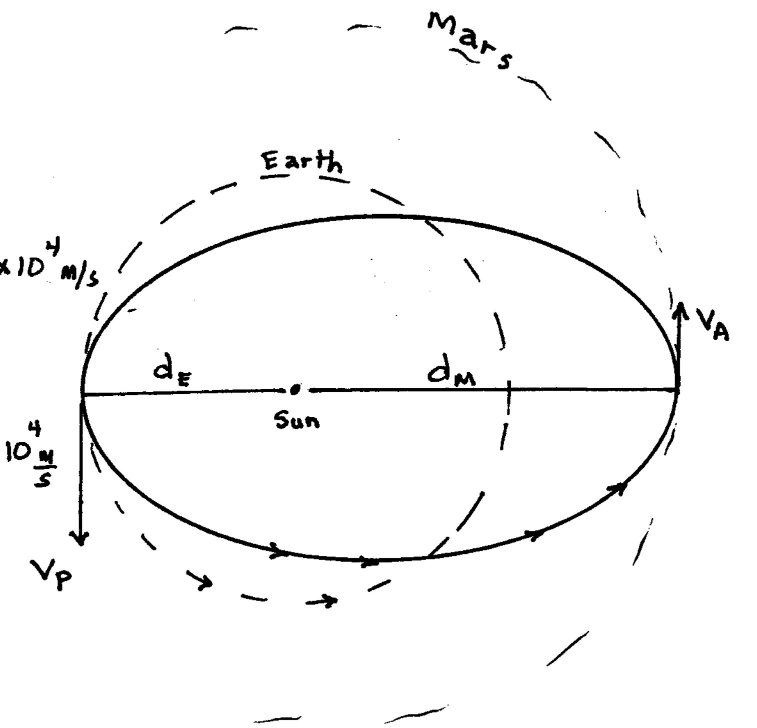
Chapter 12
Prob. 87

$$V_E = \sqrt{\frac{GM_\odot}{d_E}} = 2.98 \times 10^4 \text{ m/s}$$

$$V_M = \sqrt{\frac{GM_\odot}{d_m}} = 2.41 \times 10^4 \frac{\text{m}}{\text{s}}$$



$d_E = 1.50 \times 10^{11}$ m

$d_M = 2.28 \times 10^{11}$ m

What the values for V_A and V_P ?

$V_P = ?$

$$E = -\frac{GM_\odot m}{2a} = -\frac{GM_\odot m}{d_E + d_M} = KE(d_E) + PE(d_E)$$

for an ellipse

$$-\frac{GM_\odot m}{d_E + d_M} = \frac{1}{2} m V_P^2 - \frac{GM_\odot m}{d_E} \qquad V_P^2 = 2GM_\odot\left(\frac{1}{d_E} - \frac{1}{d_E + d_M}\right)$$

$$V_P = \sqrt{2(6.67 \times 10^{-11})(1.99 \times 10^{30})\left(\frac{1}{1.50 \times 10^{11}} - \frac{1}{(1.50 + 2.28) \times 10^{11}}\right)}$$

$$\boxed{V_P = 3.27 \times 10^4 \text{ m/s}} \quad > V_E = 2.98 \times 10^4 \text{ m/s}$$

$V_A = ?$

$$E_{ellipse} = -\frac{GM_\odot m}{d_E + d_M} = KE(d_M) + PE(d_M)$$

$$-\frac{GM_\odot m}{d_E + d_M} = \frac{1}{2} m V_A^2 - \frac{GM_\odot m}{d_M} \qquad V_A^2 = 2GM_\odot\left(\frac{1}{d_M} - \frac{1}{d_E + d_M}\right)$$

$$V_A = \sqrt{2(6.67 \times 10^{-11})(1.99 \times 10^{30})\left(\frac{1}{2.28 \times 10^{11}} - \frac{1}{(1.50 + 2.28) \times 10^{11}}\right)}$$

$$\boxed{V_A = 2.15 \times 10^4 \text{ m/s}}$$