

Centripetal Force 6.1 Prob Set 1

HW 1

① $a_c = \frac{v^2}{r} = \frac{(4)^2}{1.5} = \boxed{11 \text{ m/s}^2}$ directed towards the center

③ ~~$a_c = \frac{v^2}{r}$~~ $r = \frac{v^2}{a_c} = \frac{(2.5)^2}{4} = \boxed{1.6 \text{ m}}$

⑤ $F = \frac{GM_1m_2}{r^2} = \frac{(6.67 \times 10^{-11})(60)(10,000)}{(5)^2} = \boxed{1.6 \times 10^{-6} \text{ N}}$

Force would be different at a distance of $2r$.

⑦ $F_1 = F = \frac{GM_1m_2}{r^2}$ $F_1 = \frac{GM_1m_2}{r^2} = 4 = \frac{m a_1}{m a_2} = \frac{m_1 \frac{v_1^2}{r}}{m_2 \frac{v_2^2}{2r}}$ so $2v_1^2 = 4v_2^2$

$\frac{v_1^2}{v_2^2} = 2 \cdot \frac{(2\pi r)^2}{(2\pi(2r))^2}$ so $\frac{(T_2)^2}{(2T_1)^2} = 2$ $T_2^2 = 8T_1^2$ $T_2 = \sqrt{8} \cdot 1 \text{ yr} = \boxed{2.8 \text{ years}}$

⑨ $g = \frac{GM}{r^2} = \frac{(6.67 \times 10^{-11})(6.37 \times 10^{23})}{(3,430,000)^2} = \boxed{3.6 \frac{\text{m}}{\text{s}^2}}$

HW 2

- ① B, ③ D, ⑤ A, ⑦ A, ⑨ D.