Artificial Gravity (Questions from Notes)

① $a = \frac{v^2}{r} \Rightarrow r = \frac{v^2}{a} = \frac{(48\,m/s)^2}{6.8\,m/s^2} = 338.8...\,m \simeq \boxed{340\,m}$

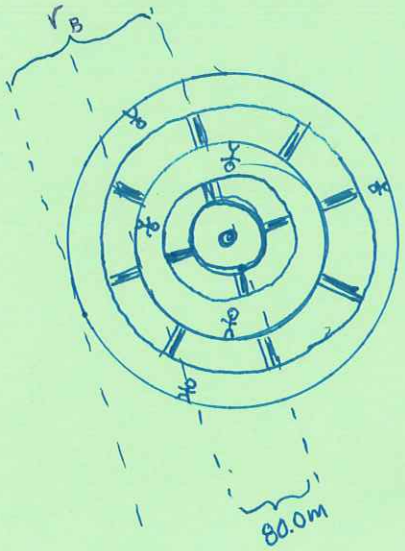
② $a = \frac{4\pi^2 r}{T^2}$, $T = 60s$

$$r = \frac{aT^2}{4\pi^2} = \frac{(14\,m/s^2)(60s)^2}{4\pi^2} = 1276.6...\,m \simeq \boxed{1300\,m}$$

③ $T = 20s$

$$a = \frac{4\pi^2 r}{T^2} = \frac{4\pi^2(78m)}{(20s)^2} = 7.698291433\,m/s^2 \simeq \boxed{7.7\,m/s^2}$$

④



I'll solve this using 2 methods.

① The longer solution, easier to understand.

Level A: $a_A = \frac{4\pi^2 r_A}{T_A^2}$

$$T_A = \sqrt{\frac{4\pi^2 r}{a}} = 25.13274123\,s = T_B$$

Level B: $a_B = \frac{4\pi^2 r_B}{T_B^2} \Rightarrow r_B = \frac{a_B T_B^2}{4\pi^2}$

$$\boxed{r_B = 192m \simeq 190m}$$

② Proportionality: $a = \frac{4\pi^2 r}{T^2} \Rightarrow a \propto r$

$$a_B = \frac{12}{5} a_A \Rightarrow r_B = \frac{12}{5} r_A = \frac{12}{5}(80.0m) = 192m$$

$$\boxed{r_B = 190m}$$