# Home Work #1

Ali BaniAsad 401209244

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## 1 Question 1

$h = 200_{km} \rightarrow r = R_e + h = 6378.137 + 200 = 6578.1137, \quad \mu = 3.986 \times 10^{14}_{m^3/s^2} = 3.986 \times 10^{5}_{km^3/s^2}$

The orbit is circular.

### 1.1 Part a

$$T = 2\pi\sqrt{\frac{r^3}{\mu}} = 2\pi\sqrt{\frac{6578.1137^3}{3.986 \times 10^5}} = 5309.62_{\text{sec}} \tag{1}$$

$$T\omega = 2\pi \rightarrow \omega = \frac{2\pi}{T} = \frac{2\pi}{5309.62} = 0.00118_{rad/\,\text{sec}} \tag{2}$$

### 1.2 Part b

$$v = \sqrt{\frac{\mu}{r}} = \sqrt{\frac{3.986 \times 10^5}{6578.1137}} = 7.78_{km/\,\text{sec}} \tag{3}$$

The new velocity is calculated as:

$$v_{new} = v + 0.5_{km.\,\text{sec}} = 8.28_{km.\,\text{sec}} \tag{4}$$

Assume the new orbit is circular just changed altitude and has a new velocity.

$$v_{new} = \sqrt{\frac{\mu}{r_{new}}} \rightarrow r_{new} = \frac{\mu}{v_{new}^2} = 5808_{km} \tag{5}$$

$$T = 2\pi\sqrt{\frac{r_{new}^3}{\mu}} = 2\pi\sqrt{\frac{5808^3}{3.986 \times 10^5}} = 4405.08_{\text{sec}} \tag{6}$$

$$T_{new}\omega_{new} = 2\pi \rightarrow \omega_{new} = \frac{2\pi}{T_{new}} = \frac{2\pi}{4405.08} = 0.00143_{rad/\,\text{sec}} \tag{7}$$

$r_{new}$ is smaller than the earth's radius.

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