Doppler's Shift :

A LEO satellite in circular polar orbit with altitude h =1000 km. A transmitter of a satellite on a frequency (f_t) of 2.68 GHz.

Find out:

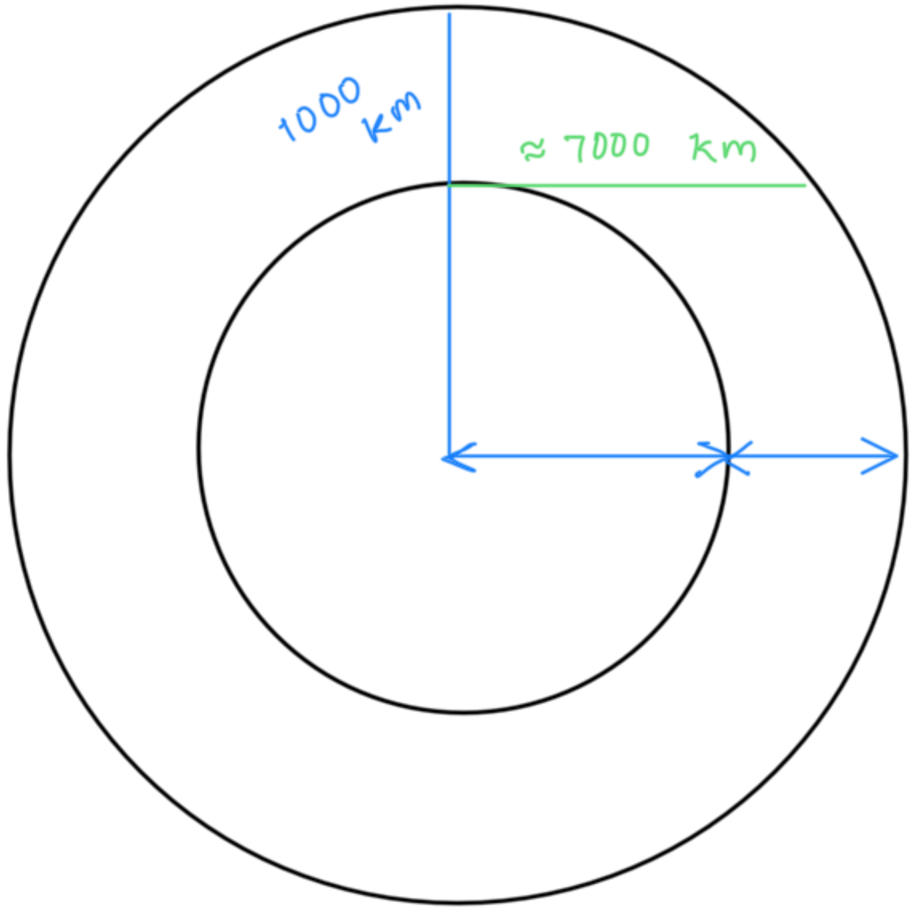
1. Velocity of the satellite in orbit.
2. Components of the velocity towards observer on earth.
3. Find the doppler's shift of the received signal assume R_e = 6378 km. (Given: f_t = 20 GHz)

✅

$$\frac{f_R - f_T}{f_T} = \frac{\Delta f}{f_T} = \frac{V_T}{V_P} \Rightarrow \Delta f = \frac{V_T}{V_P/f_T}$$

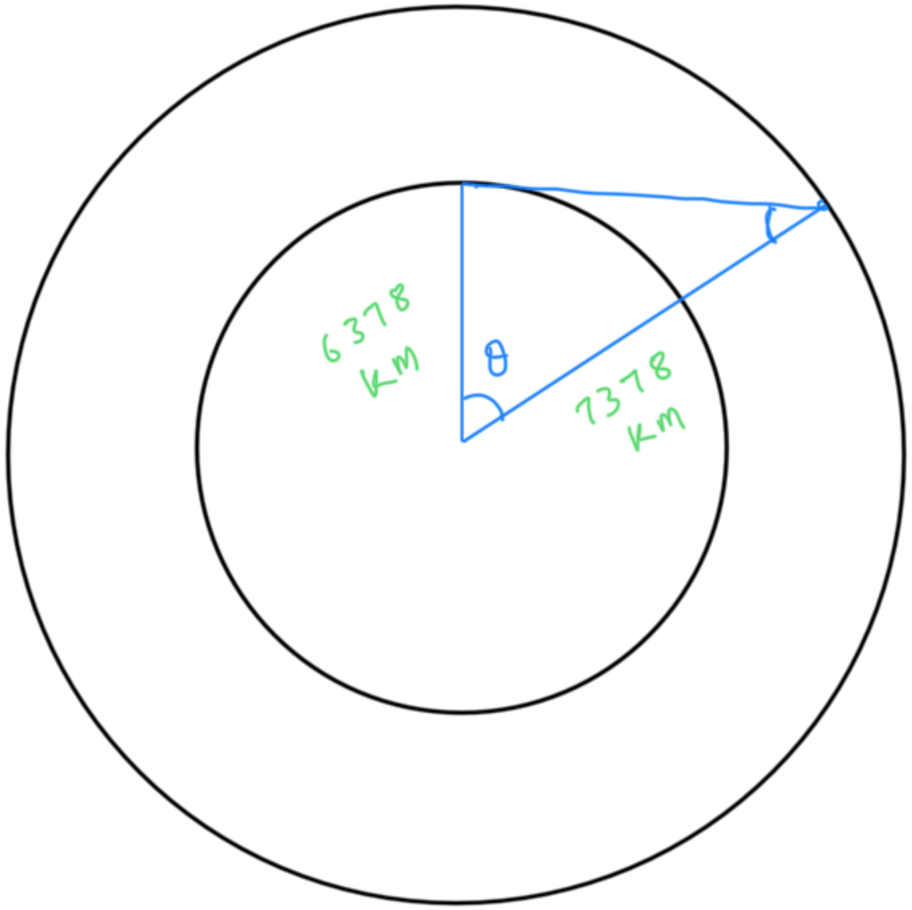
$$= \frac{V_T \cos\theta}{\lambda}$$

$V_{approach}$ is used for doppler shift calculation



$$T^2 = \frac{4\pi^2}{\mu} a^3$$

$$V_T = \frac{\cancel{2\pi a}}{\frac{\cancel{2\pi a}\sqrt{a}}{\sqrt{\mu}}} = \sqrt{\frac{\mu}{a}}$$



$$V_{approach} = V_T \cos\theta$$

$$= 6.354 \text{ km/s}$$

$$\boxed{V_{approach} = 6354 \text{ m/s}}$$

$$\Delta f = \frac{6354 \times 2.65 \times 10^9}{3 \times 10^8} = 56130 \text{ Hz} = 56.13 \text{ kHz}$$

$$f_T = 20 \text{ GHz} \quad \text{(Given)}$$

$\Delta f = 423.3$ kHZ

There are 2 doppler frequencies, we use based on different approaches.