Obtain an expression for the time period of a satellite orbiting the earth. At what altitude should a satellite be placed for its orbit to be geosynchronous?

Second Newton's law for this case:

$$G\frac{M_E m}{(R_E+h)^2} = m\frac{v^2}{R_E+h}$$

$$G\frac{M_E}{R_E+h} = v^2$$

$$v = \sqrt{G\frac{M_E}{R_E+h}} = \sqrt{\frac{gR_E{}^2}{R_E+h}} = R_E\sqrt{\frac{g}{R_E+h}}$$

One revolution will be made during time (period):

$$T = \frac{2\pi(R_E+h)}{R_E\sqrt{\frac{g}{R_E+h}}} = \frac{2\pi(R_E+h)^{3/2}}{R_E\sqrt{g}}$$

Assuming that the Earth period is 24h:

$$\frac{2\pi(R_E+h)^{3/2}}{R_E\sqrt{g}} = 24*3600s$$

$$h = \left(\frac{86400s*R_E\sqrt{g}}{2\pi}\right)^{2/3} - R_E$$

$$h = \left(\frac{86400s*6400000m*\sqrt{9.8m/s^2}}{2*3.14}\right)^{2/3} - 6400000m = 3.6*10^7 m = 3.6*10^4 km$$

Answer: $T = \frac{2\pi(R_E+h)^{3/2}}{R_E\sqrt{g}}$, $h = 3.6*10^4 km$