3. (a) The time for one revolution is the circumference of the orbit divided by the speed v of the Sun: $T = 2\pi R/v$, where R is the radius of the orbit. We convert the radius:

$$R = \left(2.3 \times 10^4 \,\text{ly}\right)\left(9.46 \times 10^{12} \,\text{km/ly}\right) = 2.18 \times 10^{17} \text{ km}$$

where the ly $\leftrightarrow$ km conversion can be found in Appendix D or figured "from basics" (knowing the speed of light). Therefore, we obtain

$$T = \frac{2\pi\left(2.18 \times 10^{17} \,\text{km}\right)}{250 \,\text{km/s}} = 5.5 \times 10^{15} \text{ s} \,.$$

(b) The number of revolutions N is the total time t divided by the time T for one revolution; that is, $N = t/T$. We convert the total time from years to seconds and obtain

$$N = \frac{\left(4.5 \times 10^9 \,\text{y}\right)\left(3.16 \times 10^7 \,\text{s/y}\right)}{5.5 \times 10^{15} \text{ s}} = 26 \,.$$