Chapter 3 Problem 39 [†]

Given
$r = 385,000\ km = 3.85 \times 10^8\ m$
$t = 27\ days$

Solution
Find the acceleration of the moon.

First convert the time into seconds.

$$t = (27\ d)\left(\frac{24\ hr}{1\ d}\right)\left(\frac{3600\ s}{1\ h}\right) = 2.33 \times 10^6\ s$$

Since the moon is traveling in a nearly circular orbit at constant speed, the acceleration will be centripetal acceleration. The velocity of the moon is the circumference of the orbit divided by the time.

$$v = \frac{d}{t} = \frac{2\pi r}{t} = \frac{2\pi(3.85 \times 10^8\ m)}{2.33 \times 10^6\ s}$$

$$v = 1038\ m/s$$

The centripetal acceleration is then

$$a = \frac{v^2}{r} = \frac{(1038\ m/s)^2}{3.85 \times 10^8\ s} = 2.8 \times 10^{-3}\ m/s^2$$

[†]Problem from Essential University Physics, Wolfson