Answer on Question #50550 – Physics – Mechanics |Kinematics | Dynamics

## Question.

A moon worm is orbiting an asteroid in a circular path with radius $r$ and speed $v$. If the moon worm decides to double its speed, how will it have to change the radius of its path so that it continues to orbit the asteroid in a perfect circle?

## Solution.

Let remember the Newton's second law:

$$\sum F = ma$$

In our case, the acceleration is the centripetal.

$$a = a_c$$

By definition the centripetal accelerations is equal to:

$$a_c = \frac{v^2}{R}$$

To continue to orbit the asteroid in a perfect circle it must be satisfied:

$$\sum F = const$$

But in our case, $m = const$.

Therefore,

$$a_c = const \to \frac{v^2}{R} = const$$

So, if we double the speed $v = 2v_0$, then:

$$\frac{v^2}{R} = \frac{v_0^2}{R_0} = const$$

$$\frac{(2v_0)^2}{R} = \frac{v_0^2}{R_0} \to R = 4R_0$$

Thus, to double the speed it needs to increase 4 times the radius.

## Answer.

To increase 4 times: $R = 4R_0$