A 2.00kg kg stone is sliding to the right on a frictionless horizontal surface at 5.50m/s m/s when it is suddenly struck by an object that exerts a large horizontal force on it for a short period of time.
1)What impulse does this force exert on the stone?
2)Just after the force stops acting, find the magnitude of the stone's velocity if the force acts to the right.
3)Just after the force stops acting, find the magnitude of the stone's velocity if the force acts to the left.

Solution:

What impulse does this force exert on the stone?

Let F - horizontal force;
t – time of action this force;

So $\vec{F} = m\frac{d\vec{v}}{dt} = \frac{d\vec{p}}{dt} \rightarrow \vec{p} = \int \vec{F}dt \rightarrow p = Ft$

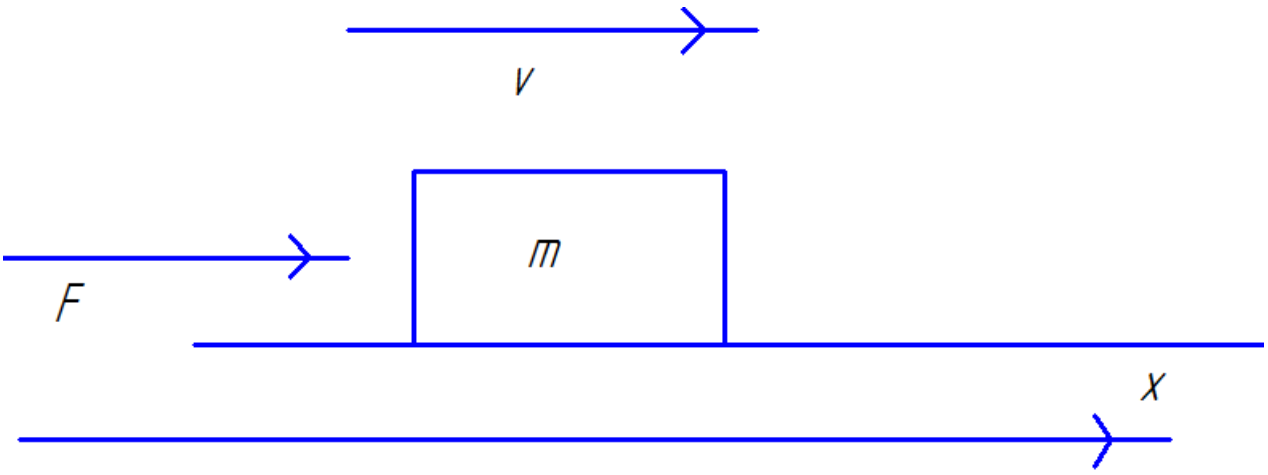
Just after the force stops acting, find the magnitude of the stone's velocity if the force acts to the right.

Let $v_0 - magnitude\ of\ the\ stone\ velocity\ before\ force\ action$

$v_f - magnitude\ of\ the\ stone\ velocity\ after\ force\ action$

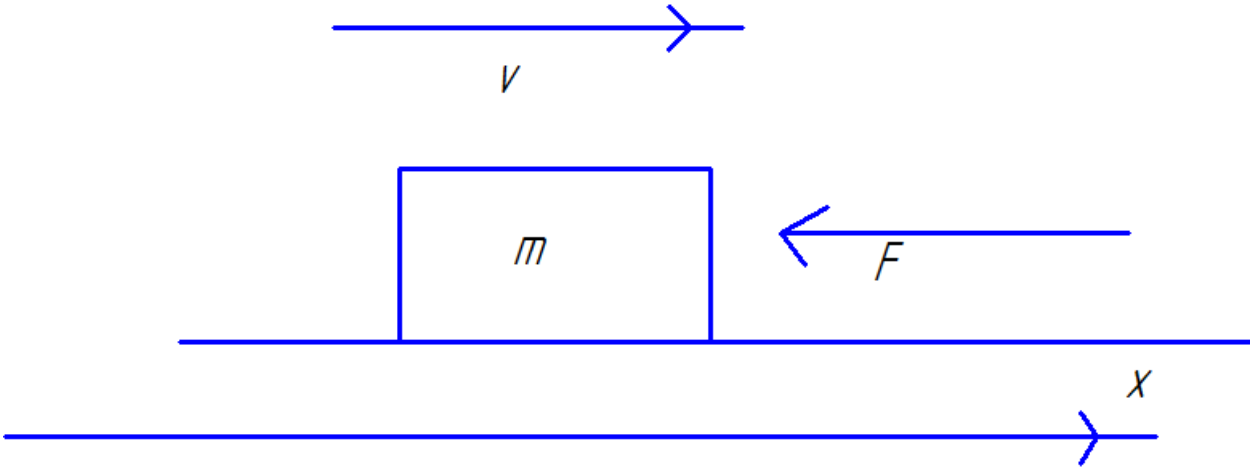
Since the force and velocity have the same direction:

$$F = m\frac{v - v_0}{t} \rightarrow v = v_0 + \frac{Ft}{m}$$



Just after the force stops acting, find the magnitude of the stone's velocity if the force acts to the left.
Since the force and velocity have the opposite direction:

$$-F = m\frac{v - v_0}{t} \rightarrow v = v_0 - \frac{Ft}{m}$$



Answer: 1. $p = Ft,$ 2. $v = v_0 + \frac{Ft}{m}$ 3. $v = v_0 - \frac{Ft}{m}$