1. A 125 kg box is sling down a 27 degree ramp at a constant velocity of 1.12 m/s. What is the friction force acting on it?

$m = 125\,kg$
$\varphi = 27^0$
$v = 1.12\,m/s$
$F - ?$

Solution.

Let write down the equation of the motion of the box (Newton 2-nd law) onto the *X*- and *Y*-axes (*X*-axis is directed along the plane and *Y*-axis goes in the perpendicular direction upward): $m\vec{a} = m\vec{g} + \vec{N} + \vec{F}$,

where $\vec{F}$ is the friction force.

As the velocity of the box is constant, the acceleration equals to zero ($\vec{a} = 0$).

Then, write down this law in projectives:

$$\begin{cases} m \cdot 0 = mg\sin\alpha - F \\ m \cdot 0 = -mg\cos\alpha + N \end{cases}.$$

One can obtain the friction force from the first equation of the system: $\boxed{F = mg\sin\alpha}$.

Let check the dimension: $[F] = m \cdot \frac{m}{s^2} = N$.

Let evaluate the quantity: $F = 125 \cdot 9.81 \cdot \sin 27^0 = 557(N)$.

Answer: $557\,N$.