6. We choose $+y$ upward, which implies $a > 0$ (the acceleration is upward since it represents a deceleration of his downward motion through the snow).

   (a) The maximum deceleration $a_{\max}$ of the paratrooper (of mass m and initial speed $v = 56$ m/s) is found from Newton's second law

   $$F_{\text{snow}} - mg = ma_{\max}$$

   where we require $F_{\text{snow}} = 1.2 \times 10^5\,\text{N}$. Using Eq. 2-15 $v^2 = 2a_{\max}d$, we find the minimum depth of snow for the man to survive:

   $$d = \frac{v^2}{2a_{\max}} = \frac{mv^2}{2\left(F_{\text{snow}} - mg\right)} \approx \frac{(85\,\text{kg})(56\,\text{m/s})^2}{2(1.2 \times 10^5\,\text{N})} = 1.1\,\text{m}\ .$$

   (b) His short trip through the snow involves a change in momentum

   $$\vec{p}_f - \vec{p}_i = 0 - (85\,\text{kg})(-56\,\text{m/s})$$

   (the negative value of the initial velocity is due to the fact that downward is the negative direction) which yields 4.8×10^3 kg·m/s. By the impulse-momentum theorem, this equals the impulse due to the net force $F_{\text{snow}} - mg$, but since $F_{\text{snow}} \gg mg$ we can approximate this as the impulse on him just from the snow.