74. We take her original elevation to be the $y = 0$ reference level and observe that the top of the hill must consequently have $y_A = R(1 - \cos 20°) = 1.2$ m, where R is the radius of the hill. The mass of the skier is $600/9.8 = 61$ kg.

(a) Applying energy conservation, Eq. 8-17, we have

$$K_B + U_B = K_A + U_A \implies K_B + 0 = K_A + m\ .gy_A$$

Using $K_B = \frac{1}{2}(61\,\text{kg})(8.0\,\text{m/s})^2$, we obtain $K_A = 1.2 \times 10^3$ J. Thus, we find the speed at the hilltop is $v = \sqrt{2K/m} = 6.4$ m/s. (Note: one might wish to check that the skier stays in contact with the hill – which is indeed the case, here. For instance, at A we find $v^2/r \approx 2\ \text{m/s}^2$ which is considerably less than g.)

(b) With $K_A = 0$, we have

$$K_B + U_B = K_A + U_A \implies K_B + 0 = 0 + mgy_A$$

which yields $K_B = 724$ J, and the corresponding speed is $v = \sqrt{2K/m} = 4.9$ m/s.

(c) Expressed in terms of mass, we have

$$\begin{aligned} K_B + U_B &= K_A + U_A \implies \\ \frac{1}{2}mv_B^2 + mgy_B &= \frac{1}{2}mv_A^2 + mgy_A\ . \end{aligned}$$

Thus, the mass m cancels, and we observe that solving for speed does not depend on the value of mass (or weight).