17. (a) We use $\vec{F}$ to denote the upward force exerted by the cable on the astronaut. The force of the cable is upward and the force of gravity is mg downward. Furthermore, the acceleration of the astronaut is $g/10$ upward. According to Newton's second law, $F - mg = mg/10$, so $F = 11mg/10$. Since the force $\vec{F}$ and the displacement $\vec{d}$ are in the same direction, the work done by $\vec{F}$ is

$$W_F = Fd = \frac{11mgd}{10} = \frac{11(72\,\text{kg})\left(9.8\,\text{m/s}^2\right)(15\,\text{m})}{10} = 1.164 \times 10^4\ \text{J}$$

which (with respect to significant figures) should be quoted as 1.2×10^4 J.

(b) The force of gravity has magnitude mg and is opposite in direction to the displacement. Thus, using Eq. 7-7, the work done by gravity is

$$W_g = -mgd = -(72\,\text{kg})\left(9.8\,\text{m/s}^2\right)(15\,\text{m}) = -1.058 \times 10^4\ \text{J}$$

which should be quoted as -1.1×10^4 J.

(c) The total work done is $W = 1.164 \times 10^4\ \text{J} - 1.058 \times 10^4\ \text{J} = 1.06 \times 10^3$ J. Since the astronaut started from rest, the work-kinetic energy theorem tells us that this (which we round to 1.1×10^3 J) is her final kinetic energy.

(d) Since $K = \frac{1}{2}mv^2$, her final speed is

$$v = \sqrt{\frac{2K}{m}} = \sqrt{\frac{2(1.06 \times 10^3\ \text{J})}{72\,\text{kg}}} = 5.4\ \text{m/s}\ .$$