71. We use Eq. 8-20.

(a) The force at $x = 2.0$ m is

$$F = -\frac{dU}{dx} \approx -\frac{-(17.5)-(-2.8)}{4.0-1.0} = 4.9\,\text{N}.$$

(b) The force points in the $+x$ direction (but there is some uncertainty in reading the graph which makes the last digit not very significant).

(c) The total mechanical energy at $x = 2.0$ m is

$$E = \frac{1}{2}mv^2 + U \approx \frac{1}{2}(2.0)(-1.5)^2 - 7.7 = -5.5$$

in SI units (Joules). Again, there is some uncertainty in reading the graph which makes the last digit not very significant. At that level (–5.5 J) on the graph, we find two points where the potential energy curve has that value — at $x \approx 1.5$ m and $x \approx 13.5$ m. Therefore, the particle remains in the region $1.5 < x < 13.5$ m. The left boundary is at $x = 1.5$ m.

(d) From the above results, the right boundary is at $x = 13.5$ m.

(e) At $x = 7.0$ m, we read $U \approx -17.5$ J. Thus, if its total energy (calculated in the previous part) is $E \approx -5.5$ J, then we find

$$\frac{1}{2}mv^2 = E - U \approx 12\ \text{J} \Rightarrow v = \sqrt{\frac{2}{m}(E-U)} \approx 3.5\ \ \text{m/s}$$

where there is certainly room for disagreement on that last digit for the reasons cited above.