7-53)

As is usual with bio-problems, there are some assumptions we must make, and it's always difficult to know what to include and what to ignore. To that end, let's think about Part B first.

What normal force acts on the bottom of the jogger's foot when he is simply standing still on one foot?

$$-gm_B + F_{\text{Standing on one foot}} = 0 \quad \rightarrow \quad F_{\text{standing on on foot}} = gm_B = 10(75) = 750\text{ N}$$

Back to Part A. Let's make the assumption that the jogger's torso doesn't rise or fall; any forces exerted on it or by it would do no work since the displacement would then be zero. In addition, sometimes the torso will be pushing down on the leg and other times it will be pulling up on the leg. Let's look at just the leg. We'll assume that all of the leg is initially moving at 6 m/s and completely stops. Let's call that final position y = 0.

Then using the WE thm,

W_{Torso} = 0 (no displacement)
W_{Ground} = F_{Ground} Δy cos(180)
W_g - conservative

$$W_{NC} = \Delta KE + \Delta PE$$

$$F_{\text{Ground}}|\Delta y|\,(-1) = \frac{1}{2}m_{\text{Leg}}v_f^2 - \frac{1}{2}m_{\text{Leg}}v_i^2 + gm_{\text{Leg}}y_f - gm_{\text{Leg}}y_i$$

The terms in red will be zero.

PID

$$F_{\text{Ground}}\,y_i = +\frac{1}{2}m_{\text{Leg}}v_i^2 + gm_{\text{Leg}}y_i$$

$$F_{\text{Ground}}|\Delta y| = \frac{\frac{1}{2}m_{\text{Leg}}v_i^2 + gm_{\text{Leg}}y_i}{|\Delta y|} = \frac{\frac{1}{2}(13)6^2 + 10(13)0.015}{0.015} = 15{,}730\text{ N}$$

Now, since this number is so much larger that the force required simply to hold up the body, I would assert that we made a good approximation by ignoring the torso and other leg in the calculation.