Answer on question #69400, Physics / Other

Question a runner is running at a steady velocity of 5.6m/s. When she 38.1m away from the finish line she accelerates at a constant rate. If her velocity at the start line was 7.1 m/s what was her acceleration as she approaches the line?

Solution Equations for distance and velocity of last 38.1 m are:

$$s = v_0 t + at^2/2$$

$$v = v_0 + at$$

We know following values:

$$s = 38.1\,m, \quad v_0 = 5.6\,m/s, \quad , v = 7.1\,m/s.$$

We can solve this system by eliminating t:

$$t = \frac{v - v_0}{a}$$

$$s = v_0 \frac{v - v_0}{a} + a(\frac{v - v_0}{a})^2/2 = v_0 \frac{v - v_0}{a} + \frac{(v - v_0)^2}{2a}$$

From this we find acceleration:

$$a = v_0 \frac{v - v_0}{s} + \frac{(v - v_0)^2}{2s} = 0.25\,m/s^2$$