DCM2.10 $F = -kx^{-2} \Rightarrow V = -k/x$ + energy $\Rightarrow$

$$\frac{1}{2} m \dot{x}^2 - k/x = E = 0$$ by initial conditions.

$$\therefore \quad \dot{x}^2 = \frac{2k}{m}\frac{1}{x} \Rightarrow \dot{x} = -\sqrt{\frac{2k}{m}}\frac{1}{x^{1/2}} = \frac{dx}{dt}$$

$$\Rightarrow \quad dt = -\sqrt{\frac{m}{2k}}\, x^{1/2}\, dx \Rightarrow t - t_c = -\sqrt{\frac{m}{2k}}\,\frac{2}{3}\, x^{3/2}$$

$$\Rightarrow \quad x^{3/2} = \left(\frac{2k}{m}\right)^{\frac{1}{2}} \frac{3}{2}(t_c - t) \Rightarrow$$

$$x^3 = \frac{2k}{m}\frac{9}{4}(t_c - t)^2 = \frac{9k}{2m}(t_c - t)^2$$

$$\Rightarrow \quad \boxed{x(t) = \left(\frac{9k}{2m}\right)^{1/3}(t_c - t)^{2/3}}$$

The particle reaches the origin at $t = t_c$.
The force is ∞ at $x = 0$, + $\therefore$ conditions of theorem 1 for continuing solution are violated. Look also at the equation for $\dot{x}$. Evidently $1/x^{1/2}$ is singular at $x = 0$, + again the conditions for theorem 1 are violated.