Principle of work & kinetic energy:

\[ T_1 + U_{1\rightarrow 2} = T_2 \]  

Conservation of mechanical energy:

\[ T_1 + V_1 = T_2 + V_2 \]

1. Kinetic energy of the body at time 1, \( T_1 = \frac{1}{2} m v_1^2 \)
2. Kinetic energy of the body at time 2, \( T_2 = \frac{1}{2} m v_2^2 \)
3. Work done on the body during its motion from position 1 to position 2, \( U_{1\rightarrow 2} \)
4. Potential energy of the body at position 1, \( V_1 \)
5. Potential energy of the body at position 2, \( V_2 \)

Potential energy of a body at a given position is equal to the amount of work received by the body from the conservative force during its motion from its current position to the reference datum.

\( V_g = \frac{-GMm}{r} \) for a spacecraft where the reference datum is \( \infty \)

\( V_e = \frac{1}{2} k x^2 \) for a body in the elastic force field

\[ V_g = W \overline{R}_1 \]
\[ V_g = -W \overline{R}_2 \]

\[ T_1 + V_1 = T_2 + V_2 \]

\[ T_A + V_A = T_B + V_B \]

\[ T_A = 0, \quad T_B = \frac{1}{2} (20) v_B^2 \]

\[ V_A = (V_A)_e + (V_A)_g \]
\[ = 20 (9.81)(5) + \frac{1}{2} (20) (13-10)^2 \]

\[ V_B = (V_B)_e + (V_B)_g \]
\[ = 0 + \frac{1}{2} (120) (15-10)^2 \]

\[ v_B = \text{m/s} \]

13.49 (Prob. 13.19)

(R.D.: x-plane)

\[ W = m g \quad M_1 (N, \xi) \]

\[ \overline{AD} = 13 \text{m} \quad V_c = \frac{1}{2} R x^2 \]

\[ \overline{BD} = 15 \text{m} \quad \therefore V_B = 0 \]

[Diagram showing forces and distances]