Solution: In this case force is variable (function of x). So, let's use eq.(4)

$$W = \int_2^4 (3x + 4).dx \quad = \left[\frac{3x^2}{2}\right]_2^4 + [4x]_2^4$$

$$W = \left(\frac{3\times 4^2}{2} - \frac{3\times 2^2}{2}\right) + \left[4(4-2)\right] = 26J$$

Example 3: A man weighing 70 kg carries a 30 kg box to the top of a building 20 m high. Calculate the work done by the man. Take g = 9.8 ms^{-2}. **Ans:** 19600 J.

Solution: The total upward force applied by the man = weight of the man + weight of the box

So, the net upward force (F) = Mg + mg = 70 x 9.8 + 30 x 9.8

= 980 N

Net upward displacement (S) = 20m

Since, force and the displacement are in the same direction, $\theta = 0^o$.

Since, $W = F.S\cos\theta$

$$W = 980 \times 20 \times \cos 0^\circ \quad = 1960J$$

Example 4: A body constrained to move along the z-axis of a coordinate system is subject to a constant force F given by

$$\mathbf{F} = -\hat{\boldsymbol{\imath}} + 2\boldsymbol{j} + 3\hat{\boldsymbol{k}}\ \text{N}$$

Where, $\hat{\imath}, \hat{\jmath}\ and\ \hat{k}$ are unit vectors along the x-, y- and z-axis of the system respectively. What is the work done by this force in moving the body a distance of 4 m along the z-axis? **(NCERT) Ans.** 12 J

Solution: Since the body is constrained to move along the z-axis, the displacement vector is $\vec{S} = 4\hat{k}$. So work done is