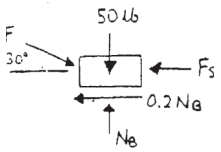
14–58.

The 50-lb block rests on the rough surface for which the coefficient of kinetic friction is $\mu_k = 0.2$. A force $F = (40 + s^2)$ lb, where s is in ft, acts on the block in the direction shown. If the spring is originally unstretched ($s = 0$) and the block is at rest, determine the power developed by the force the instant the block has moved $s = 1.5$ ft.

SOLUTION



$+\uparrow \Sigma F_y = 0; \qquad N_B - (40 + s^2)\sin 30° - 50 = 0$

$$N_B = 70 + 0.5s^2$$

$$T_1 + \Sigma U_{1-2} = T_2$$

$$0 + \int_0^{1.5} (40 + s^2)\cos 30°\, ds - \frac{1}{2}(20)(1.5)^2 - 0.2\int_0^{1.5} (70 + 0.5s^2)ds = \frac{1}{2}\left(\frac{50}{32.2}\right)v_2^2$$

$$0 + 52.936 - 22.5 - 21.1125 = 0.7764v_2^2$$

$$v_2 = 3.465 \text{ ft/s}$$

When $s = 1.5$ ft,

$$F = 40 + (1.5)^2 = 42.25 \text{ lb}$$

$$P = \mathbf{F} \cdot \mathbf{v} = (42.25 \cos 30°)(3.465)$$

$$P = 126.79 \text{ ft} \cdot \text{lb/s} = 0.231 \text{ hp} \qquad \textbf{Ans.}$$

Ans:
$P = 0.231$ hp