33. (a) The power is given by $P = Fv$ and the work done by $\vec{F}$ from time t_1 to time t_2 is given by

$$W = \int_{t_1}^{t_2} P\,\mathrm{d}t = \int_{t_1}^{t_2} Fv\,\mathrm{d}t\,.$$

Since $\vec{F}$ is the net force, the magnitude of the acceleration is $a = F/m$, and, since the initial velocity is $v_0 = 0$, the velocity as a function of time is given by $v = v_0 + at = (F/m)t$. Thus

$$W = \int_{t_1}^{t_2} (F^2/m)t\,\mathrm{d}t = \frac{1}{2}(F^2/m)(t_2^2 - t_1^2)\,.$$

For $t_1 = 0$ and $t_2 = 1.0\,\mathrm{s}$,

$$W = \frac{1}{2}\left(\frac{(5.0\,\mathrm{N})^2}{15\,\mathrm{kg}}\right)(1.0\,\mathrm{s})^2 = 0.83\,\mathrm{J}\,.$$

(b) For $t_1 = 1.0\,\mathrm{s}$ and $t_2 = 2.0\,\mathrm{s}$,

$$W = \frac{1}{2}\left(\frac{(5.0\,\mathrm{N})^2}{15\,\mathrm{kg}}\right)\left((2.0\,\mathrm{s})^2 - (1.0\,\mathrm{s})^2\right) = 2.5\ \mathrm{J}\,.$$

(c) For $t_1 = 2.0\,\mathrm{s}$ and $t_2 = 3.0\,\mathrm{s}$,

$$W = \frac{1}{2}\left(\frac{(5.0\,\mathrm{N})^2}{15\,\mathrm{kg}}\right)\left((3.0\,\mathrm{s})^2 - (2.0\,\mathrm{s})^2\right) = 4.2\ \mathrm{J}\,.$$

(d) Substituting $v = (F/m)t$ into $P = Fv$ we obtain $P = F^2t/m$ for the power at any time t. At the end of the third second

$$P = \frac{(5.0\,\mathrm{N})^2(3.0\,\mathrm{s})}{15\,\mathrm{kg}} = 5.0\ \mathrm{W}\,.$$