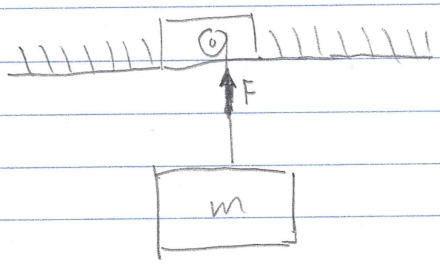
20-P-MOM-DY-21

A motor is lifting a crate with mass $m = 20$ kg. The motor provides a force that can be described by the function $F = 200\, t^{(1/2)}$. If starting from rest, determine the magnitude of velocity of the crate at time $t = 3$s.



Solution:

$$\Sigma F_y = F - mg = ma_y$$
$$\Sigma F_x = 0$$

Find when crate starts to move up

$$F - mg = 0$$
$$200\, t^{(1/2)} = mg \qquad t = 0.962 \text{ s}$$

$$mv_1 + \sum \int_{t_1}^{t_2} F\, dt = mv_2$$

$$0 + \frac{400}{3} t^{(3/2)} \Big|_{0.962}^{3} = mv_2 \qquad v_2 = 19.796 \text{ m/s}$$