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P1.

$a = 2t - 10$

$t = 0$

$s = -4m$

$v_0 = 3m/s$

$a = \dfrac{dv}{dt} = 2t - 10$

$dv = (2t - 10)dt$

$\int_{v_0}^{v_n} dv = \int_{t_0}^{t_n}(2t - 10)dt$

$v_n - v_0 = t^2 - 10t$

$v_n = t^2 - 10t + v_0$

$= t^2 - 10t + 3$

$v = \dfrac{ds}{dt} = t^2 - 10t + 3$

$\int_{s_0}^{s_n} ds = \int_{t_0}^{t_n}(t^2 - 10t + 3)dt$

$s_n - s_0 = \dfrac{1}{3}t^3 - 5t^2 + 3t$

$s_n = \dfrac{1}{3}t^3 - 5t^2 + 3t + s_0$

$= \dfrac{1}{3}t^3 - 5t^2 + 3t - 4$

P2.

$a = \dfrac{dv}{dt}, \ dt = \dfrac{ds}{dt}, \ vdv = ads$

$\int_{v_0}^{v_n} vdv = \int_{s_0}^{s_n} ads$

$\left[\dfrac{v^2}{2}\right]_{v_0}^{v_n} = \left[-k\dfrac{s^3}{3}\right]_{s_0}^{s_n}$

$\dfrac{v_n^2 - v_n^2}{2} = \dfrac{-k(s_n^3 - s_0^3)}{3}$

$$\frac{v_n^2 - 100}{2} = \frac{-0.1(125 - 27)}{3}$$

$$v_n^2 = 100 - \frac{125 - 27}{15}$$

$$v_n = \sqrt{100 - \frac{125 - 27}{15}}$$

$$v_n = 9.668$$

P3.

$$t_0 = 0, t_1 = 2, t_3 = 10$$

$$a = \frac{dv}{dt}, dv = adt, \int_{v_0}^{v_n} dv = \int_{t_0}^{t_n} adt = v = at$$

$$v = \frac{ds}{dt}, ds = atdt, \int_{s_0}^{s_n} ds = \int_{t_0}^{t_n} atdt, s = \frac{1}{2}at^2$$

$$s_1 = \frac{1}{2}at_1^2$$

$$v_{max} = at_1$$

$$s_1 = \frac{1}{2}v_{max}t_1$$

$$s_1 + s_2 = 100$$

$$\frac{1}{2}v_{max}t_1 + v_{max} \cdot 8 = 100$$

$$v_{max} + 8v_{max} = 100$$

$$v_{max} = \frac{100}{9}m/s$$

P4.

$$v_0 = 10m/s$$

$$v_{max} = v_0 + a \cdot t$$

$$= 10 + 6 \times 15$$

$$= 100$$

$$v_n = 0m/s$$

$$v_n = v_{max} + a \cdot t$$

$$= 100 - 4 \times (T - 15)$$

$$T = 100 \div 4 + 15$$

$$= 40$$