(2) $\xrightarrow{+}$) $\Sigma F = ma$

$\therefore 480(t-10)^2 = 2000\,a$

$\therefore a = \frac{480}{2000}(t^2 - 20t + 100)$

$\therefore \int_0^v dv = \frac{48}{200}\int_0^t (t^2 - 20t + 100)\,dt$

$\therefore v = \frac{48}{200}\left(\frac{1}{3}t^3 - \frac{20}{2}t^2 + 100t\right)$

At $t = 10\,s$: $v = 80\ m.s^{-1}$

$\int_0^x dx = \frac{48}{200}\int_0^{10}\left(\frac{1}{3}t^3 - 10t^2 + 100t\right)dt$

$\therefore x = \frac{48}{200}\left[\frac{1}{12}t^4 - \frac{10}{3}t^3 + \frac{100}{2}t^2\right]_0^{10}$

$\therefore x = 600\,m$

(9) $m = 900 kg$

$\xrightarrow{+} \Sigma F = ma: \quad 3000 - 30V = 900a$

$\therefore 900 \frac{dv}{dt} = 3000 - 30V$

$\therefore \frac{900}{3000 - 30V} dv = dt$

$\therefore \int_0^V \frac{30}{100 - V} dv = \int_0^t dt$

$\therefore -30 \ln(100 - V)\Big|_0^V = t$

$30[\ln 100 - \ln(100 - V)] = t \quad -①$

If $V = 5\ m.s^{-1}$: $t = 1,54\ s$

From ①: $\ln\left[\frac{100 - V}{100}\right] = -\frac{1}{30}t$

$\therefore \frac{100 - V}{100} = e^{-\frac{1}{30}t}$

$\therefore V = 100[1 - e^{-\frac{1}{30}t}]$

$\therefore dx = 100\int_0^{1,54}[1 - e^{-\frac{1}{30}t}]\, dt$

$\therefore x = 100[t - (-30e^{-\frac{1}{30}t})]\Big|_0^{1,54}$

$x = 3,88\ m$

No resistance.

$\xrightarrow{+} \Sigma F = ma: \quad 3000 = 900a$

$\therefore \int_0^V dv = \frac{100}{3}\int_0^t dt$

$\therefore V = \frac{10}{3}t \quad -①$

$\therefore x = \frac{10}{6}t^2 \quad -②$

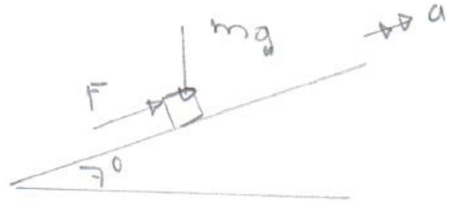
If $V = 5\ m.s^{-1}$

①: $t = 1,5\ s$

②: $x = 3,75\ m\ s^{-1}$

Miscellaneous exercise 4

(2)(a) $\xrightarrow{+}$) $\Sigma F = ma$



$$150e^{-\frac{1}{30}t} - 60(10)\sin 7^\circ = 60a$$

$$\therefore \quad a \equiv \frac{dv}{dt} = 2{,}5e^{-\frac{1}{30}t} - 1{,}2$$

(b) $$\int_0^v dv = \int_0^{12} \left[2{,}5e^{-\frac{1}{30}t} - 1{,}2\right] dt$$

$$v = \left[-30(2{,}5)e^{-\frac{1}{30}t} - 1{,}2t\right]_0^{12}$$

$$v = 10{,}3 \text{ m s}^{-1}$$

The driving force decays with time