(15) $a(t) = 4(t+3)^2$, $v_0 = -1$, $x_0 = 1$

$$\frac{dv}{dt} = 4(t+3)^2 \rightarrow dv = 4(t+3)^2\,dt$$

$$\int dv = 4\int (t+3)^2\,dt \rightarrow v = 4\int (t+3)^2\,dt$$

$u = t+3$

$dw = dt$

$$v = 4\int w^2\,dw$$

$$v = 4\,\frac{w^3}{3} + c_1$$

$$v = \frac{4(t+3)^3}{3} + c_1$$

$$-1 = \frac{4(0+3)^3}{3} + c_1 \rightarrow -1 = \frac{4(27)}{3} + c_1$$

$$-1 = 4(9) + c_1 \rightarrow -1 = 36 + c_1 \rightarrow -1-36 = c_1$$

$$-37 = c_1$$

$$v = \frac{4(t+3)^3}{3} + 37$$

$$\frac{dx}{dt} = \frac{4(t+3)^3}{3} - 37 \rightarrow \int dx = \frac{4}{3}\int (t+3)^3\,dt - \int 37\,dt$$

$$x = \frac{4}{3}\int (t-3)^3\,dt - \int 37\,dt$$

$$x = \frac{4}{3}\frac{u^4}{4} - 37t + C_2$$

$$x = \frac{(t-3)^4}{3} - 37t + C_2$$

$$1 = \frac{(0-3)^4}{3} - 37(0) + C_2$$

$$1 = 81 + C_2 \rightarrow 1 - 81 = C_2$$

$$-80 = C_2$$

$$\underline{x = \frac{(t-3)^4}{3} - 37t - 80}$$

(16) $a(t) = \frac{1}{\sqrt{t+4}}$, $v_0 = -1$, $x_0 = 1$

$u = t+4$ $\quad du = dt$ $\quad \frac{dv}{dt} = \frac{1}{\sqrt{t+4}} \rightarrow dv = \frac{dt}{\sqrt{t+4}}$

$$v = \int \frac{dt}{\sqrt{t+4}} \rightarrow v = \int \frac{du}{\sqrt{u}} \rightarrow v = \int u^{-1/2}\,du$$

$$v = 2\sqrt{u} + C_1 \rightarrow v = 2\sqrt{t+4} + C_1$$

$$-1 = 2\sqrt{0+4} + C_1 \rightarrow -1 = 4 + C_1$$

$-5 = C_1$

$v = 2\sqrt{t+4} - 5$

$\frac{dx}{dt} = 2\sqrt{t+4} - 5$

$dx = dt(2\sqrt{t+4} - 5)$

$x = 2\int \sqrt{t+4}\, dt - 5\int dt$

$x = 2\int \sqrt{w}\, dw - 5t$

$x = 2\, w^{3/2} \cdot \frac{2}{3} - 5t \rightarrow x = \frac{4(t+4)^{3/2}}{3} - 5t + C_2$

$1 = \frac{4(0+4)^{3/2}}{3} - 5(0) + C_2$

$1 = \frac{4(4)^{3/2}}{3} + C_2$

$3 = 8\sqrt{2} + C_2 \rightarrow \frac{3}{8\sqrt{2}} = C_2$

$\frac{3\sqrt{2}}{16} = C_2 \rightarrow x = \frac{4(t+4)^{3/2}}{3} - 5t + \frac{3\sqrt{2}}{16}$

$1 + \frac{1}{2} = \frac{2+1}{2} = \frac{3}{2}$

(17) $a(t) = \frac{1}{(t+1)^3}$, $v_0 = 0$, $x_0 = 0$

$u = t+1$
$du = dt$

$\int dv = \int \frac{1}{u^3} du \rightarrow v = \int u^{-3} du$

$v = -\frac{u^{-2}}{2} + C_1 \rightarrow v = -\frac{1}{2(t-1)^2} + C_1$

$0 = -\frac{1}{2(0-1)^2} + C_1 \rightarrow 0 = -\frac{1}{2} + C_1$

$\frac{1}{2} = C_1$

$v = -\frac{1}{2(t-1)^2} + \frac{1}{2}$

$\frac{dx}{dt} = -\frac{1}{2(t-1)^2} + \frac{1}{2} \rightarrow x = -\frac{1}{2}\int \frac{1}{(t-1)^2} dt + \frac{1}{2}\int dt$

$x = -\frac{1}{2}\int u^{-2} du + \frac{1}{2}t$

$x = -\frac{1}{2}\left(\frac{u^{-1}}{-1}\right) + \frac{1}{2}t + C_2$

$x = \frac{1}{2u} + \frac{1}{2}t + C_2$

$$x = \frac{1}{2(t-1)} + \frac{1}{2}t + C_2$$

$$0 = \frac{1}{2(0-1)} + \frac{1}{2}(0) + C_2$$

$$0 = -\frac{1}{2} + C_2$$

$$\frac{1}{2} = C_2 \rightarrow \boxed{x = \frac{1}{2(t-1)} + \frac{1}{2}t + \frac{1}{2}}$$

-7+1

(10) $a(t) = 50 \operatorname{sen} 5t$, $v_0 = -10$, $x_0 = 8$

$$\frac{dv}{dt} = 50 \operatorname{sen}(5t) \rightarrow v = 50 \int \operatorname{sen}(5t)\, dt$$

$w = 5t$

$dw = 5\,dt$

$\frac{dw}{5} = dt$

$$v = \frac{50}{5} \int \operatorname{sen} w\, dw$$

$$v = 10(-\cos w)$$

$$v = -10\cos(5t) + C_1$$

$$-10 = -10\cos 0 + C_1$$

$$-10 = -10 + C_1$$

$$0 = C_1$$

$$v = -10\cos 5t$$

$$\frac{dx}{dt} = -10\cos 5t$$

$$x = -10\int \cos 5t\, dt$$

$w = 5t$

$dw = 5\,dt$

$\frac{dw}{5} = dt$

$$x = -10\int \frac{\cos w}{5}\, dw$$

$$x = -2\int \cos w\, dw$$

$$x = -2\operatorname{sen} w\, dw$$

$$x = -2\operatorname{sen} 5t + C_2$$

$$8 = -2\operatorname{sen} 5(0) + C_2$$

$$8 = C_2$$

$$x = -2\operatorname{sen} 5t + 8$$

(25) $v_0 = 100 km/h \quad x_0 = 0$

$a = 10 m/s^2$

$$100\frac{km}{h} * \frac{1000m}{1km} * \frac{1h}{60min} * \frac{1min}{60s} =$$

$v_0 = 27.7777 m/s$

$$\frac{dv}{dt} = 10 \rightarrow dv = 10\,dt \rightarrow v = \int 10\,dt$$

$v = -10t + C_1 \rightarrow 27.7777 = 10(0) = C_1$

$C_1 = 27.7777$

$v = -10t + 27.7777$

$x = -\int 10t\,dt + 27.7777 \int dt$

$x = -\frac{10t^2}{2} + 27.78t + C_2$

$x = -5t^2 + 27.78t + C_2$

$0 = C_2$

$x = -5t^2 + 27.78t$

$0 = -10t + 27.78$

$\frac{-27.78}{-10} = t$

$2.778s = t$

$$X = -(5)(2.778) + 27.78$$

$$X = 13.89\ m$$

Antes de detenerce el vehiculo recorre 13.89 m

(26) $a = -9.8\ m/s^2 \quad x_0 = 20$

$v_0 = 100\ m/s$

$$\frac{dv}{dt} = -9.8 \rightarrow dv = -9.8\,dt$$

$$v = -9.8 \int dt \Rightarrow v = -9.8t + C_1$$

$$100 = -9.8(0) + C_1$$

$$100 = C_1$$

$$v = -9.8t + 100$$

$$x = -9.8 \int t + 100 \int dt$$

$$x = \frac{-9.8t^2}{2} + 100t + C_2$$

$$x = -4.9t^2 + 100t + C_2$$

$$20 = C_2$$

$X = -4.9t^2 + 100t + 20$

$V = -9.8t + 100$

$0 = -9.8t + 100$

$\frac{-100}{-9.8} = t \Rightarrow t = 10.2040\ (s)$

9100

$X = -4.9(10.2040)^2 + 100(10.2040) + 20$

$X = 530.2040\ m$

a) La altura maxima es de 530.2040 m

$20 = -4.9t^2 + 100t + 20$

$0 = -4.9t^2 + 100t$

$4.9t^2 = 100t \Rightarrow \frac{t^2}{t} = \frac{100}{4.9}$

530.2040
99.999
101.99

$t = 20.4081$

b) Despues de 20.4081 segundos

$0 = -4.9t^2 + 100t + 20$

$t = 20.6062\ (s)$

c) el tiempo total en el aire es de 20.6062 (s)

(27) $v_0 = 10 m/s$ $vf = 60 m/s$

$a = -9.8 m/s^2$

$v = -9.8 \int dt \Rightarrow v = -9.8t + C_1$

$-10 = C_1$

$v = -9.8t - 10$

$x = -9.8 \int t\,dt + 10 \int dt$

$x = \frac{-9.8t^2}{2} - 10t + C_2$

$x = -4.9t^2 - 10t + C_2$

$-60 = -9.8t - 10$

$\frac{-50}{-9.8} = t$

$5.1020 = t$

$0 = -4.9(5.1020)^2 - 10(5.1020) + C_2$

$0 = -178.5689 + C_2$

$178.5689 \rightarrow x = -4.9(t)^2 - 10t + 178.5689$

$X_0 = -4.9(0) - 10(0) + 178.5689$

$X_0 = 178.5689$

La altura del edificio es de 178.5689 cm

28) $X_0 = 555\ ft$

$V_0 = 40\ ft/s$

$a = -32.16\ ft/s^2$

$\frac{dv}{dt} = -32.16 \Rightarrow v = \int 32.16\, dt$

$v = -32.16t + C_1$

$40 = C_1 \rightarrow v = -32.16t + 40$

$\frac{dx}{dt} = -32.16t + 40$

$x = \int (32.16t + 40)\, dt$

$x = 32.16 \int t\, dt + (-40) \int dt$

$x = \frac{-32.16t^2}{2} + (-40)t$

$x = -16.08t^2 + 40t + C_2$

$555 = C_2 \rightarrow x = -16.08t^2 + 40t + 555$

$0 = 16.08t^2 + 40t + 555$

$t_1 = 4.7613\,(s)$

$V = -32.16(4.7613) - 40$

$V = -193.1234\,ft/s$

Tardara en llegar 4.7613 (s) y con una velocidad de 193.1234 ft/s