Part 1: Engine

Givens:
$a = -.7t^2 + 18$ m/s^2
$t = 5.8$ s

Needs:
velocity, position

$$a = -0.7t^2 + 18$$

$$\int_0^{5.8} -0.7t^2 + 18 \, dt = \text{velocity}$$

$$-7/3 t^3 + 18t$$

$$\int_0^{5.8} -7/3 t^3 + 18t = \text{position}$$

$7/10 \cdot 1/3 = 7/30$

$7/30 \cdot 1/4 = 7/120$

$$-7/3/4 t^4 + 9t^2 \Big|_0^{5.8}$$

$$-\frac{7}{120} t^4$$

$$-7/120 t^4 + 9t^2 \Big|_0^{5.8}$$

$$-\frac{7}{120}(5.8)^4 + 9(5.8)^2$$

position = 236.7471067
velocity = 58.87388667 m/s
time = 5.8 sec

Part 2: Freefall

Givens:

$a = -9.8$ m/s^2
$V = 0$
$V_0 \approx 58.87$ m/s
$x_0 \approx 236.75$ m

Needs:
time, Δx,

1a. Before maximum

$$\frac{V - V_0}{a} = t$$

$$\frac{0 - 58.87388667}{-9.8} = t$$

$$t = 6.007537415$$

$$\Delta x = \left(\frac{58.87388667 + 0}{2}\right)(6.007537415)$$

$$\Delta x = 176.8434785$$

2a. After maximum

$$v^2 = v_0^2 + 2a\Delta x$$

$$v^2 = 0^2 + 2(-9.8)(145)$$

$$v^2 = -2842$$

$$v = -53.31041174$$

$$t = \frac{v - v_0}{a}$$

$$t = \frac{-53.31041174}{-9.8}$$

$$t = 5.439837933$$

Givens:

$a = -9.8$

$v_0 = 0$

$x_0 \approx 413.59$

$\Delta x = 145$

Need

time, velocity (end)

Part 3: Parachute

$$\int -22(1 - e^{-t/10})$$

$$\int_0^t -22 + 22e^{-t/10}$$

$$-22t - (220)e^{-t/10}\Big|_0^t$$

$$-220e^{0}$$

$$-22t - 220e^{-t/10} + 220 + 268.5905852$$

(Desmos)

$$t = 20.98188$$

Given:

$v_0 \approx -53.31$

$v_p = -22(1 - e^{-t/10})$ m/s

$v = 0$

$\Delta x \approx 268.59$

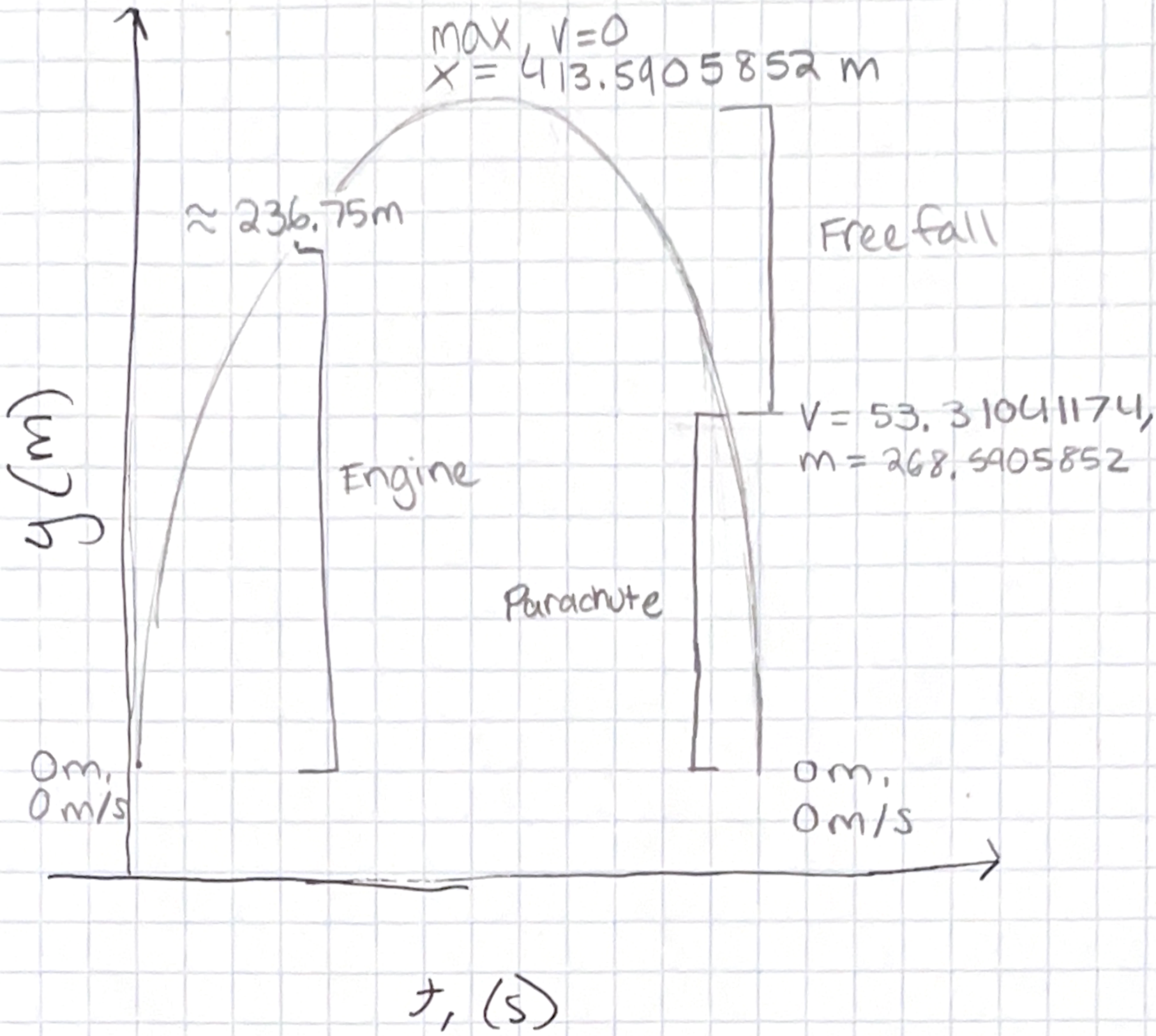
Need

time

Part 4: Total

$5.8 + 6.007537415 + 5.439837933 + 20.98188 = 38.231$

model:


max, v=0
x = 413.59058 52 m
≈ 236.75m
Free fall
Engine
V = 53.3104 1174,
m = 268.5905852
Parachute
y (m)
0m,
0 m/s
0m,
0 m/s
t, (s)