Problem 1

we know

$$m_{eqdt} = \frac{[(G_{RAX}\, G_{RTRAN})^2 (I_e + I_{TRAN}) + G_{RAX}^2 I_D + I_{RW}}{R_{TR}^2}$$

we have all the required values in the given spec sheet.

use the matlab code attached to find the different m_{eq} for the drive train.

problem 2

$$(m + m_{eqf} + m_{eqdt})\ddot{x} = \frac{G_{RAX}\, G_{RTran}\, T_e}{R_{TR}} \cdot \eta - f_r mg - \frac{1}{2} \rho C_D A \dot{x}^2$$

we need to convert the engine speed to road speed using

$$\dot{x} = \frac{R_{TR}}{G_{RAX} \cdot G_{RTran}} \dot{\theta}_e \quad (\text{engin speed in rad/s})$$

$$RPM \times \frac{2\pi}{60} = \frac{rad}{s}$$

$$m_{eqf} = \frac{2 I_{TF}}{R_{TF}^2}$$

$\eta = 1$

$C_d = 1.2578$ (standard air density)

$g = 9.81\ m/s^2$

$$\ddot{x} = \frac{G_{RAX} \cdot G_{RTran} \cdot T_e \cdot \eta(1) - f_r mg - \frac{1}{2} \rho C_D A \dot{x}^2}{(m + m_{eqf} + m_{eqdt})}$$

use the matlab code to find and plot the $\ddot{x}$

Problem 3
Based on the plot of problem 2

Gr(1) ≈ 0 - 50mph
Gr 2 ≈ 50 - 80mph
Gr 3 ≈ 70 - 100 mph
Gr 4 ≈ 100 - 120mph
Gr 5 ≈ 120 - 160
Gr 6 ≈ 160 - 200
Gr 7 ≈ 200 - 225
Gr 8 ≈ don't really use it. use it

Problem 4

10mph - Gr(1) - 0.5956 g's
30mph - Gr(2) - 1.4335 g's
60mph - Gr(2) - 1.0020 g's
100 mph - Gr(4) - 0.5569 g's
150mph - G(5) - 0.3106 g's