P6.2-3) A RWD 2011 Corvette Coupe's technical specifications are listed below. Assuming that the air drag is constant, applied at the center of mass, and equal to 100 lb and the rolling resistance coefficient is f_r = 0.014, what is the car's maximum acceleration on level ground and driving uphill on a road with a 10% grade? Estimate the friction characteristics as that between rubber and dry asphalt and note that the total rolling resistance is equal to $R_r = f_r W$.

Given:

- Curb weight: W = 3175 lb
- Wheel base: L = 105.7 in (Distance between the axles.)
- CG height: h = 19.8 in
- Rear wheel drive
- Weight distribution: 51/49 f/r (%)

Find:

Solution:

Free-body diagram

Draw a free-body diagram of the car.

Hill angle

What is the angle of the incline in degrees?

θ = _____

Equilibrium

Use the weight distribution to determine the location of the C.G. Indicate these measurements on the free-body diagram.

l_1 = _____

l_2 = _____

Tractive Force

Write down the variable equation for the maximum tractive force before the car's rear wheels slip.

F_T = _____

Equation of Motion

Use Euler's second law to derive the normal force (in variable form) on the rear wheels for the uphill incline case.

N_{rear} = _____

Use Newton's second law to derive the normal force (in variable form) on the rear wheels for the uphill incline case.

N_{rear} = _____

Acceleration

Calculate the maximum acceleration of the car.

a (incline) = _____

a (flat) = _____