Table of Contents

Clear Workspace

```
close all;
clear;
clc;
```

Given Data

```
w = 4e4*4.448; % Weight (N)
m = w/9.81; % Mass (kg)
l = 15/3.281; % Wheelbase (m)
a = 0.6*l; % Length of CG from front axle (m) for 40% front load
b = 0.4*l; % Length of CG from rear axle (m) for 40% front load
d = 4/3.281; % Length of front axle from snowplow (m)
v = 50/2.237; % Velocity (m/s)
R = 500/3.281; % Turning radius
Fs = 1000*4.448; % Snow force (N)
```

3A.A

```
dA = atan2(l,R);
fprintf('Ans 3A.A: The Ackerman steering angle (dA) is %f rad\n\n',dA)
```

Ans 3A.A: The Ackerman steering angle (dA) is 0.029991 rad

3A.B

```
ay = v^2/R;
fprintf('Ans 3A.B: The lateral acceleration (ay) is %f m/s^2\n\n',ay)
```

Ans 3A.B: The lateral acceleration (ay) is 3.278267 m/s^2

3A.C

```
r = v/R;
fprintf('Ans 3A.C: The yaw rate (r) is %f rad/s\n\n',r)
```

Ans 3A.C: The yaw rate (r) is 0.146670 rad/s

3A.D

```
Fy = m*ay;
Fyfr = [1,1;-a,b]\[(Fs+Fy);-Fs*(a+d)];
Fyf = Fyfr(1);
fprintf('Ans 3A.D: The front lateral force (Fyf) is %f N\n\n',Fyf)
```

Ans 3A.D: The front lateral force (Fyf) is 29416.771056 N

3A.E

```
Fyr = Fyfr(2);
fprintf('Ans 3A.E: The rear lateral force (Fyr) is %f N\n\n',Fyr)
```

Ans 3A.E: The rear lateral force (Fyr) is 34487.823251 N

3A.F

```
Cf = 2*(0.2196*(0.5*0.4*(w/4.448)) -
 (7.35e-6*(0.5*0.4*(w/4.448))^2))*4.448*(180/pi);
af = Fyf/Cf;
fprintf('Ans 3A.F: The front slip angle (af) is %f rad\n\n',af)
```

Ans 3A.F: The front slip angle (af) is 0.044864 rad

3A.G

```
Cr = 2*(0.2196*(0.5*0.6*(w/4.448)) -
 (7.35e-6*(0.5*0.6*(w/4.448))^2))*4.448*(180/pi);
ar = Fyr/Cr;
fprintf('Ans 3A.G: The rear slip angle (ar) is %f rad\n\n',ar)
```

Ans 3A.G: The rear slip angle (ar) is 0.042911 rad

3A.H

```
Mz = a*Fyf - b*Fyr;
fprintf('Ans 3A.H: The total yaw moment (Mz) is %f Nm\n\n',Mz)
```

Ans 3A.H: The total yaw moment (Mz) is 17623.895154 Nm

3A.I

```
B = b/R - ar;
fprintf('Ans 3A.I: The vehicle sideslip angle (B) is %f rad\n\n',B)
```

Ans 3A.I: The vehicle sideslip angle (B) is -0.030911 rad

3A.J

```
d = dA + af - ar;
fprintf('Ans 3A.J: The steering angle (d) is %f rad\n\n',d)
```

Ans 3A.J: The steering angle (d) is 0.031944 rad

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