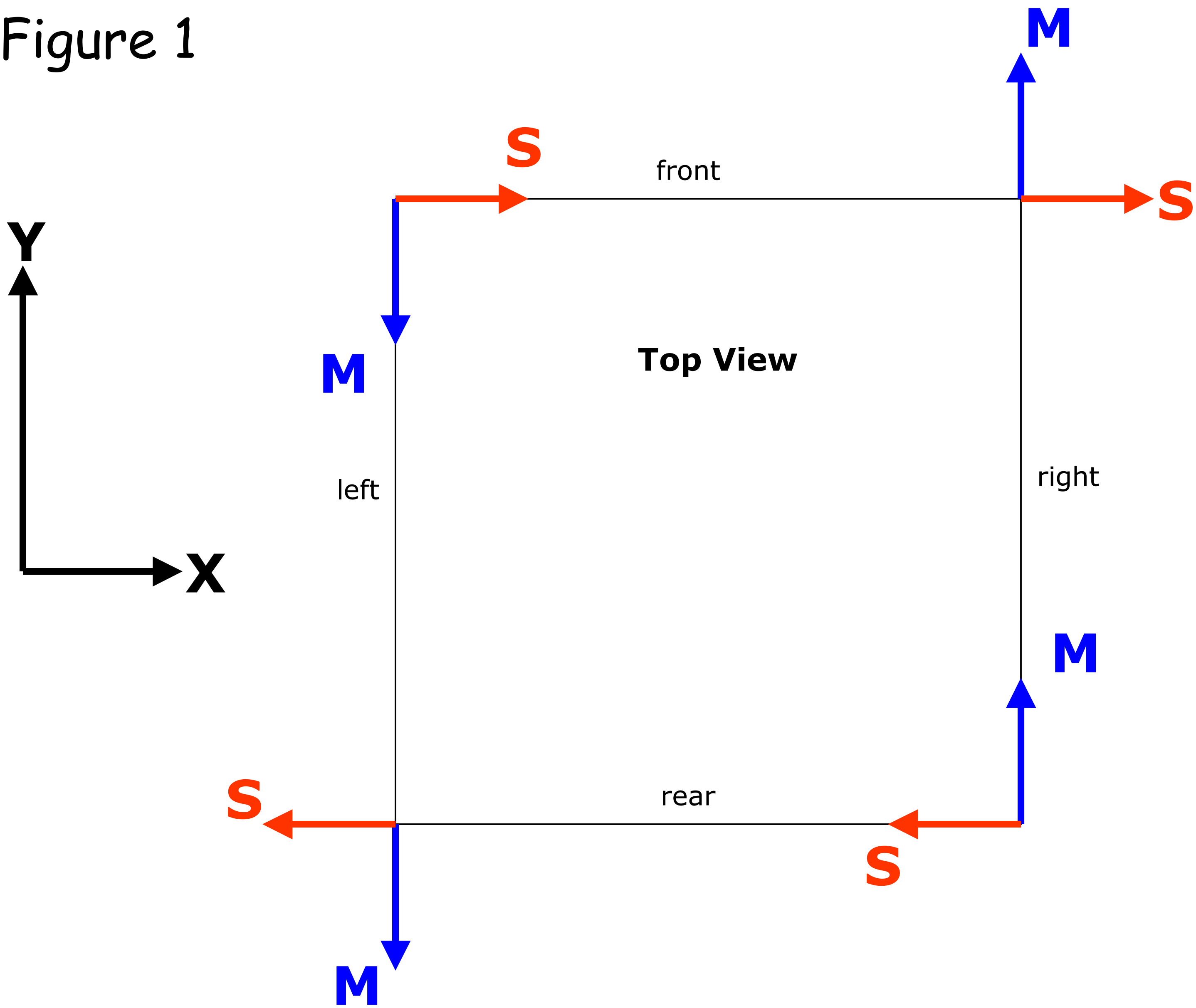
Figure 1



See Figure 1 on previous page.

- square wheel pattern (trackwidth=wheelbase)

- all four wheels identical

- CoM located at CoA

- coefficient of static friction equal in all directions

- same torque magnitude (but opposite direction) driving each side

The vectors M and S on the diagram are the Y and X components, respectively, of the net force that the carpet is exerting in the XY plane on the bottom of each wheel.

The magnitude of M is equal to the driving torque being applied to the wheel divided by the radius of the wheel.

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Proceed as follows:

1) By symmetry, all four M forces are equal to each other in magnitude, and all four S forces are equal to each other in magnitude.

2) To be in equilibrium, the net torque acting on the vehicle must be zero. Therefore M=S.

3) The magnitude of the net force on each wheel is F=sqrt(M^2+S^2)=M*sqrt(2)

4) From symmetry, the normal force N is the same at each wheel, so N=W/4 (W is the vehicle weight).

5) To break the static equilibrium and start the vehicle moving, F must be greater than mu*N:

F > mu*N => M*sqrt(2) > mu*W/4 => M > mu*(W/4)/sqrt(2)

The vehicle will turn when M > mu*(W/4)/sqrt(2), which means the torque on each wheel must be greater than radius*mu*(W/4)/sqrt(2)