February 15, Week 5

Today: Chapter 4, Newton's Laws of Motion

Homework 4, Due February 20.
Mastering Physics: 9 problems from chapters 1 and 3.
Written Question: 3.56

Review

Underlying all three of Newton's Laws is the concept of force.

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Force - Push or Pull

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- S. I. : Newton (N), $1\,N = 0.22\,lb$ (on Earth)

Superposition

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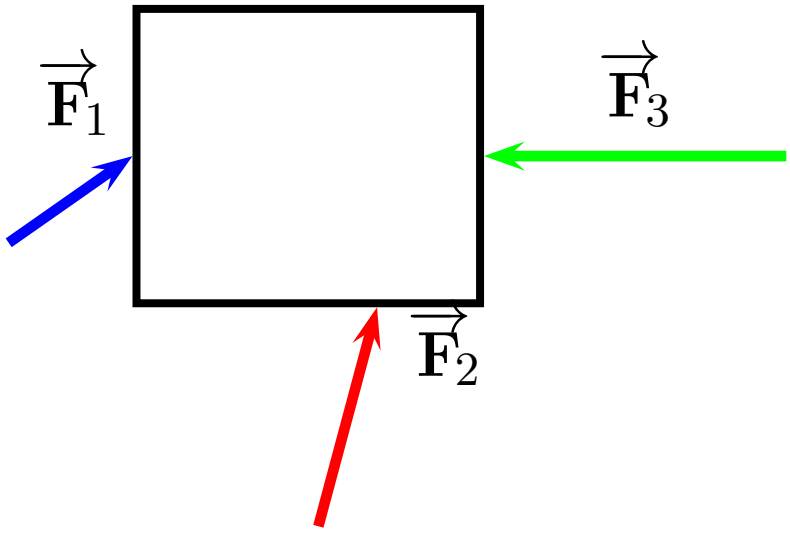

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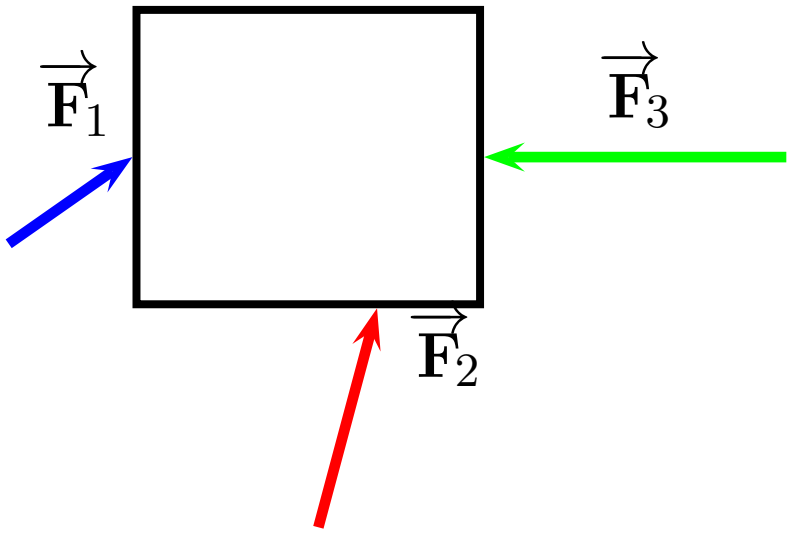

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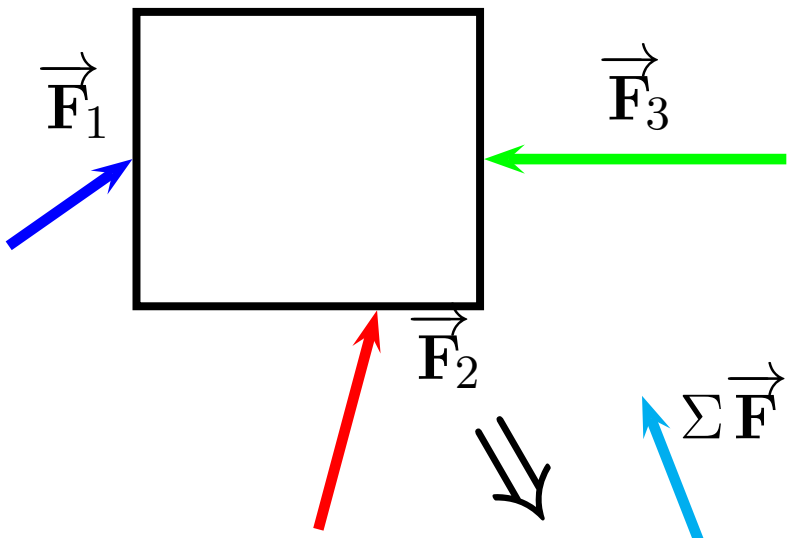

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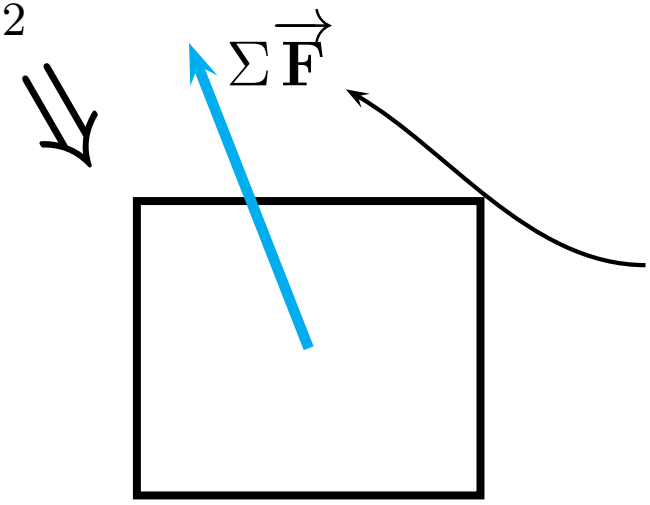

One single force.

Applied at the center

to avoid rotation.

Newton's First Law

First Law - The Law of Inertia

An object at rest stays at rest, an object in uniform motion stays if uniform motion if (and only if) the net force acting on the object is zero.

Uniform motion - Straight line and constant speed, *i.e*, constant velocity.

Inertia - The property of all matter to stay in motion if already in motion; to stay at rest if already at rest.

First Law Example

Example: A $6860\,N$ car is traveling with a constant $30\,m/s$ speed on a straight road. If the engine is exerting a forward $350\,N$ force*, what is the magnitude and direction of all forces acting on the car? (* Not technically correct, but good enough for now.)

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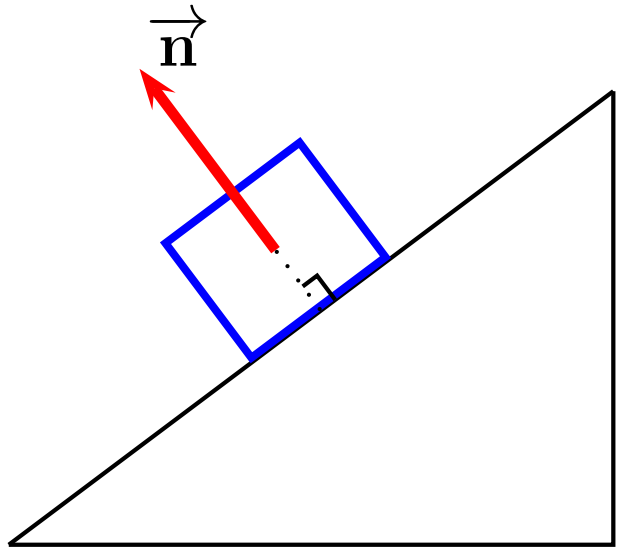

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Free-Body Diagram - f. b. d. sketch of all the *forces* acting on an object using a convenient coordinate system.

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Measure of the amount of matter inside an object

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An object already in motion will not move in the direction of the net force. It will **accelerate** in the direction of the net force.

Clicker Quiz

A $700\,kg$ minivan is traveling at $30\,m/s$ and accelerating at $1\,m/s^2$ on a horizontal road. If there is a $350\,N$ frictional force acting against the car, what force is the engine exerting on the car?

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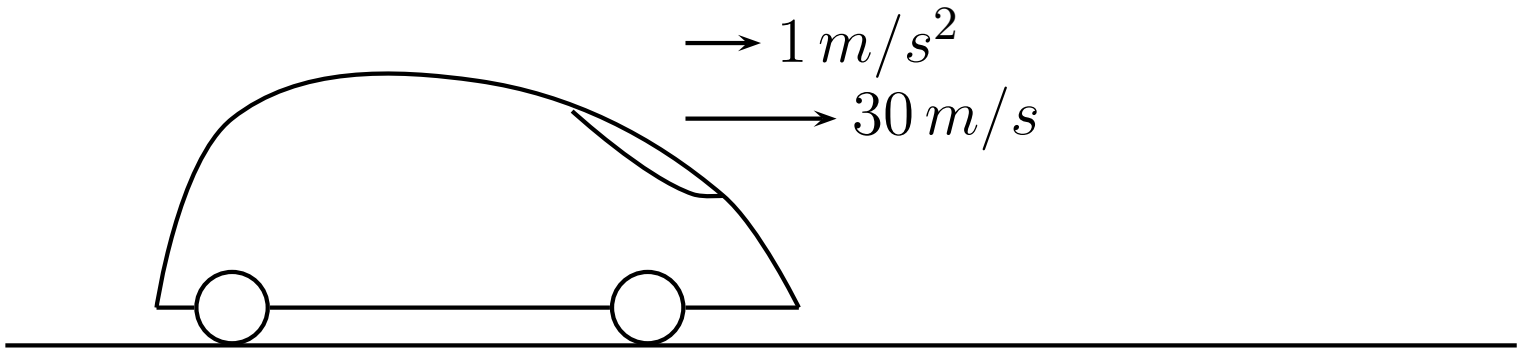

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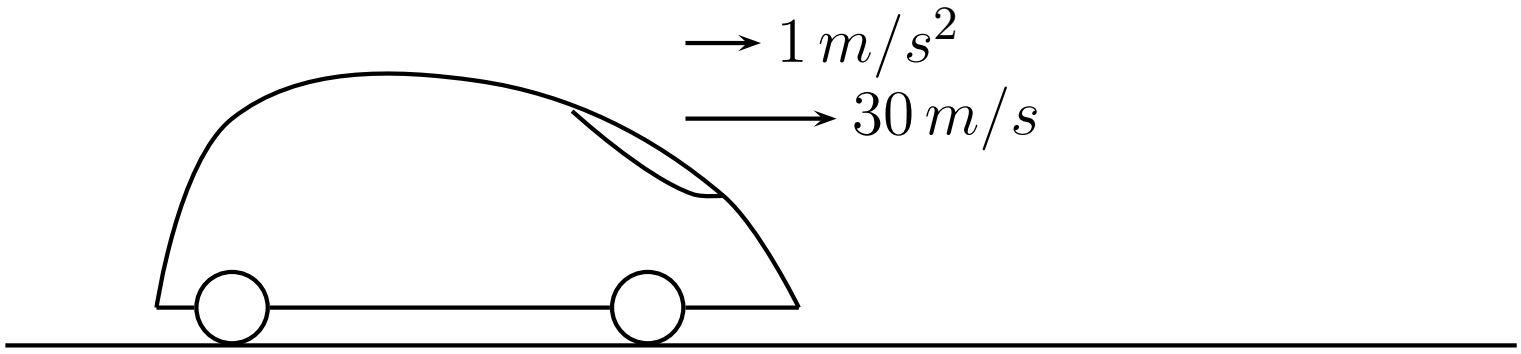

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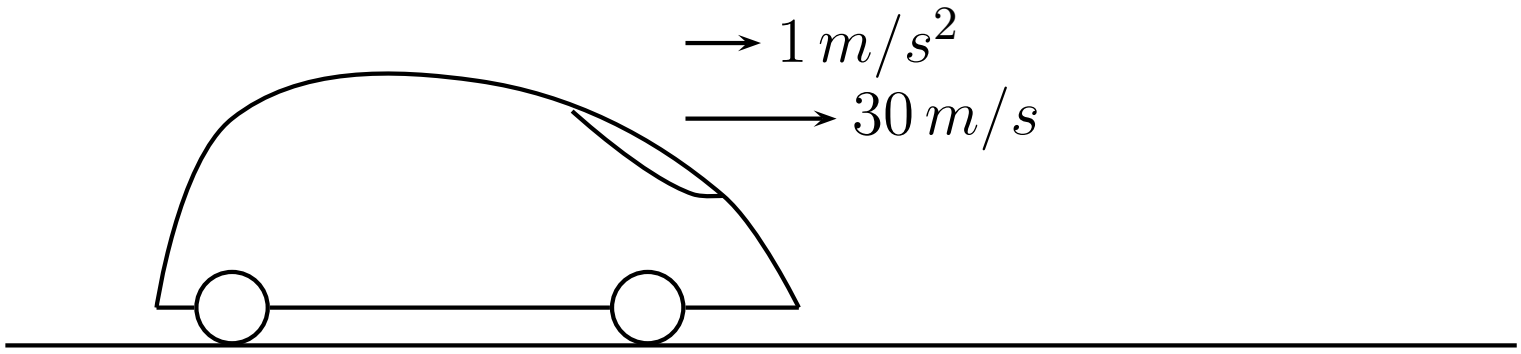

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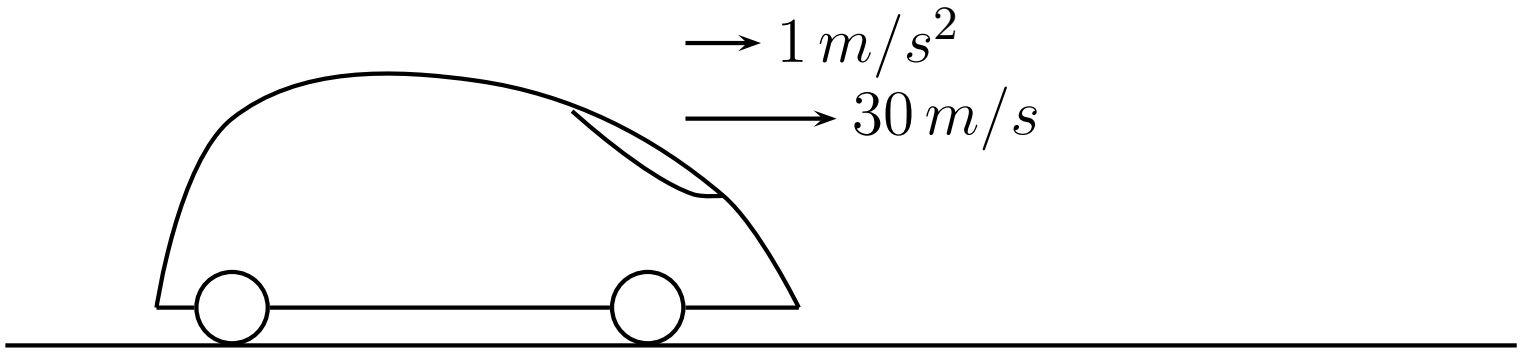

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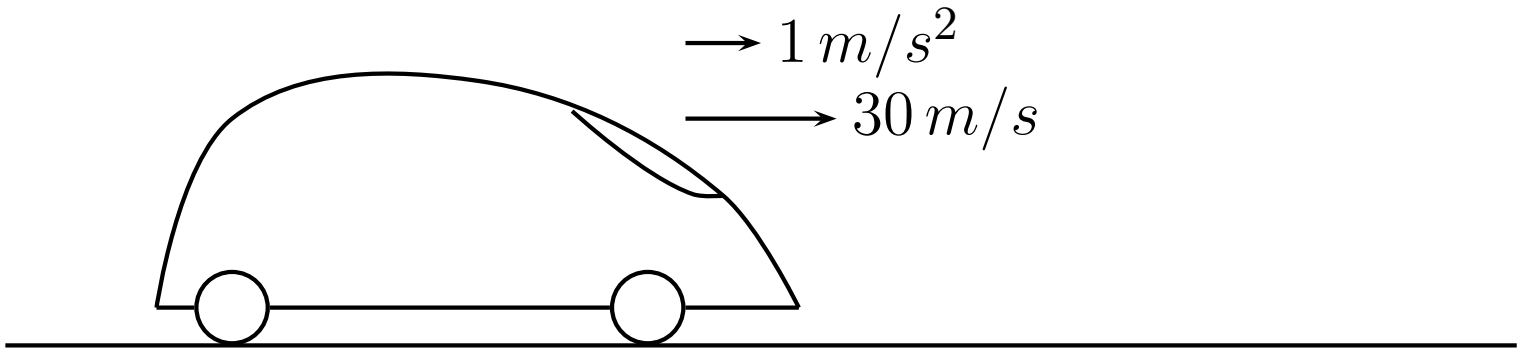

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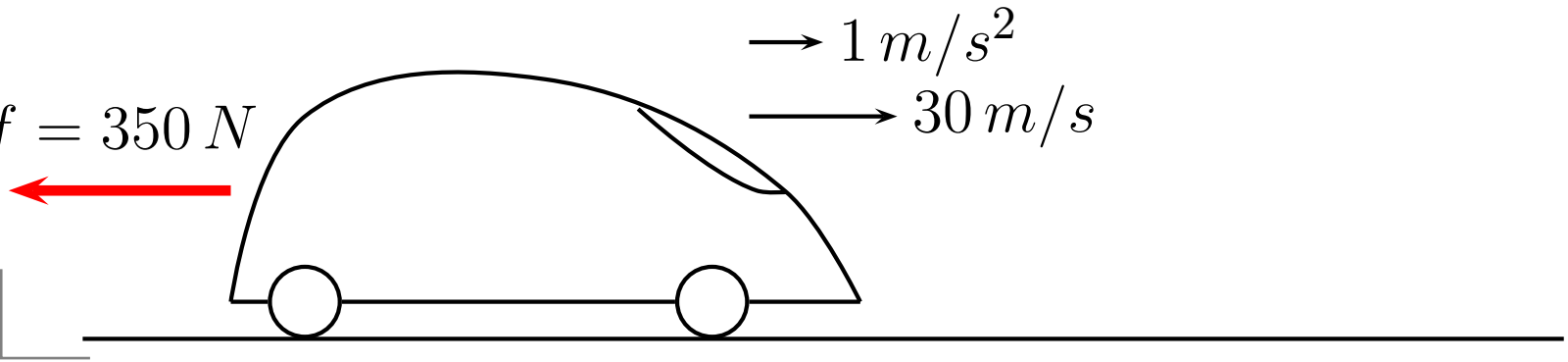

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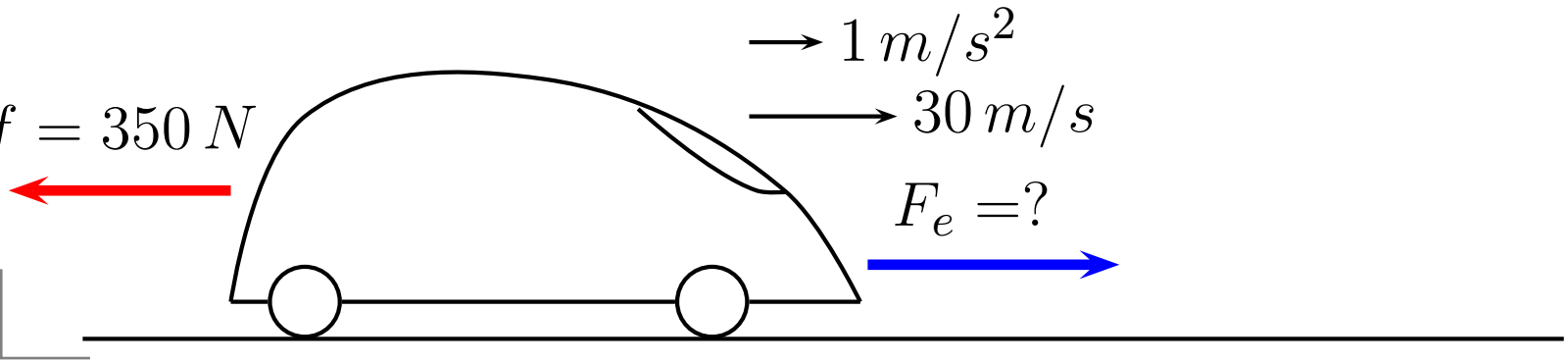

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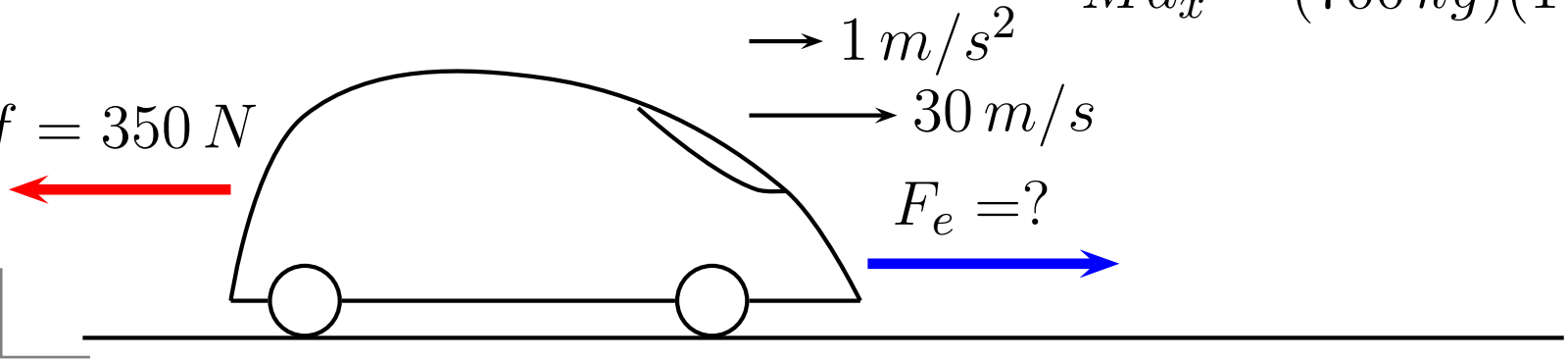

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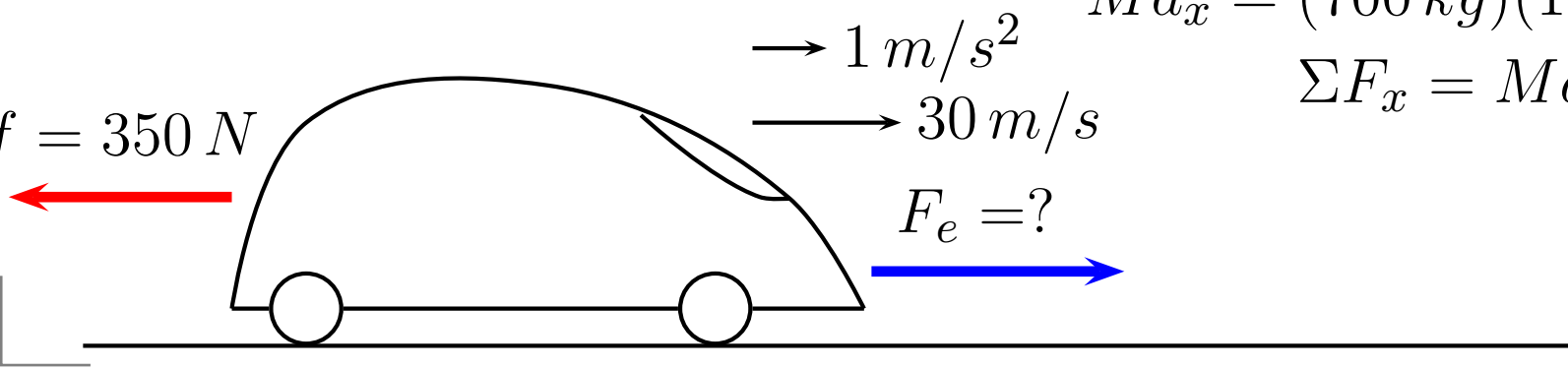

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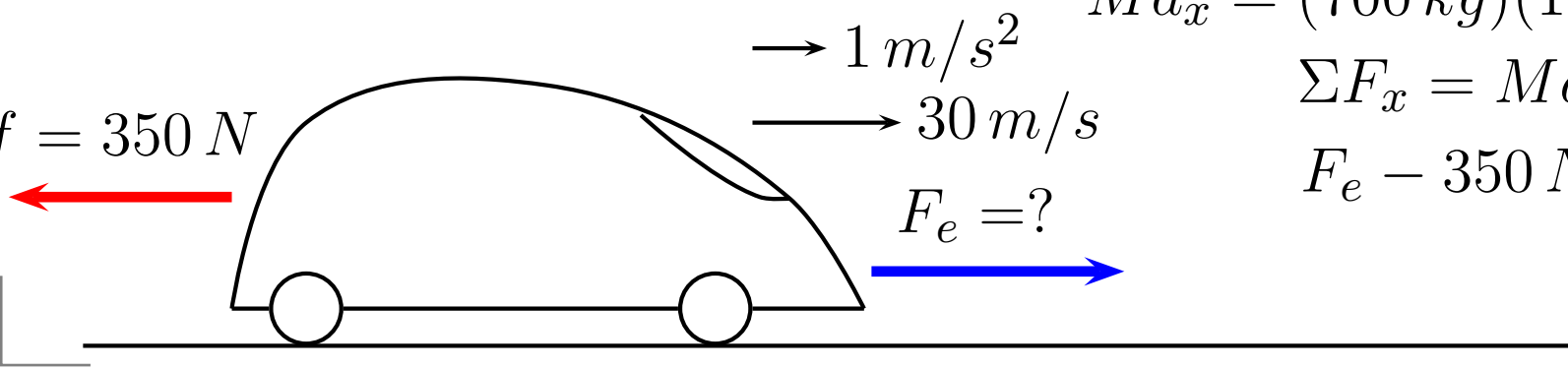

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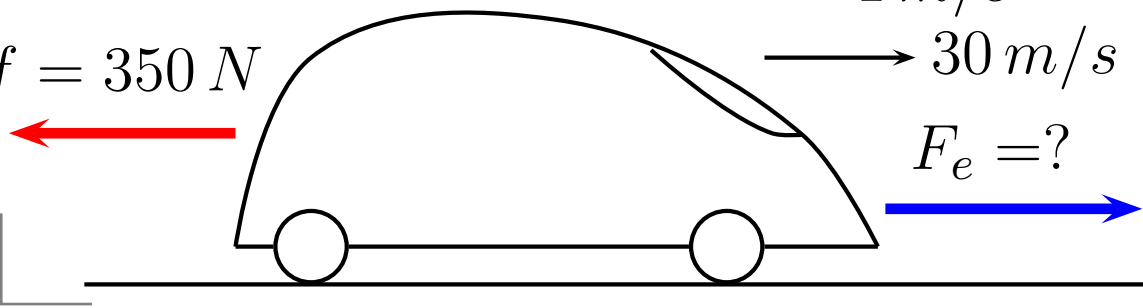

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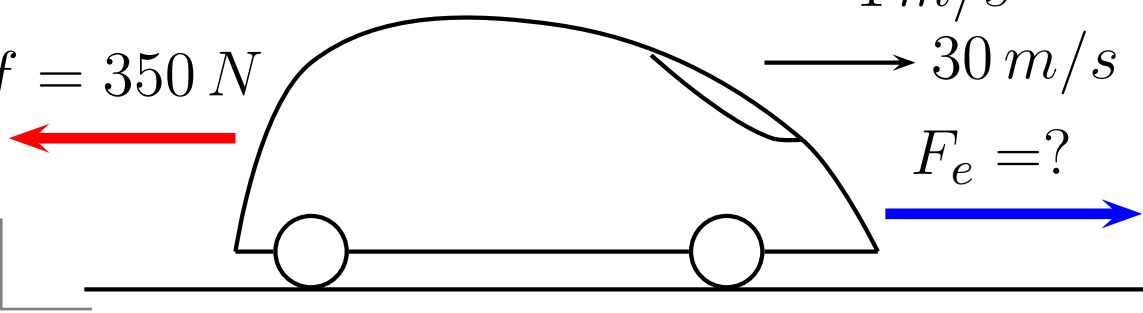

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