The aim of every artist is to arrest motion, which is life, by artificial means and hold it fixed so that a hundred years later, when a stranger looks at it, it moves again since it is life.

William Faulkner

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**SES 194**

# Energy in Everyday Life

Kinematics

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Distance is a familiar quantity. We measure distances with tape measures, odometers, or other measuring devices. Distance measures how far away things are.

Displacement, which might be less familiar, adds information about the direction to how far away something is.
**For example, 300 meters North or 1 cm to the right.**
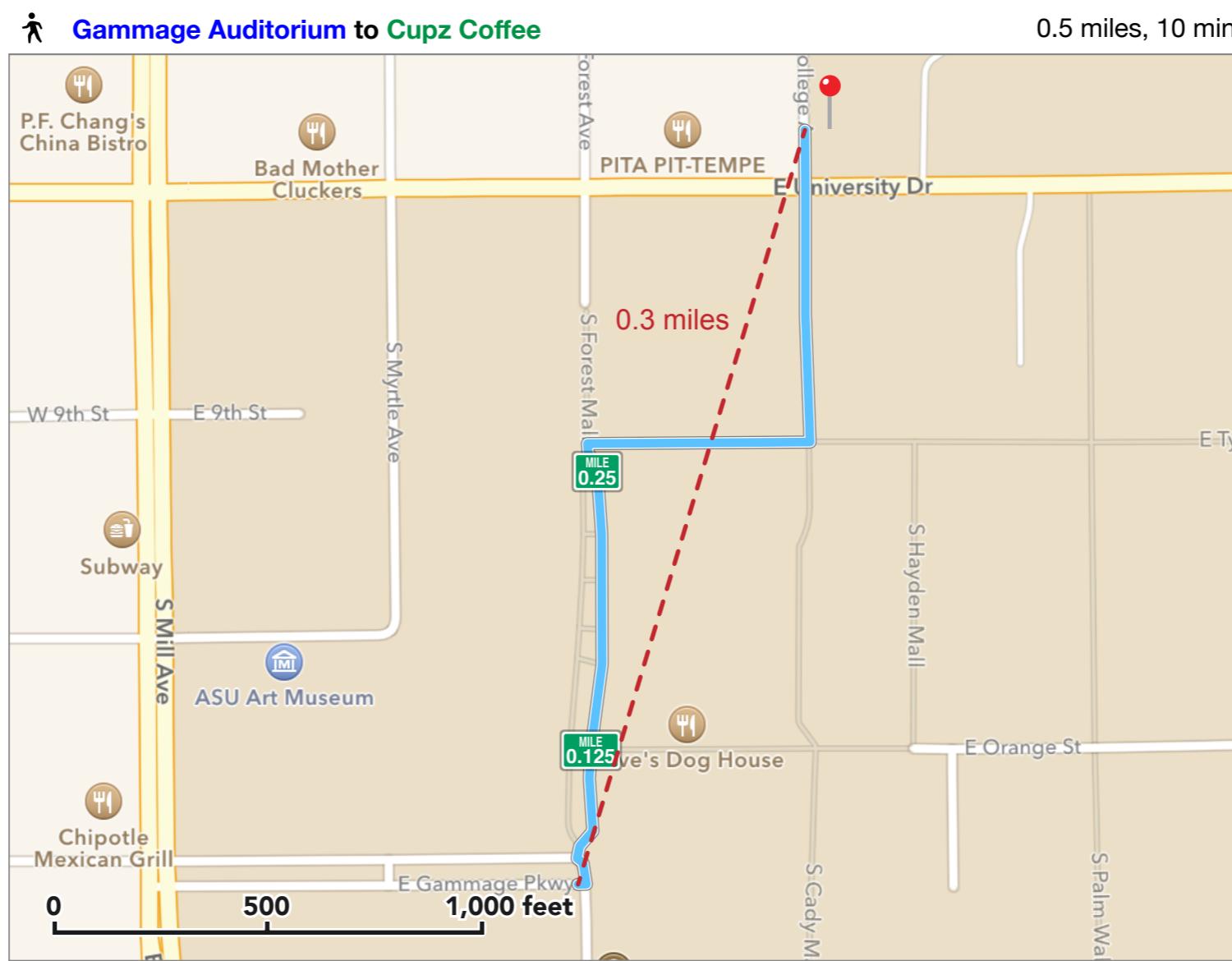
This extra information about direction, essential for everyday life, distinguishes quantities known as "vectors" from quantities specified only by numbers.
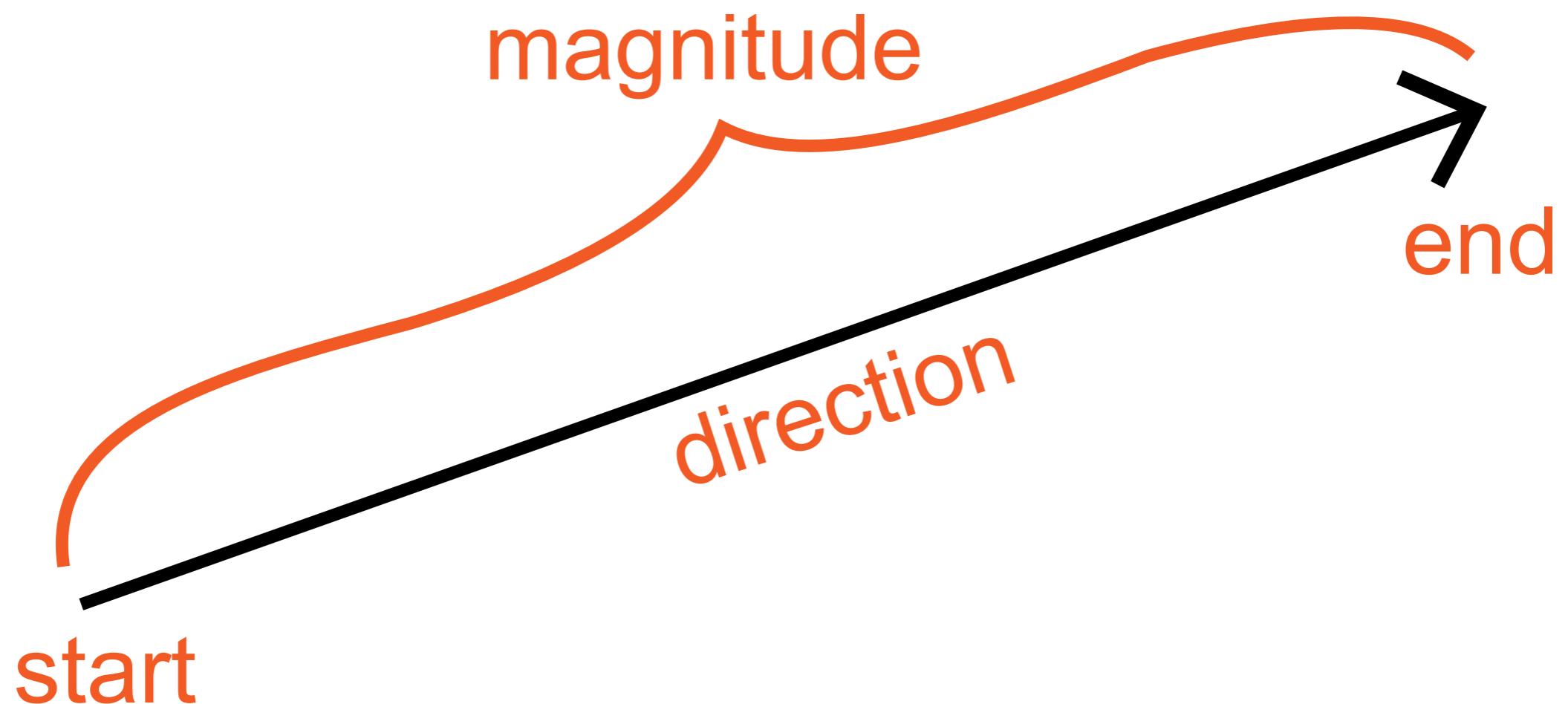
Vectors have a direction and a numeric value.

Distance is just a number. When both the distance and direction from one location to another location are specified, it is a displacement.

Gammage Auditorium to Cupz Coffee — 0.5 miles, 10 min

0.3 miles
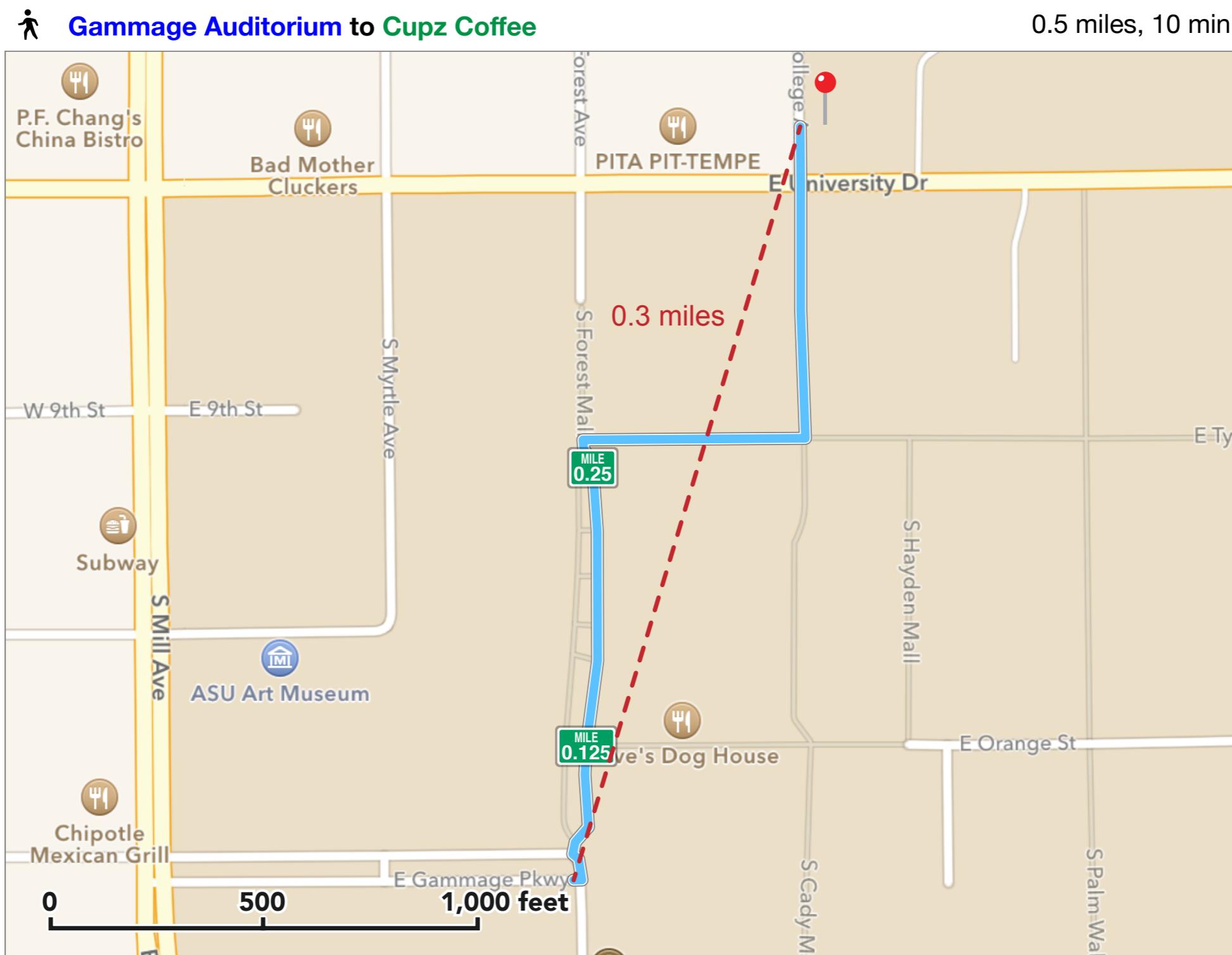
Speed is another familiar quantity. The speedometer in a car tells us how much territory we can cover in given time.

$$\text{speed} = \frac{\text{distance traveled}}{\text{time to travel that distance}}$$
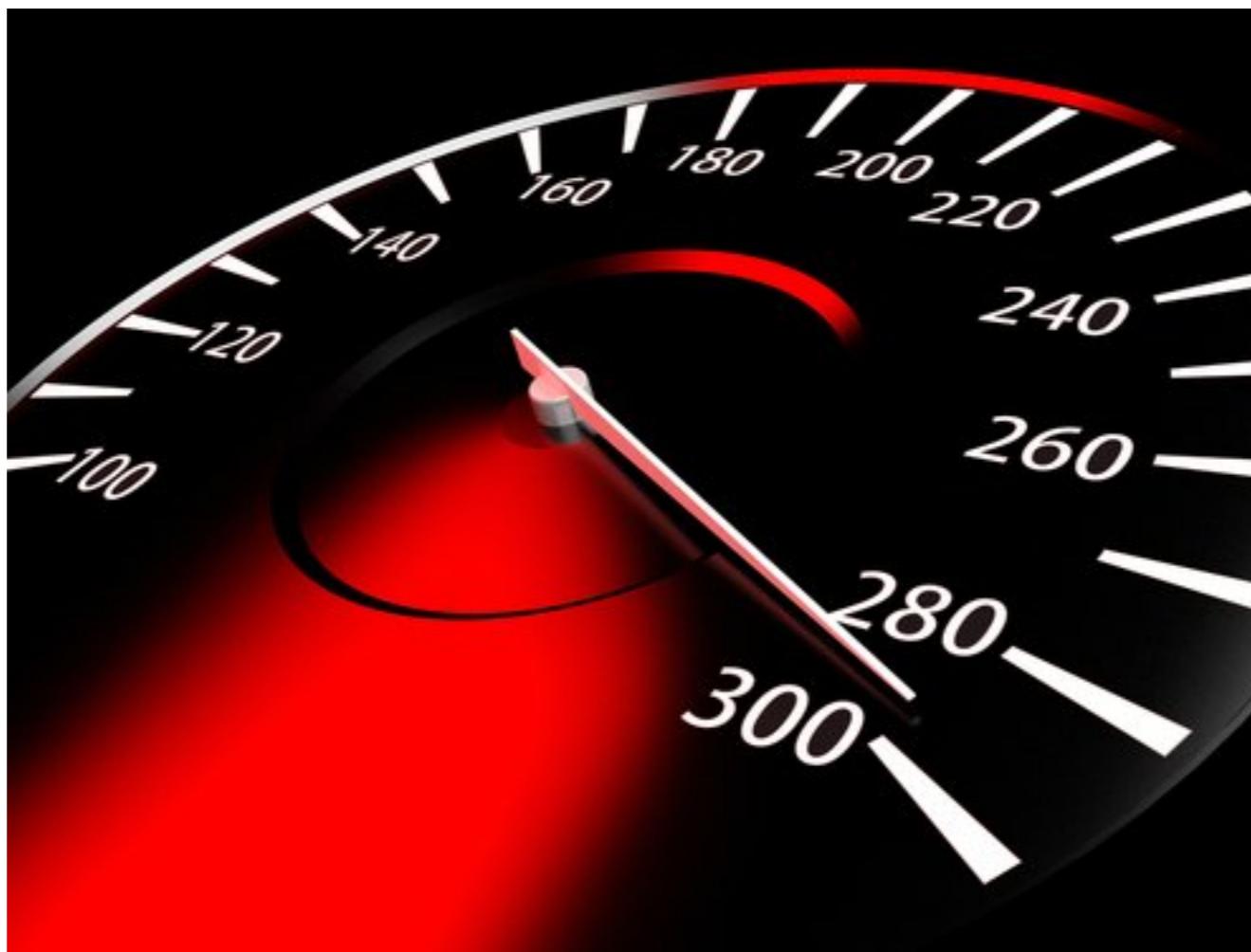
We often use "speed" and "velocity" interchangeably in casual speech. But speed is a scalar - just a number - and velocity is a vector. Specifying a velocity gives the speed and the direction of that speed.

$$\text{velocity} = \frac{\text{displacement}}{\text{time to travel that displacement}}$$

For example, driving 55 mph toward Omaha.

Acceleration is a measure of how rapidly velocity changes.

The "accelerator" is a device that allows you to change the speed of the car. The more it is pushed, the greater the rate at which your speed changes. The car's brakes are also an accelerator since applying they change the car's speed, as is the steering wheel since it changes the car's direction.

$$\text{acceleration} = \frac{\text{change in velocity}}{\text{time to change the velocity}}$$

Acceleration, like velocity and displacement, is a vector. We specify the numeric value of the acceleration and the direction of the change in velocity.