



Flipping Physics Lecture Notes:  
Introduction to Tip-to-Tail Vector Addition, Vectors and Scalars

Slow Velocity Racer: Distance = 1.00 m =  $1.00 \times 10^3$  mm & Time = 23.8 seconds

$$\text{speed} = \frac{\text{distance}}{\text{time}} = \frac{1000\text{mm}}{23.8\text{sec}} = 42.0168 \approx 42 \frac{\text{mm}}{\text{s}}$$

$$\text{speed}_{\text{bottomtrack}} = 42 \frac{\text{mm}}{\text{s}} + 42 \frac{\text{mm}}{\text{s}} = 84 \frac{\text{mm}}{\text{s}}$$

$$\text{speed}_{\text{inthemiddle}} = 42 \frac{\text{mm}}{\text{s}} + 0 = 42 \frac{\text{mm}}{\text{s}}$$

$$\text{speed}_{\text{toptrack}} = 42 \frac{\text{mm}}{\text{s}} - 42 \frac{\text{mm}}{\text{s}} = 0$$

This is Tip-to-Tail (or Tail to Tip) Vector Addition:

Vector: A quantity that has both magnitude and direction.

Vector examples: Displacement, Velocity, Acceleration, Force, Torque, and Momentum

Scalar: A quantity that has magnitude only (no direction).

Scalar examples: Distance, Speed, Time, Volume, Density, and Money

Magnitude: The numerical amount of the quantity.