

Physics 161

Lecture 3

Vectors and two-dimensional  
motion

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# Lecture 3: learning objectives

You will be able to characterize physical quantities as vectors or scalars. Represent vectors graphically and perform arithmetic operations on and with vectors.

Study motion in two dimensions using vector equations for displacement, velocity and acceleration.

# Vectors and Scalars

## Vector:

Quantity with both magnitude (size) and direction.

## Scalar:

Quantity with just magnitude (size).

### Scalars

Distance

Speed

Mass

Density

Temperature

Electric potential

### Vectors

Displacement

Velocity

Acceleration

Momentum

Force

Electric field

Vectors can be added, subtracted and multiplied or divided by a scalar.

# Two-dimensional motion

Vector equations apply to motion in two dimensions.

Displacement:  $\Delta \vec{r} = \vec{r}_f - \vec{r}_i$

Average velocity:  $\vec{v}_{av} = \frac{\Delta \vec{r}}{\Delta t}$

Average acceleration:  $\vec{a}_{av} = \frac{\Delta \vec{v}}{\Delta t}$

Motion in one direction is independent of the motion in a direction perpendicular to that first direction.