Velocity

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Presentation 346

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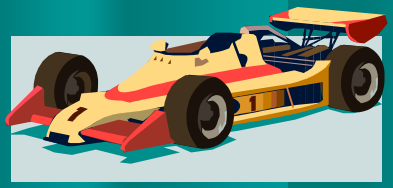
Why study velocity?

- Unit: Kinematics
- Section: Descriptions of Motion
- Lesson: Velocity

Why study velocity?



Review

Displacement

- Change in position
  - $\Delta \mathbf{r} \equiv \mathbf{r}_f - \mathbf{r}_i$
- Vector Quantity
  - Magnitude: 5 km, 3 miles, 10 feet
  - Direction: North, Right, 37° North of East

Displacement

Where we are? (Final Position)

$$\Delta \mathbf{r} \equiv \mathbf{r}_f - \mathbf{r}_i$$

Where we came from? (Initial Position)

Definition

Average Velocity

The average velocity of a particle during the time interval Δt is the displacement of the particle divided by the time interval:

$$\mathbf{v} \equiv \frac{\Delta \mathbf{r}}{\Delta t}$$

$$\Delta \mathbf{v} \equiv \frac{\Delta \mathbf{r}}{\Delta t} \equiv \frac{\mathbf{r}_f - \mathbf{r}_i}{t_f - t_i}$$

Velocity vs. Speed

Where are we going?

Units

Displacement: meters, feet, miles

Time: seconds, minutes, hours

$$v \equiv \frac{\Delta r}{\Delta t}$$

Velocity:

m/s

mi/hr

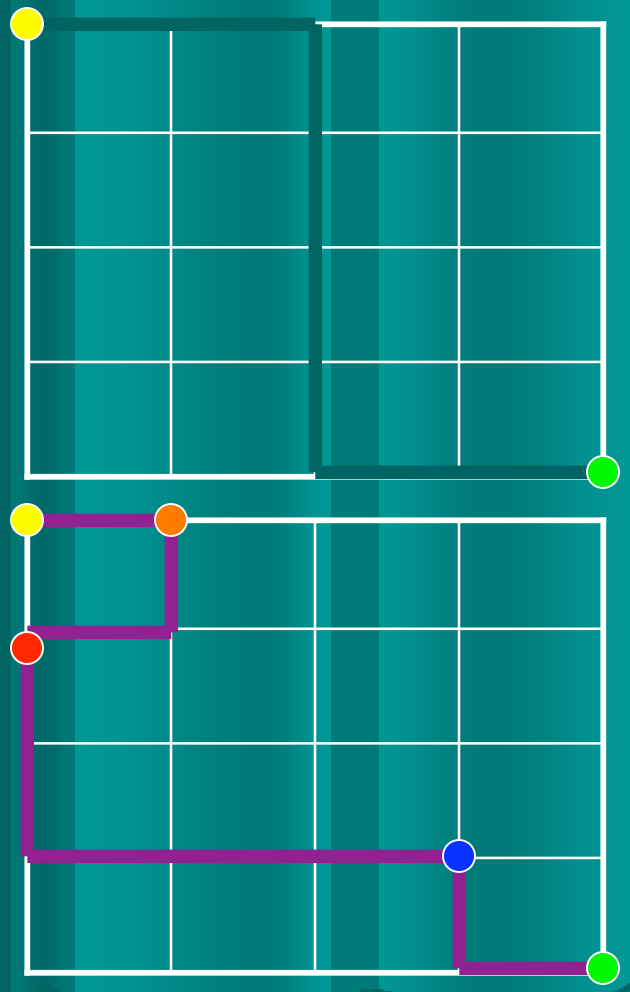
Match the Velocities

70 mi/hr

2.99 x 10^{8} m/s

475, 200 ft/month

Independent of Path



Slow Susie and Fast Fefe walk to Kmart starting from home (Yellow dot).

Slow Susie goes straight to Kmart (Green dot). It takes her one hour.

Fast Fefe goes to the Beauty Supply Store (Orange dot), then goes to the Amoco Station (Red dot), then stops by her aunt's house (Blue dot), then goes to Kmart (Green dot). She gets it all done in one hour.

Whose velocity is greater?

$$v \equiv \frac{\Delta r}{\Delta t}$$

Why is velocity independent of path?

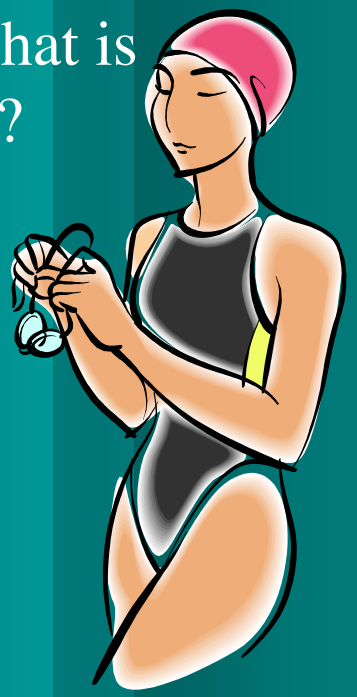
$$\mathbf{v} \equiv \frac{\Delta \mathbf{r}}{\Delta t}$$

$$\Delta \mathbf{v} \equiv \frac{\Delta \mathbf{r}}{\Delta t} \equiv \frac{\mathbf{r}_f - \mathbf{r}_i}{t_f - t_i}$$

Velocity is proportional to displacement which is solely dependent on the initial and final position vectors.

Application: LaTrice Goes Hiking

LaTrice goes swimming in a straight path from one end of the pool to the next. She swims 10 feet. It takes Latrice two hours to complete her swim. What is LaTrice's average velocity during her swim?



Answer: 5 ft/hr

Doesn't Take a Rocket Scientist

Ms. Jane is a rocket scientist. Ms. Jane's rocket travels at 4,000 km/ hr. Ms. Jane wants her rocket to land on the moon. How long will it take Jane's rocket to arrive on the moon. (Hint: Use 400,000 km as the approximate distance from the earth to the moon.)

Answer: 100 hours; approx. 4 days

World Travelers

Jhing and Jun have decided to travel across the globe. Their plan is to begin and end in Cebu, Philippines. The radius of the earth is 6, 378 km. If it takes them 6 months to complete the journey, what is their average velocity for the trip? (Hint: Velocity is independent of path.)

Answer: 0

Tomorrow's Lesson

Acceleration

$$\Delta \mathbf{a} \equiv \frac{\mathbf{v}_f - \mathbf{v}_i}{\Delta t} \equiv \frac{\mathbf{v}_f - \mathbf{v}_i}{t_f - t_i}$$

Velocity

$$\Delta \mathbf{v} \equiv \frac{\mathbf{r}_f - \mathbf{r}_i}{\Delta t} \equiv \frac{\mathbf{r}_f - \mathbf{r}_i}{t_f - t_i}$$