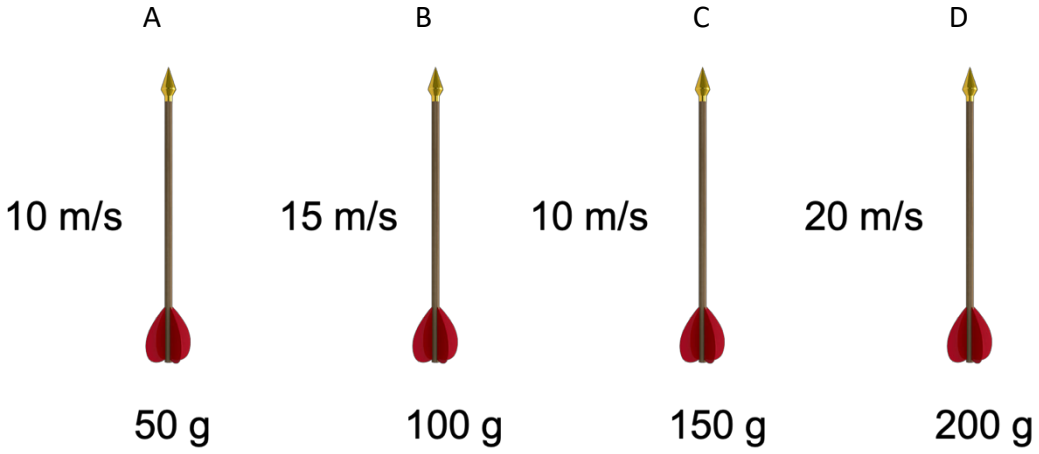
Kinematics: Describing Motion

Part I: Kinematics in One Dimension

Example Problem: Arrows shot vertically



** A note concerning air resistance: air resistance is negligible unless otherwise noted.*

- Rank the arrows in terms of their acceleration after they are released from their bows. If two or more are equal, circle them together

  Greatest Acceleration _____ _____ _____ _____ Least Acceleration

  Explain your answer:

- Now rank the arrows in terms of their maximum height reached after they are released from their bows. If two or more are equal, circle them together

  Greatest Height _____ _____ _____ _____ Least Height

  Explain your answer:

Example Problem: Free Falling Objects

Balls of equal mass are launched with different velocities and allowed to fall for 2 seconds. Arrange each of the following cases in order from greatest to least magnitude of displacement.

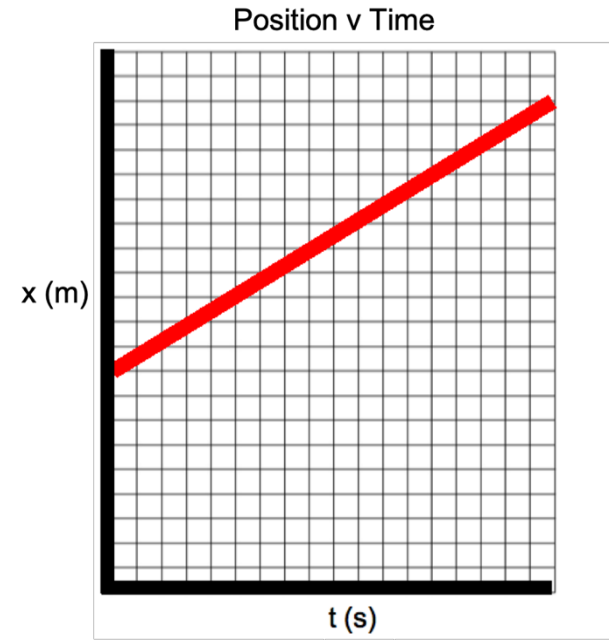
a. Ball thrown 5 m/s straight up
b. Ball thrown 10 m/s straight up
c. Ball dropped from a rest
d. Ball thrown 5 m/s straight down
e. Ball thrown 10 m/s straight down
f. Ball thrown 20 m/s straight up

Greatest displacement _____ _____ _____ _____ _____ _____ Least displacement
Explain your answer. Cite equations if necessary.

Now rank them in terms of greatest to least final velocities:

Greatest velocity _____ _____ _____ _____ _____ _____ Least velocity
Explain your answer. Cite equations if necessary.

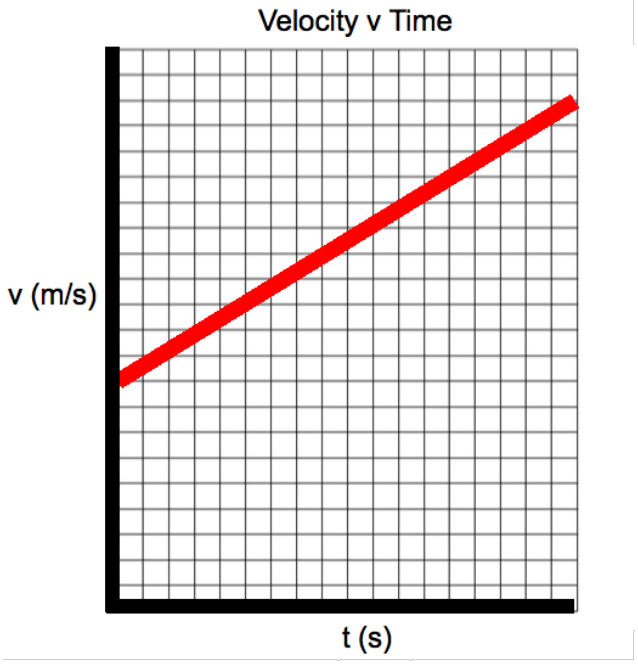
Graphical Representations of Motion



Questions to Ask Yourself

- Does the slope of this graph yield anything significant?

- Does the area of this graph yield anything significant?



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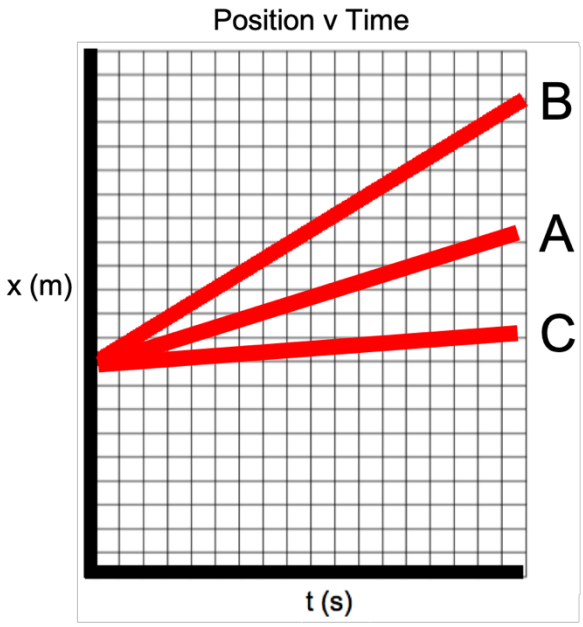
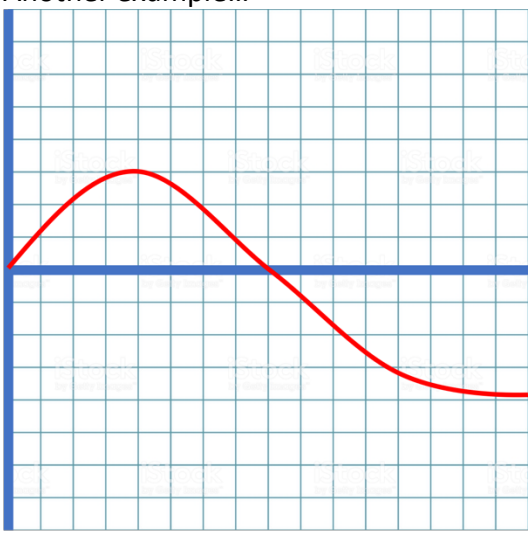
Example Problems: Motion Graphs



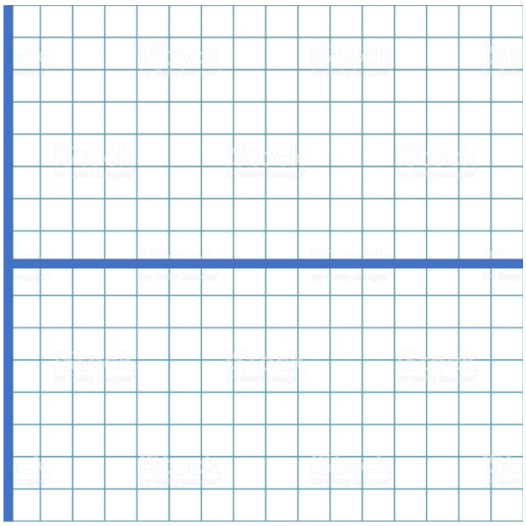
- Which graph shows an object moving at the fastest velocity?

- What property of the graph tells you this?

Another example…



- Describe the motion of the object in this graph.



- Translate the motion depicted in the position time graph into a velocity time graph.

Part II: Kinematics in Two Dimensions

Vector: Any quantity with a measurable magnitude and a direction.

- Vectors are often represented with arrows
    - Length of the arrow indicates its magnitude
    - Direction the arrow is pointed represents the direction of the vector quantity.

Example Problem: Resolving Vectors into Components
A projectile is launched at 35 m/s at an angle of 50 degrees.

- First, draw a diagram with an arrow representing the vector quantity.

- Next, resolve the vector into x and y components.
    - X Component: The portion of the vector running along the x axis.
    - Y Component: The portion of the vector running along the y axis.
        - Use trigonometric relationships to do this.

A very important principle to remember: X and Y components of motion are INDEPENDENT of one another!

Example Problem: Horizontally Launched Projectile

An object is launched horizontally from the edge of a cliff at 10 m/s. The object takes 4 s to land.

- *Think of this in two SEPARATE dimensions*
    - *Horizontally*
        - *What is affecting the horizontal motion?*
        - *Is the horizontal motion constant or accelerated?*
    - *Vertical*
        - *What is affecting the vertical motion?*
        - *Is the vertical motion constant or accelerated?*

- How far did the object fall vertically?

- How far from the base of the cliff did the object land?