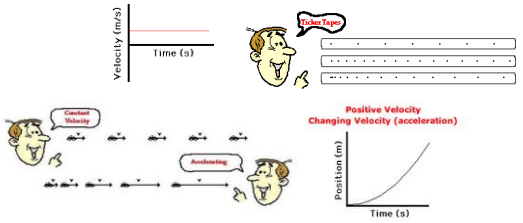
Representing Motion

- Another common way of representing motion is using diagrams and graphs.



1

Ticker Tape Diagrams

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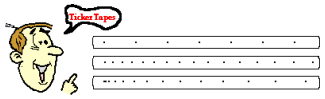
- A *tape* is attached to an object and threaded through a device that places a tick at regular intervals of time.
- As the object moves, it drags the tape through the "ticker," thus leaving a trail of dots.



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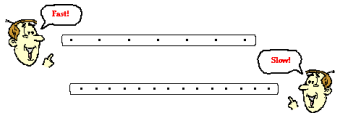
- The distance between dots represents the object's position change during that time interval.
- A large distance between dots indicates that the object was moving fast while a small distance means the object was moving slow.



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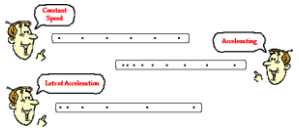
- A changing distance between dots indicates a changing velocity and thus an acceleration.
- A constant distance between dots represents a constant velocity and therefore uniform motion.



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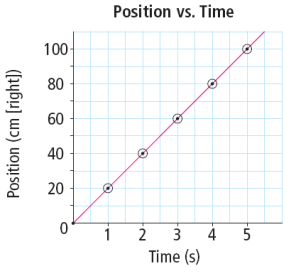
Graphing Motion

- A position-time graph plots position data on the vertical axis (y-axis) and time on the horizontal axis (x-axis).



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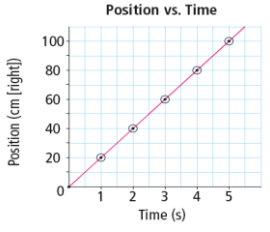
- Uniform motion is represented by a straight line on a position-time graph.



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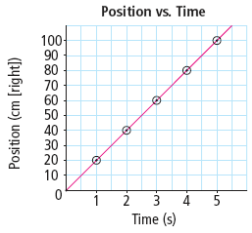
Positive Slope

- Slants up to the right.
- Indicates an object travelling in the positive direction (ie: North, East, to the right, up, etc.)



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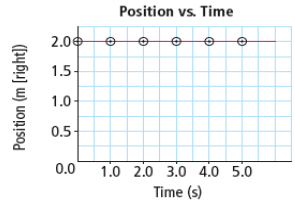
Zero Slope

- Horizontal line.
- Indicates that the object is stationary.



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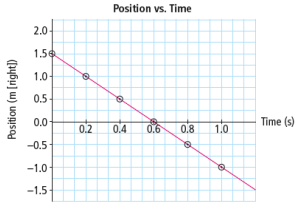
Negative Slope

- Slants down to the right.
- Indicates an object travelling in the negative direction (ie: South, West, to the left, down, etc.)



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Calculating the Slope of a P-T Graph

- The slope of a graph is represented by:

$$slope = \frac{rise}{run} = \frac{\Delta y}{\Delta x} = \frac{y_2 - y_1}{x_2 - x_1}$$

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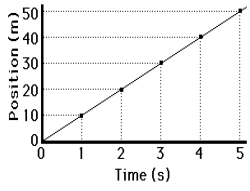
Finding Slope

1. Pick two points on the line and determine their coordinates.
2. Determine the difference in y-coordinates (*rise*).
3. Determine the difference in x-coordinates (*run*).
4. Divide the difference in y-coordinates by the difference in x-coordinates (rise/run or slope).



For points (5 s, 50 m) and (0 s, 0 m):

$slope = \frac{50\,m - 0\,m}{5\,s - 0\,s} = 10\ m/s$

For points (5 s, 50 m) and (2 s, 20 m):

$slope = \frac{50\,m - 20\,m}{5\,s - 2\,s} = 10\ m/s$

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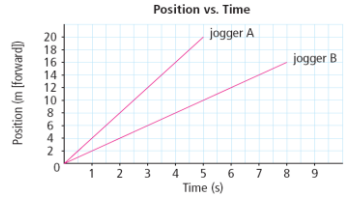
Example



Which jogger's motion has a greater slope? Which jogger is moving faster? What is the slope of each line? What is each jogger's speed?

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Slope on a P–T Graph

- On a position-time graph the slope is the change in position ($\Delta\vec{\mathbf{d}}$) divided by the change in time (Δt). We know this as speed!

$$slope = \frac{\Delta \mathbf{d}}{\Delta \mathrm{t}} = speed$$

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Any Questions?

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