Lecture1

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  - How to read graphs
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  - Instantaneous velocity
  - Instantaneous acceleration
  - Motion with constant acceleration
  - Free fall

Chapter1

SI units

- Physics: a science used to explain the phenonema around us
- To do so, we need numbers (أرقام) and units (وحدات)
- The main units for this course are:
  - Meter: unit of length (طول) (m)
  - Kilogram: unit of mass (كتلة) (kg)
  - Second: unit of time (زمن) (s)
- These units are called SI units
- Each unit has a meaning
- Convert between different units

SI units

- Example: convert 150 g to kg (1 kg = 1000g)
- Solution:
- 150 g ----> kg
- $150\ g \times \frac{1\ kg}{1000\ g} = \frac{150}{1000}\ kg = 0.15\ kg$
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SI units

- Example: convert 3.3 kg to g (1 kg = 1000g)
- Solution:
- 3.3 kg ----> g
- $3.3\ \text{kg} \times \frac{1000\ \text{g}}{1\ \text{kg}} = 3.3 \times 1000\ \text{g} = 3300\ \text{g} = 33 \times 10^2\ \text{g}$
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SI units

- Example: what is the SI unit of speed ? (Speed = distance / time)
- Solution:
- $\text{Speed} = \frac{\text{distance}}{\text{Time}} = \frac{\text{m}}{\text{s}} = \text{m / s}$
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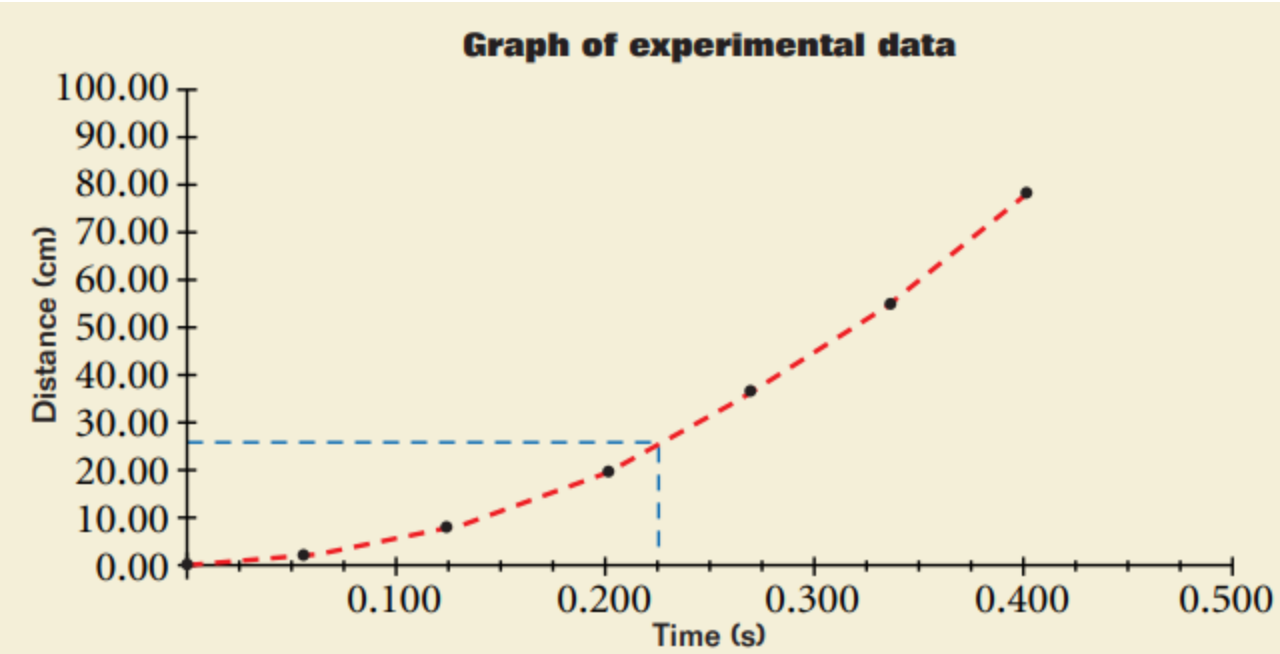
How to read graphs

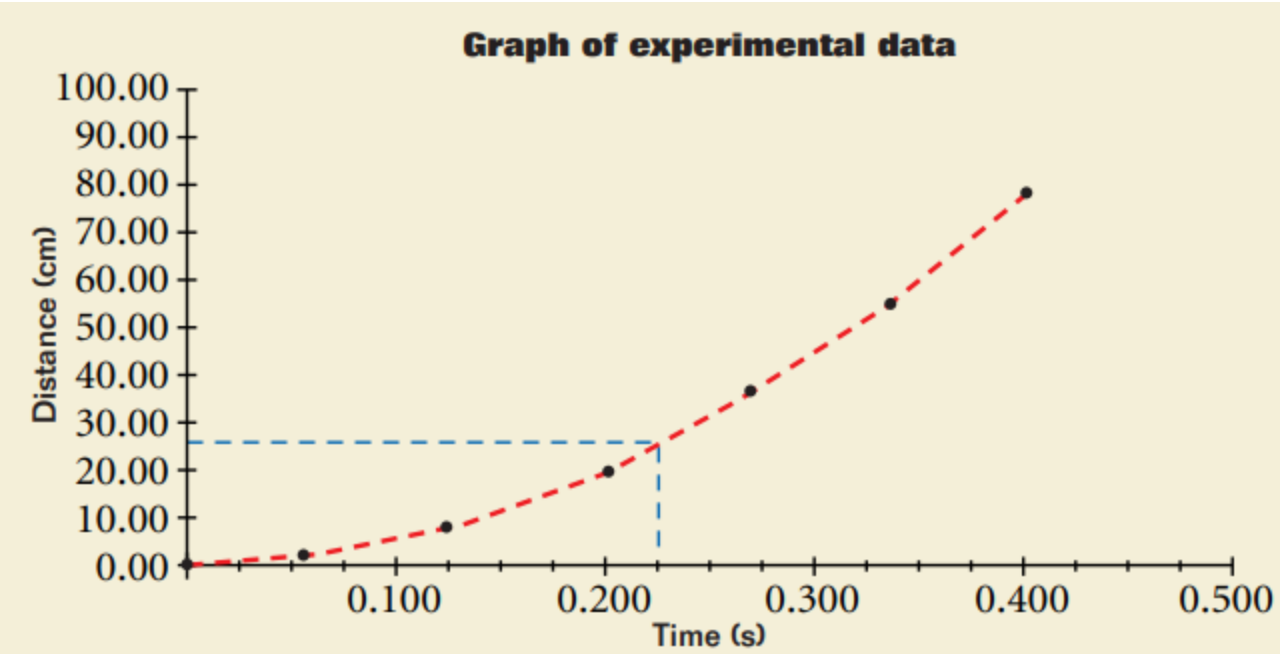
- This is an experiment for a falling ball.
- It measures the distance it falls and the time taken to reach the distance
- Another way to interpret the data is the graph shown below

Time (s)	Distance golf ball falls (cm)
0.067	2.20
0.133	8.67
0.200	19.60
0.267	34.93
0.333	54.34
0.400	78.40



How to read graphs

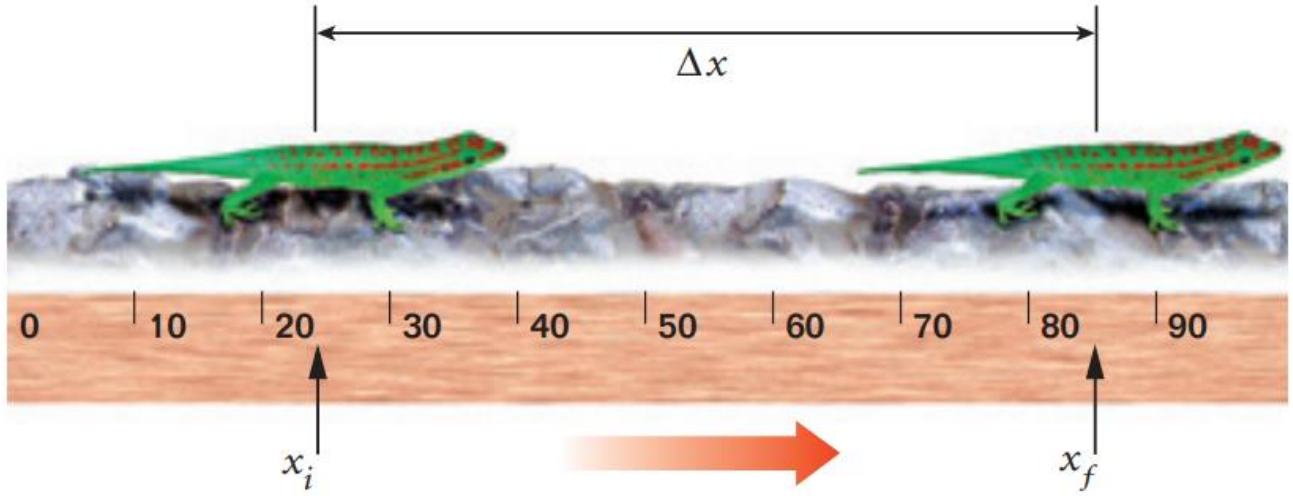
- Example: how long does it take for the ball to reach 20 cm?
- Answer: from graph---> time = 0.2s
- Example: what is the distance the ball reaches in 0.2s?
- Answer:
- from graph---> distance = 20 cm



Chapter2

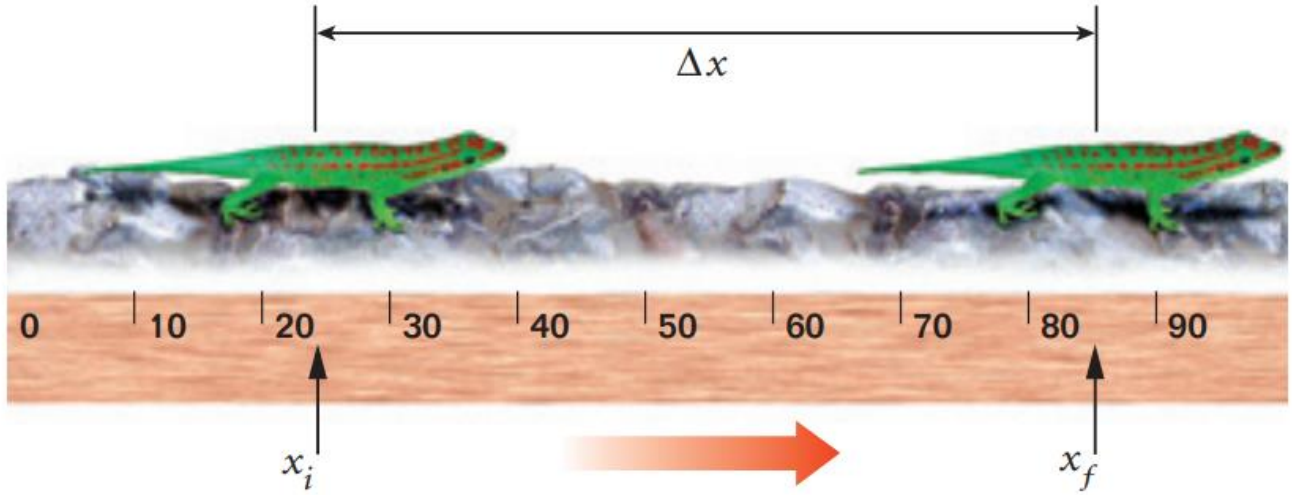
Position, distance & displacement

- If an object is at rest (سكون), its position (موقع) does not change
- When an object starts to move from position (xi) to position (xf)
- ---> it changes the position
- The displacement (الازاحة) = Δx = xf - xi



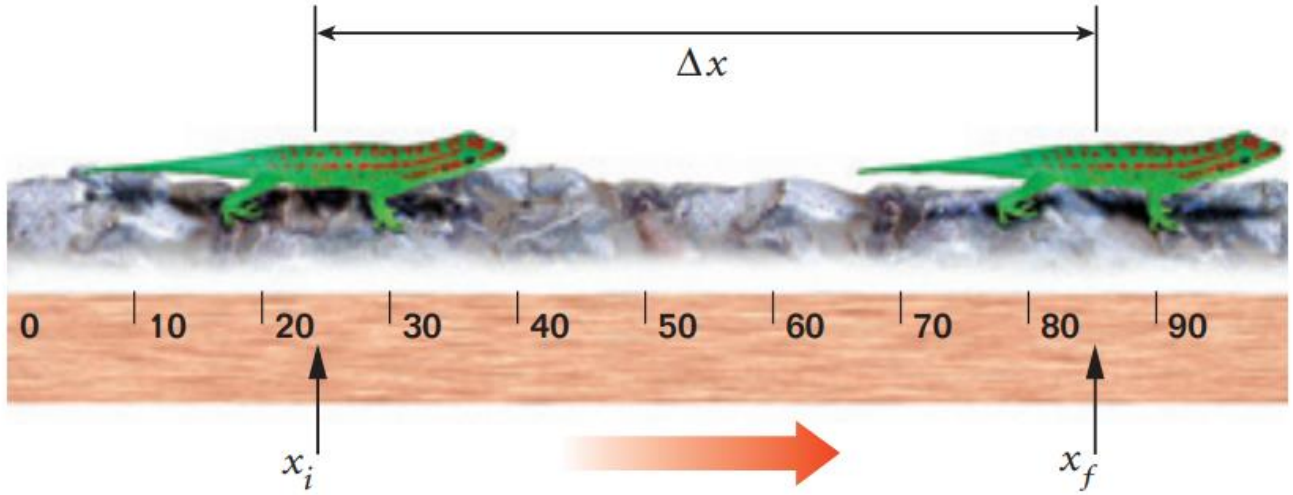
Position, distance & displacement

- Example: if the gecko (سحلية) started from x = 20cm and ended at x = 80cm find the displacement
- The displacement (الازاحة) = Δx = xf - xi = 80 – 20 = 60 cm



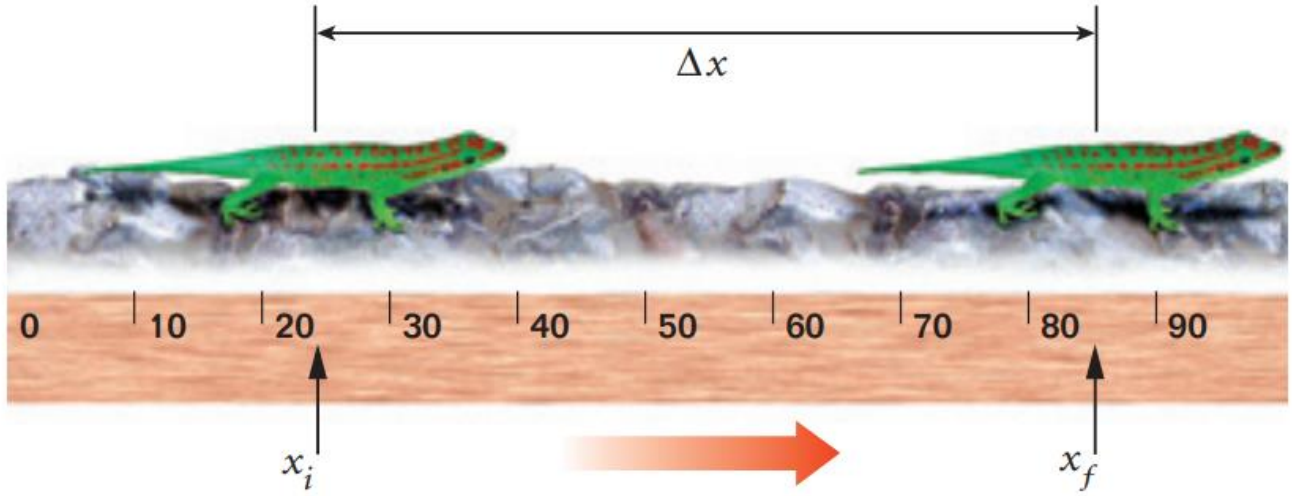
Position, distance & displacement

- If an object is at rest (سكون), its position (موقع) does not change
- When an object starts to move from position (xi) to position (xf)
- ---> it changes the position
- The distance (المسافة) = the actual distance travelled



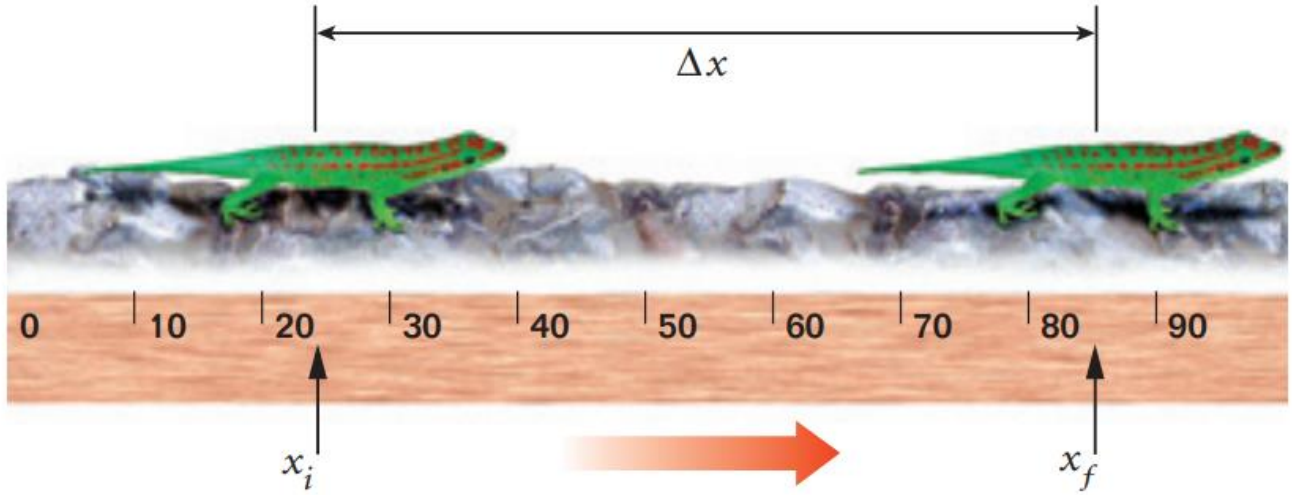
Position, distance & displacement

- Example: if the gecko (سحلية) started from x = 20cm and ended at x = 80cm find the displacement
- The distance (المسافة) = 60 cm



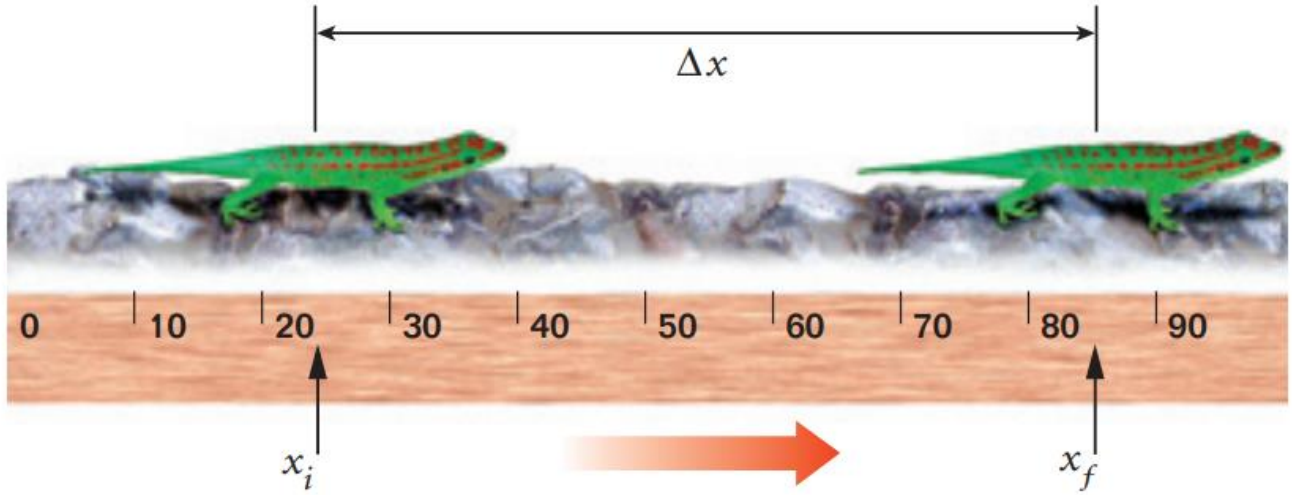
The difference between distance & displacement

- The displacement : we just look at the initial (بداية) and final (نهاية) points
- The distance: we need to look at the track (المسار)
- (actual distance) (المسار المقطوع)



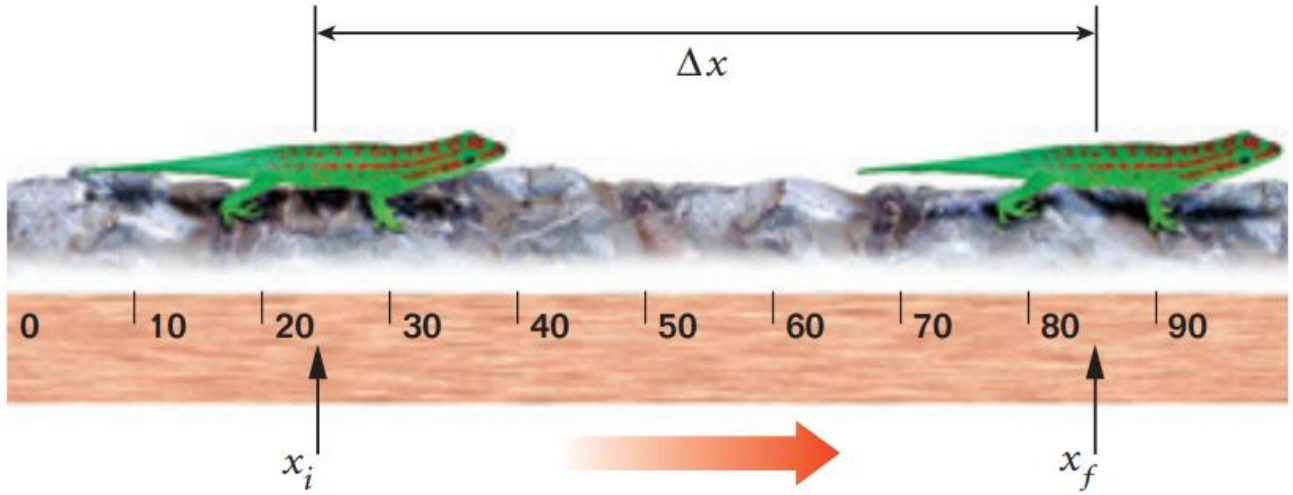
The difference between distance & displacement

- Example: if the gecko go from x = 80 cm to x = 20 cm and then went to the point x = 50. Find the displacement & distance
- Solution:
- Displacement = xf – xi = 50 – 80 = -30 cm
- Distance = actual distance = 60 +30 = 90 cm



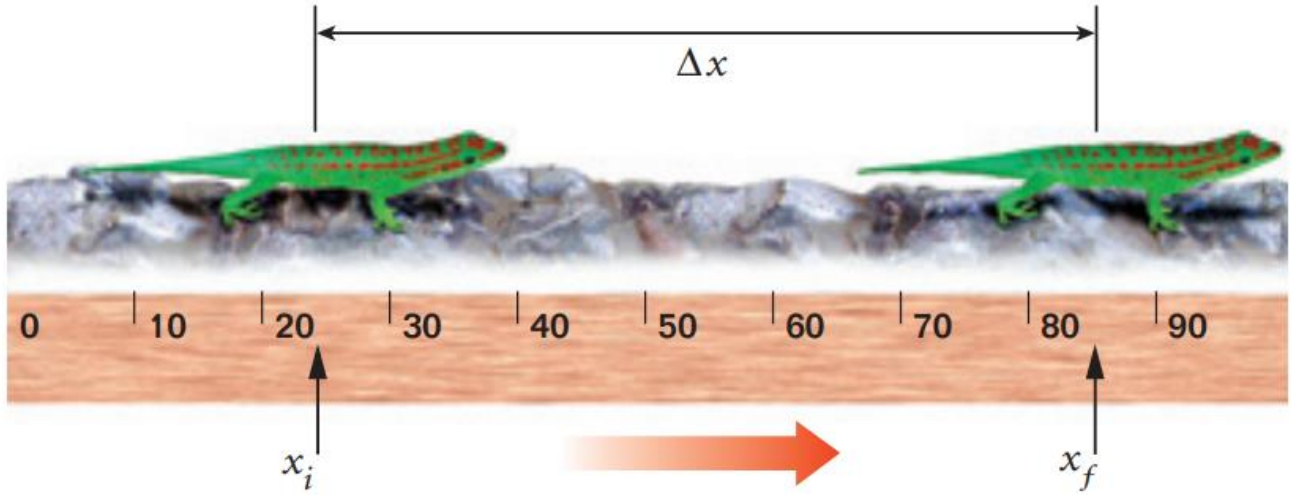
The average velocity and speed

- Average velocity (متوسط السرعة) = displacement / time = Δx / Δt
- Can be negative or positive
- Speed (السرعة المتوسطة)= distance / time = actual distance / Δt
- Always positive



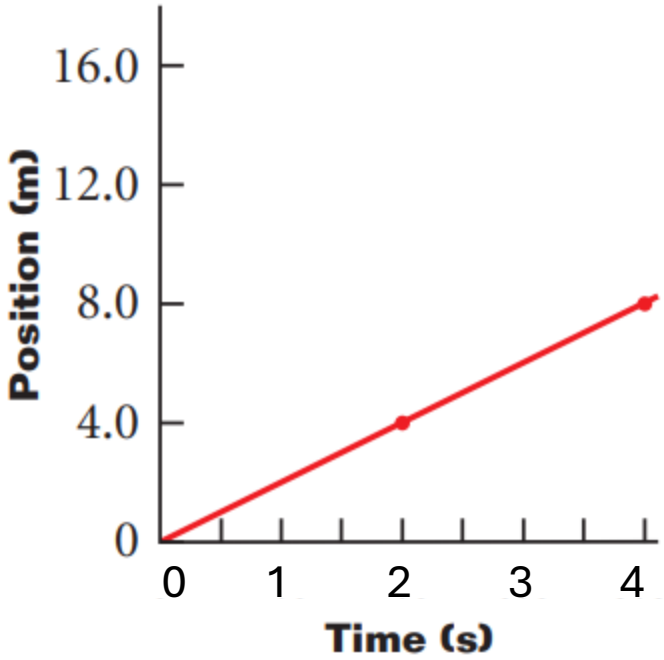
The difference between distance & displacement

- Example: if the gecko go from x = 80 cm to x = 20 cm in 6 s. Then it went to the point x = 50cm in 3s . Find the average velocity & speed
- Solution:
- Average velocity = Displacement/time
- Average velocity = $\Delta x / \Delta t$ = (50 – 80) / (9) = -30 / 9 = -3.33 cm/s
- Speed = Distance/ time =
- Speed = actual distance / Δt = (60 +30) / 9 = 90 / 9 = 10 cm/s



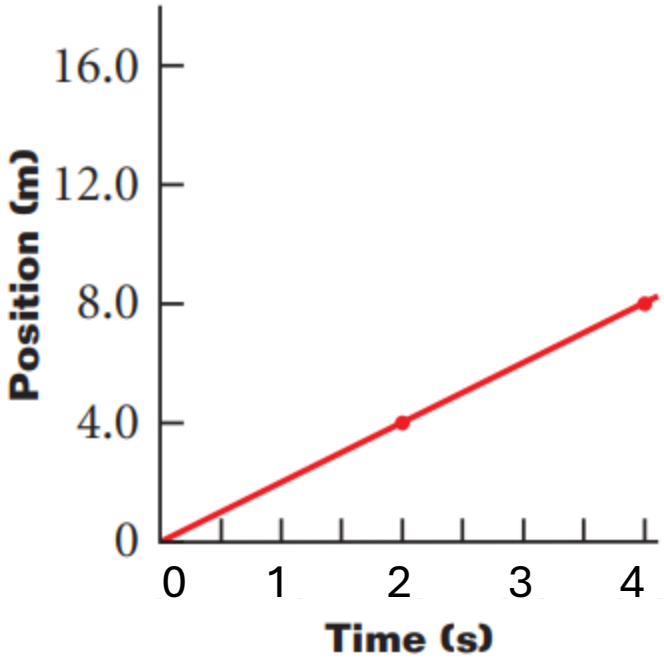
Average velocity graphically

- Average velocity (متوسط السرعة): velocity over a period of time
- If there is a graph of position vs time (as the figure):
- Average velocity = slope = $\Delta y / \Delta x = (y2 - y1) / (x2 - x1)$



Average velocity graphically

- Example: in the figure shown, find the average velocity
- Solution: Average velocity = slope = $\Delta y / \Delta x = (y2 - y1) / (x2 - x1)$
- Choose any two points
- (0 , 0) , (2 , 4)
- (x1, y1), (x2, y2)
- Average velocity =
- $(y2 - y1) / (x2 - x1) = (4-0) / (2-0) = 4 / 2 = 2$ m/s



Average velocity & instantaneous velocity

- Average velocity (متوسط السرعة): velocity over a period of time
- Example: velocity in the 5s period (فترة زمنية معينة)
- Instantaneous velocity (السرعة اللحظية) : velocity in certain time
- (السر عة في لحظة معينة)
- Velocity at t = 3s