Notes Chapter 1 Lesson 3

Graphing Position
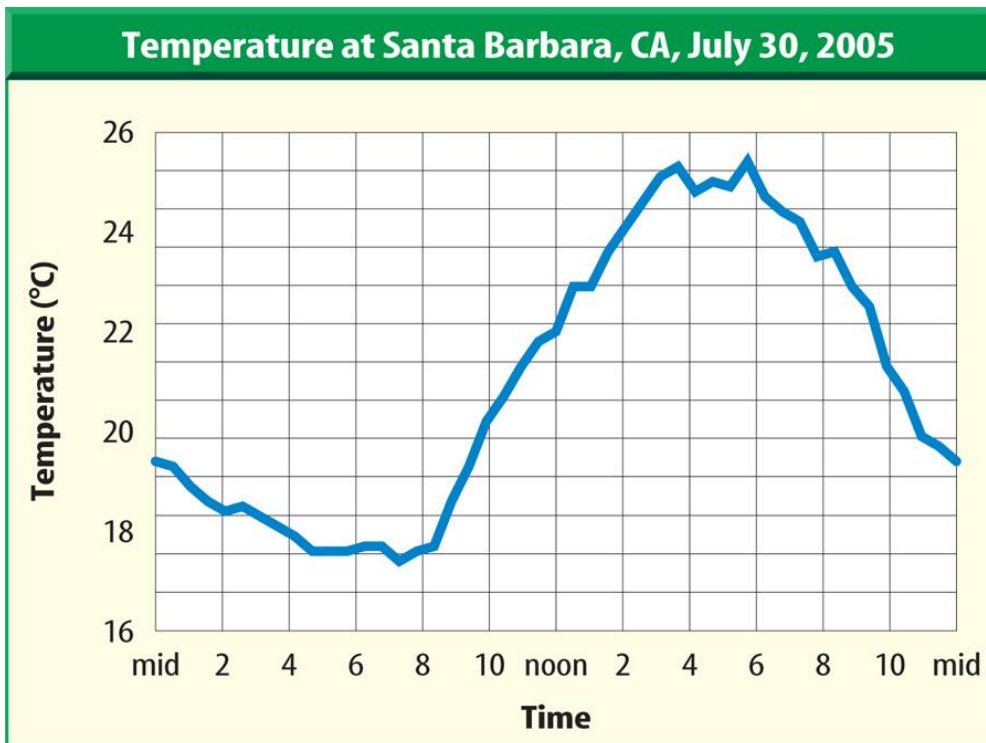
Graphs

- Graphs can show how objects change position or speed.

Turtle's Position v. Time
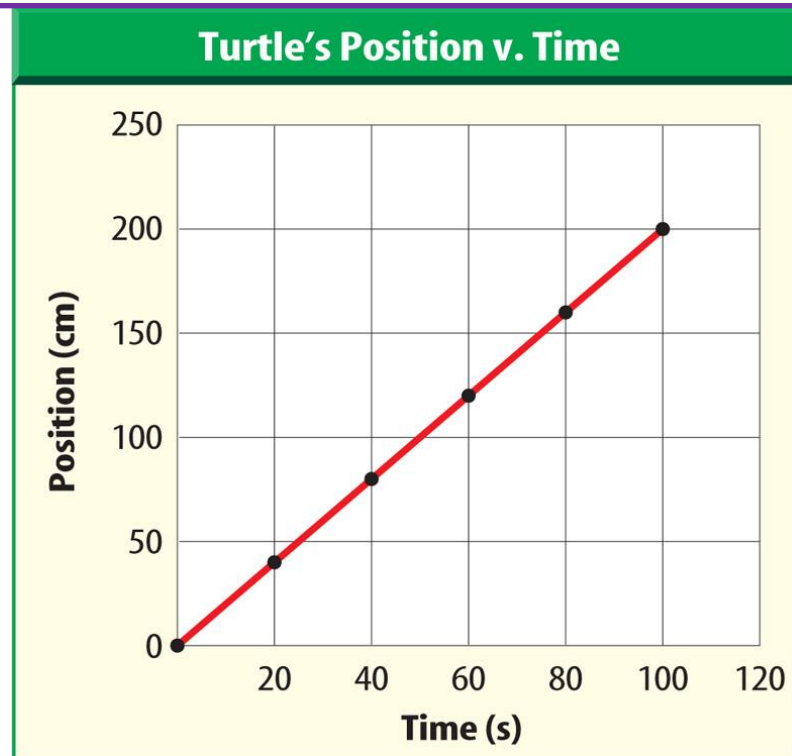
Position-Time Graphs

- Graphs often show how something changes with time.

Temperature at Santa Barbara, CA, July 30, 2005

- This graph shows how temperature changes with time in Santa Barbara, California.

CHAPTER 1

Making a Position-Time Graph

- This table shows how far a turtle has moved after an amount of time.
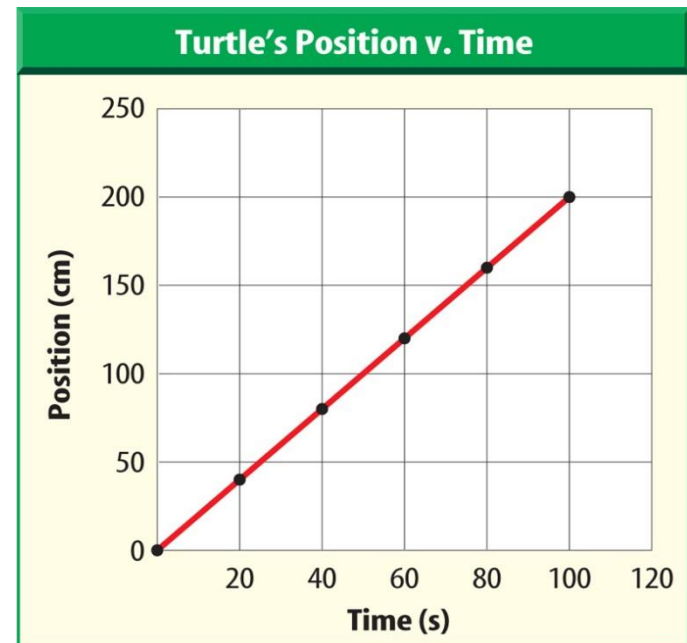
Table 1 Turtle's Position and Time

Elapsed Time (s)	Position (cm)
0	0
20	40
40	81
60	123
80	158
100	202

Making a Position-Time Graph (cont.)

- Plotting the time on the x-axis and plotting the distance the turtle has moved on the y-axis creates the graph.

- You can draw a line through the points and use it to *estimate* the position at a given time.

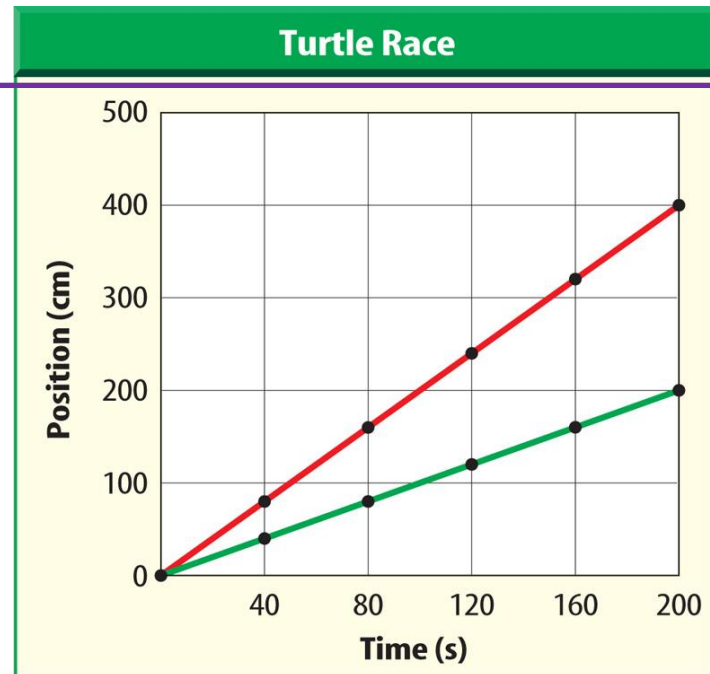**Turtle's Position v. Time**

Units on Position-Time Graphs

- Each number has units associated with it.

- Position has units of length like cm, m, or km.

- Seconds, minutes, and days are units of time.
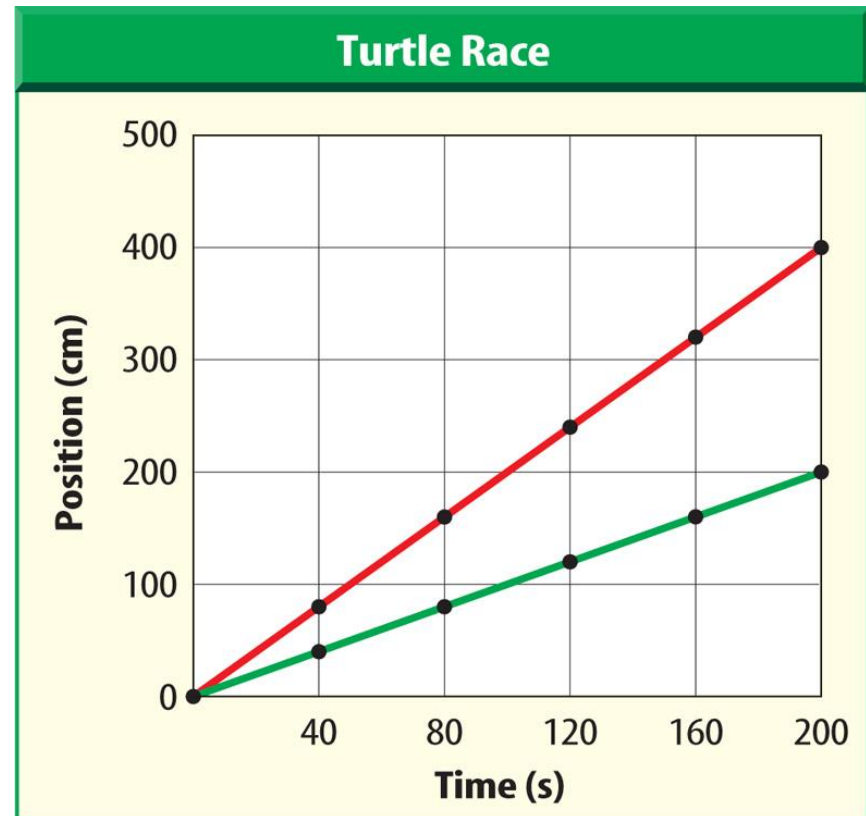
Slope of a Position-Time Graph

- The steepness of a line on a graph is called the **slope.**

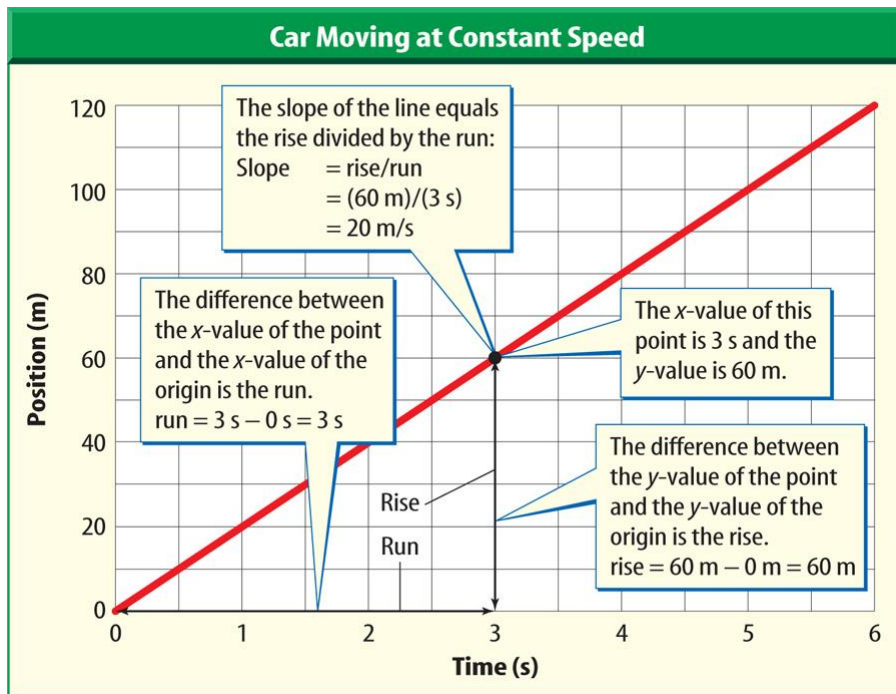- The steeper the slope, the _____ the object is traveling.
  Faster

Turtle Race

Slope of a Position-Time Graph (cont.)

- On a position-time graph, a steeper line means a greater average speed.

Turtle Race

Calculating Slope from a Position-Time Graph

Car Moving at Constant Speed

The slope of the line equals the rise divided by the run:
Slope   = rise/run
         = (60 m)/(3 s)
         = 20 m/s

The difference between the x-value of the point and the x-value of the origin is the run.
run = 3 s − 0 s = 3 s

The x-value of this point is 3 s and the y-value is 60 m.

The difference between the y-value of the point and the y-value of the origin is the rise.
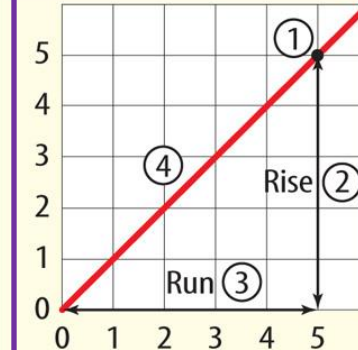rise = 60 m − 0 m = 60 m

Rise

Run

Position (m)

Time (s)

- To find the slope of a line, the origin and another point are used to calculate the rise and the run.

Calculating Slope from a Position-Time Graph (cont.)

$$slope = \frac{rise}{run}$$

- **Rise** is the change in vertical direction.

- **Run** is the change in horizontal direction.

Calculating Slope

① Choose a point on the line.

② The rise equals the y-value of the point.

③ The run equals the x-value of the point.

④ Calculate the slope by dividing the rise by the run.

Slope and Average Speed

- Average speed is the total distance divided by the total time elapse to travel that distance.

- Rise is equal to the distance traveled.

- Run is equal to the time elapsed needed to travel that distance.

- Average speed is equal to the slope of the line on a position-time graph.

Turtle Race

Position (cm) vs Time (s)
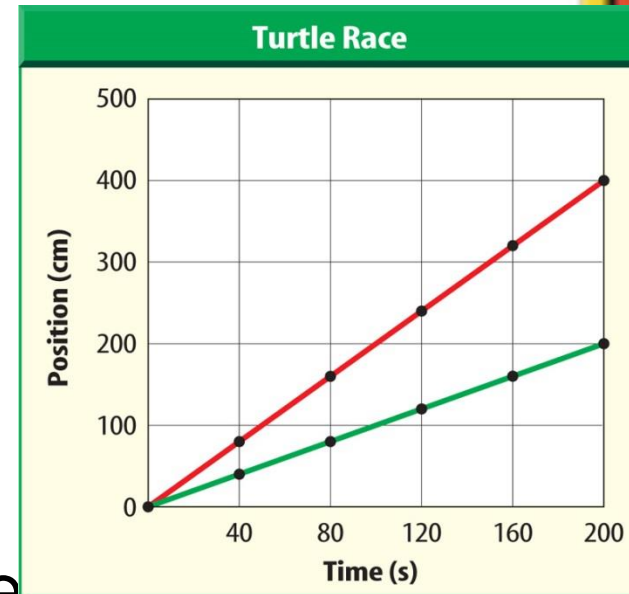
Position-Time Graphs for Changing Speed

- Only objects with a constant speed will have position-time graphs with a straight line.
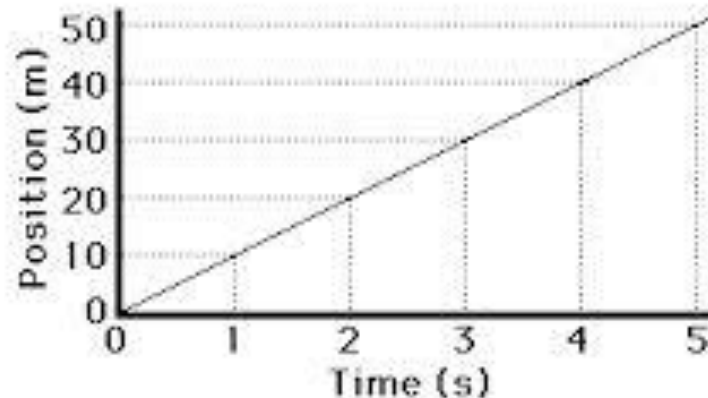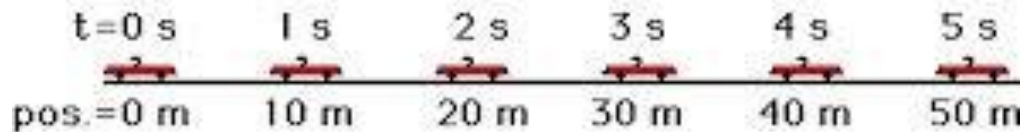
Position-Time Graphs for Changing Speed (cont.)

- To find the average speed of the entire trip, use the starting and ending points.


Train's Position v. Time
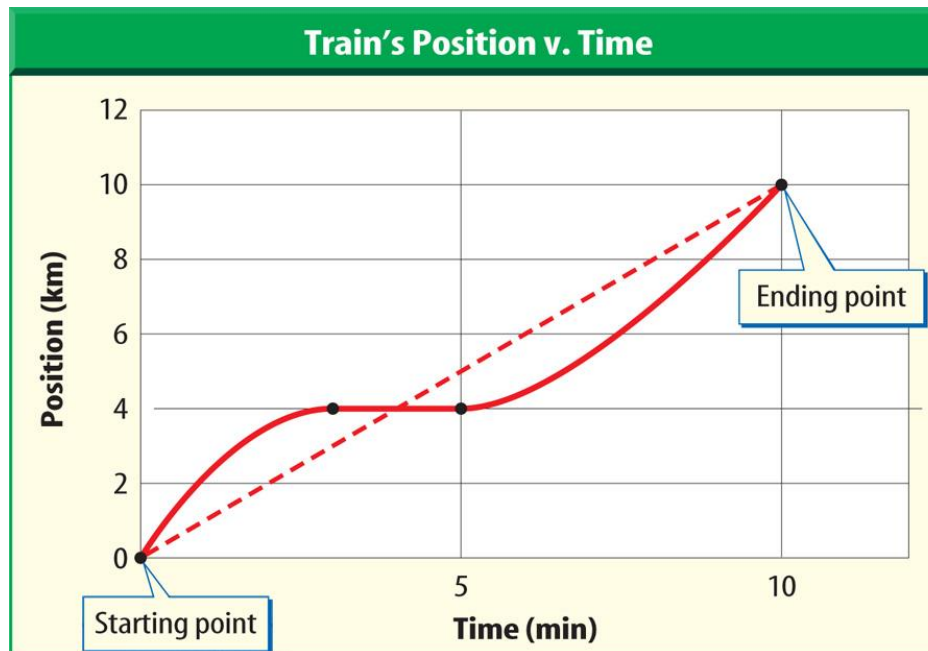
Position-Time Graphs for Changing Speed (cont.)

- Then calculate the slope of the line that would connect those points.


Train's Position v. Time
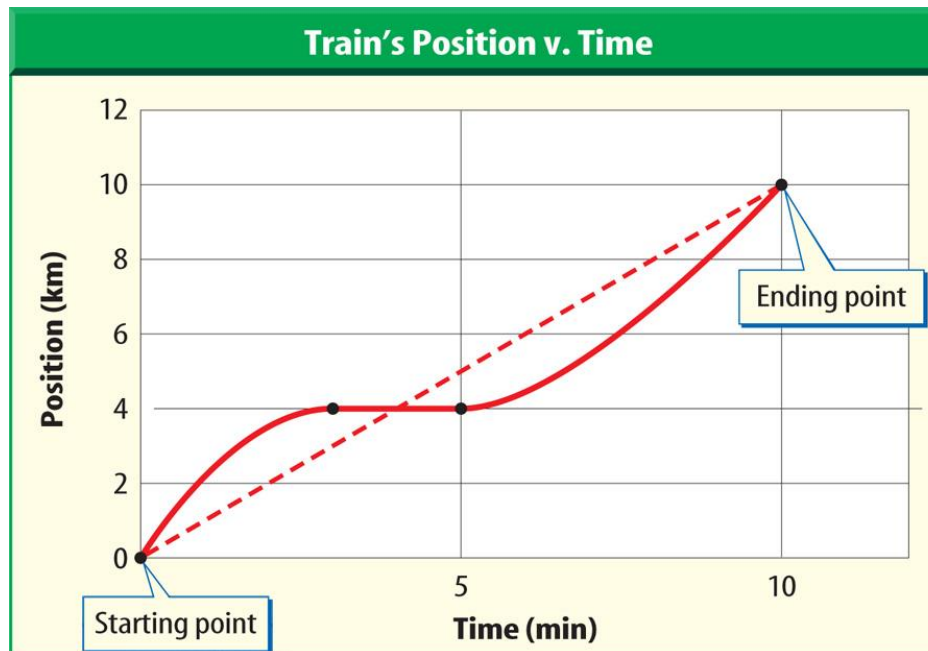
Speed-Time Graphs

- Graphing instantaneous speed of an object shows how the speed of an object changes with time.

- Constant speed on a ***speed-time graph*** is a horizontal line because the speed does not change.

Constant Speed
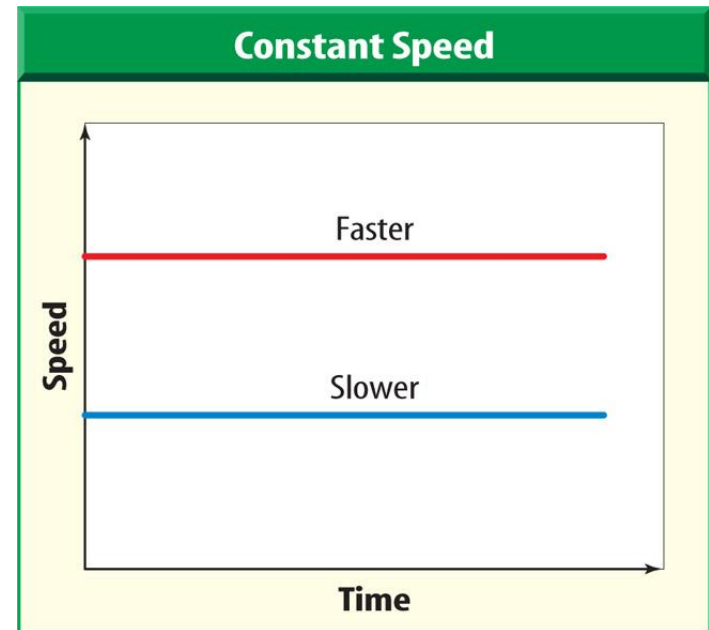
Speed-Time Graphs (cont.)

- If an object speeds up, the plotted line slants up towards the right.

Speeding Up

Speed

Acceleration is larger.

Acceleration is smaller.
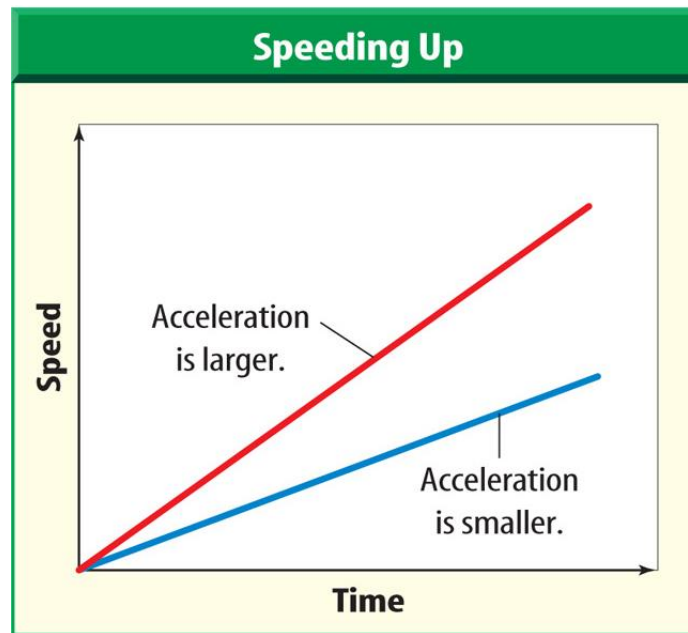
Time

Speed-Time Graphs (cont.)

- If an object slows down, the plotted line slants down towards the right.