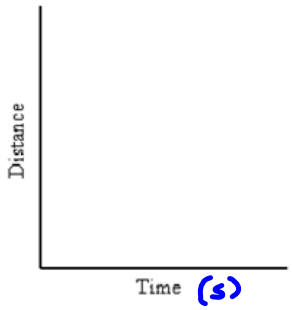
Outcome 1b:

Distance vs. time graph

Creating a graph is a useful tool for problem solving b/c it can help visualize what is occurring.



Time is always plotted on the X-axis (bottom of the graph). The further to the right on the axis, the longer the time from the start.

Distance is plotted on the Y-axis (side of the graph). The higher up the graph, the further from the start.

What are some things that have to be included in a graph?

- Title
- labels for each axis
- units

Using a set of data obtained from observation of a moving object, you can create your own distance-time graph

TABLE B1.2 Time and Distance Data for Example Problem B1.2

Time t (s)	Distance from First Marker d (m)
0.0	0.0
1.0	3.9
2.0	8.0
3.0	12.2
4.0	15.9
5.0	20.1

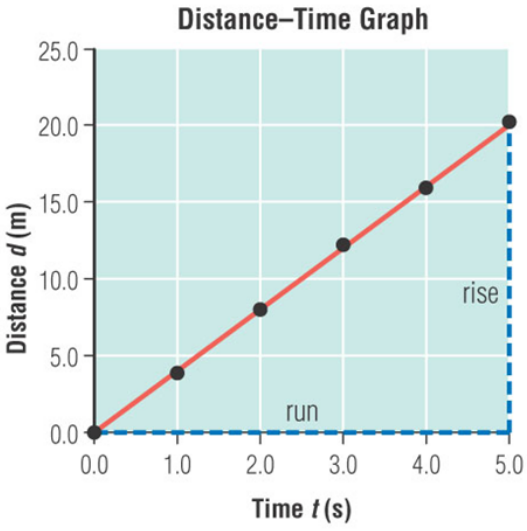
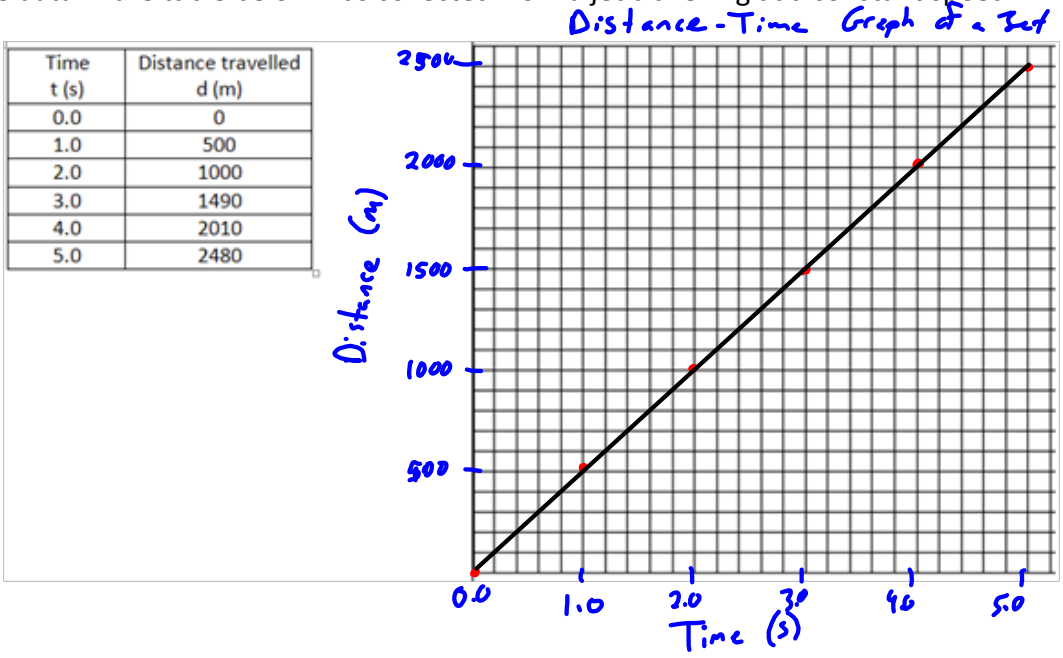


FIGURE B1.6 A distance–time graph for the data from Table B1.2

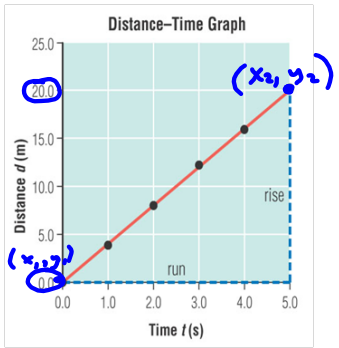
Try your own…

The data in the table below was collected from a jet travelling at a constant speed

Time t (s)	Distance travelled d (m)
0.0	0
1.0	500
2.0	1000
3.0	1490
4.0	2010
5.0	2480



Analyzing distance-time graphs



What is the slope of a line?

- steepness of a line

How do we calculate the slope of a line?

$$\text{slope} = \frac{\text{rise}}{\text{run}} = \frac{y_2 - y_1}{x_2 - x_1}$$

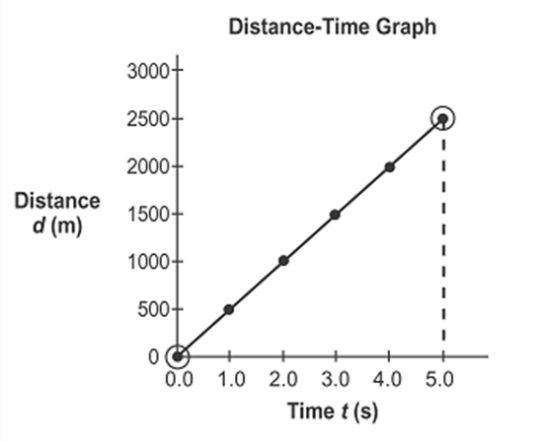
If slope if rise/run, what does the slope of a distance time graph tell us?

- speed of the object

Differences in motion animation
http://www.physicsclassroom.com/mmedia/kinema/fs.cfm

Try it on your own…

Calculate the slope of the line that you graphed in the example above (the jet one). Show all your work, including units.

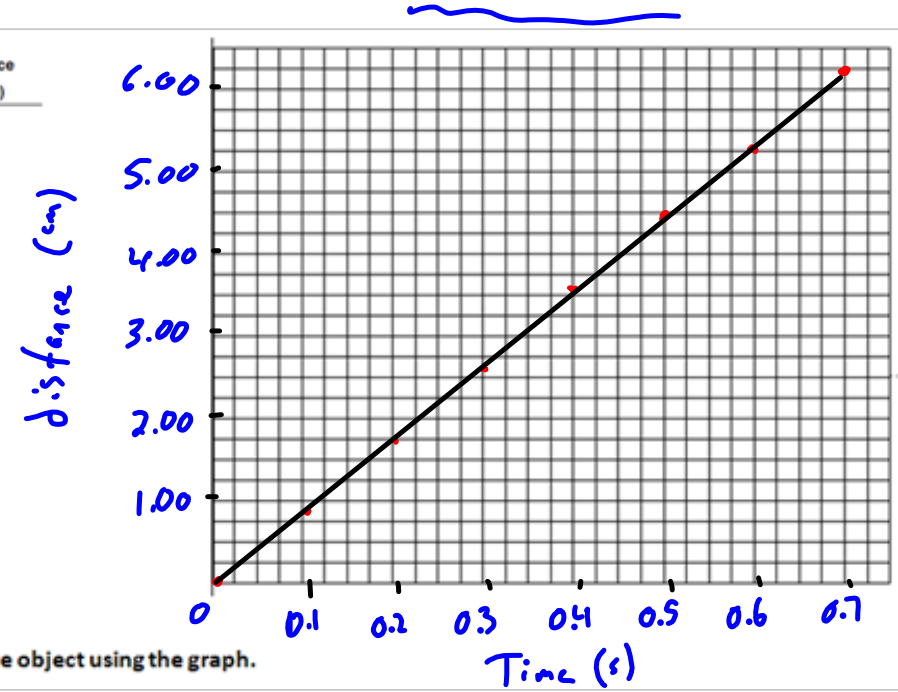


$$\text{slope} = \frac{\text{rise}}{\text{run}} = \frac{2480\text{ m} - 0\text{ m}}{5.0\text{ s} - 0.0\text{ s}} = \frac{2480\text{ m}}{5.0\text{ s}} = 496\text{ m/s} = 5.0 \times 10^2\text{ m/s}$$

Try it on your own…

Graph the motion of the object represented in the data below.

Time t (s)	Distance d (cm)
0.00	0.00
0.10	0.79
0.20	1.68
0.30	2.56
0.40	3.55
0.50	4.46
0.60	5.33
0.70	6.24



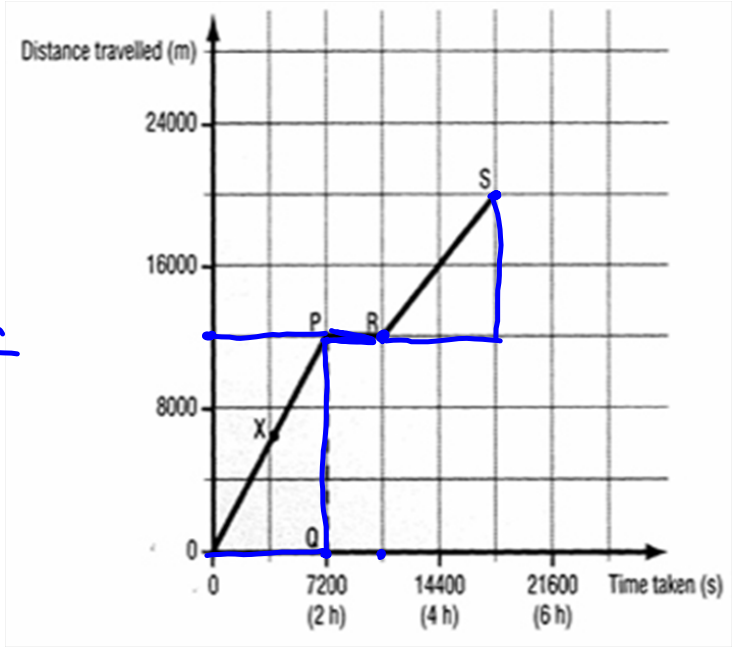
Calculate the speed of the object using the graph.

Speed: slope = $\frac{\text{rise}}{\text{run}} = \frac{6.24 - 0.00\text{ cm}}{0.70 - 0\text{ s}} = \frac{6.24\text{ cm}}{0.7\text{ s}} = 8.914\ldots\frac{\text{cm}}{\text{s}}$

$8.9\frac{\text{cm}}{\text{s}}$

Different shapes on distance-time graphs

Distance time graph of a student on a hiking trip in Jasper National Park



0m / 1h

8000m / 2h : 4000m / h

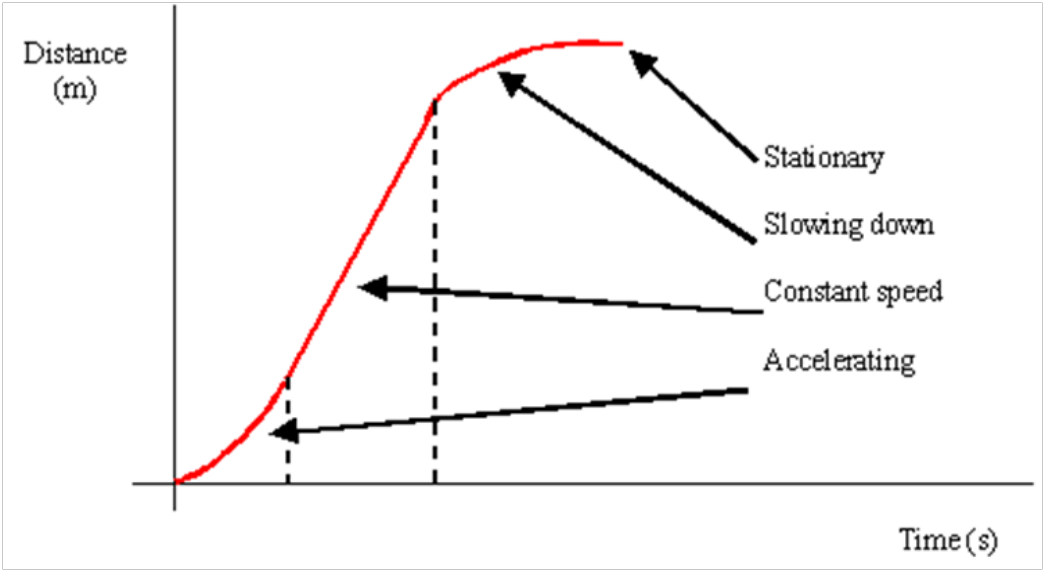
12000m / 2h : 6000m / h

Questions:

1. What was the distance traveled after 2 hours? 12000m

2. What happened from point P to point R? stopped

3. Was the students' speed greater during the first part or the second part of the hike? _____



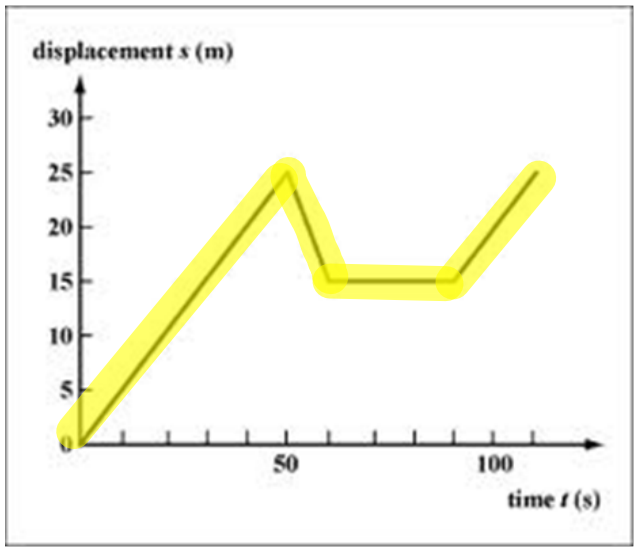
Displacement vs Time graphs

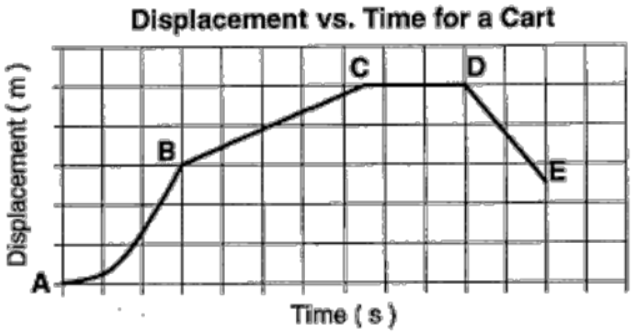
- Also called position-time graphs

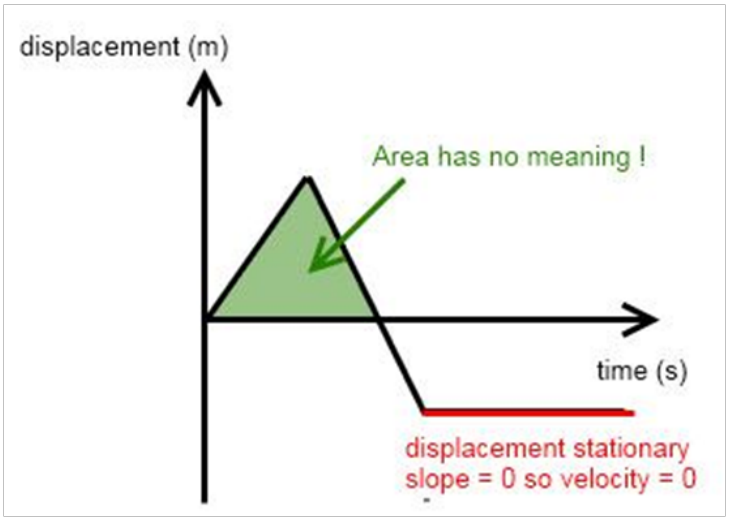
- Very similar to distance-time graphs except:

  -b/c we are dealing with displacement, not distance, the line can go back to zero and even negative.

The Moving man simulation



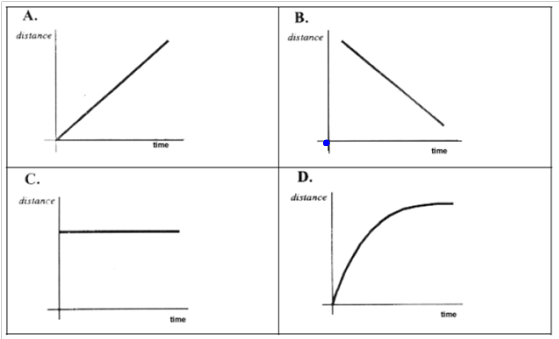




Practice Sheet 4

1. The distance-time graphs below represent the motion of a car. Match the descriptions with the graphs. **Explain your answers.**

Descriptions:
1. The car is stopped. C
2. The car is traveling at a constant speed. A or B
3. The speed of the car is decreasing. D
4. The car is coming back. B



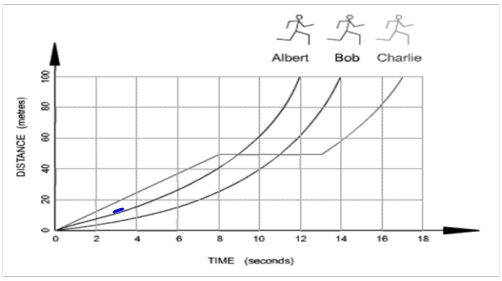
Graph A matches description _____ because _____.

Graph B matches description _____ because _____.

Graph C matches description _____ because _____.

Graph D matches description _____ because _____.

2. Use the following graph to answer the questions that follow.



Look at the graph above. It shows how three runners ran a 100-meter race.

a. Which runner won the race? Albert

b. Which runner stopped for a rest? Charlie

c. How long was the stop? 5 s

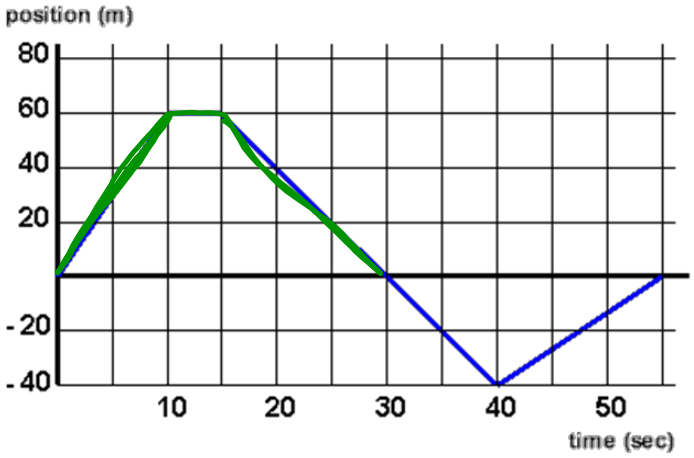
d. How long did Bob take to complete the race? 14s

e. Calculate Albert's average speed. (Figure the distance and the time first!)

$v = \frac{d}{t} = \frac{100\text{m}}{12\text{s}} = 8.33\ldots\frac{\text{m}}{\text{s}} = \boxed{8.3\frac{\text{m}}{\text{s}}}$

1

3. The graph below is a graph showing the motion of a car.



a. Describe the motion of the car in general terms.

b. Calculate the velocity of the car for the first 10 s of driving.

$\vec{v}$: slope : $\frac{60\text{m}}{10\text{s}}$ = 6.0 m/s

c. Calculate the velocity of the car for the first 30 s of driving.

0 m/s

d. How long was the car at rest (stopped) for?

5 s

Attachments

The Moving man simulation.jar