

# MiSP Force and Gravity Worksheet #3, L2

Name \_\_\_\_\_

Date \_\_\_\_\_

## FORCE AND ACCELERATION

### Introduction

Today you will view a video of a typical skydive. The skydiver had a skydiving altimeter mounted in a special box with a video camera, so you can see the skydiver's altitude during the skydive on the screen. You will collect and record time and altitude data directly from the video. The altimeter records several aberrant values at the beginning of the jump due to the abrupt change from the still air in the cabin of the airplane to the ~100 mph airstream. At about 14 seconds, the altimeter stabilizes and you can record more accurate data.

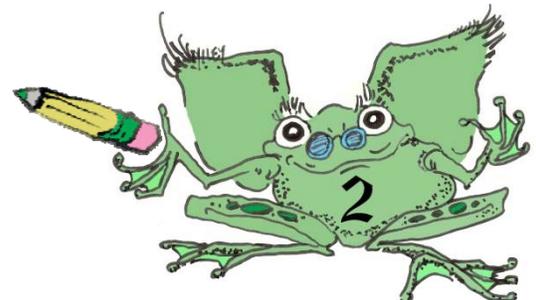
### Procedure:

- Practice reading the altimeter, using the worksheet your teacher provides.
- View the video in its entirety to become familiar with the sequence.
- View the video a second time, and record in data table 1 the altitude at which the skydiver leaves the plane and the time when she lands.

Data Table 1	Time (min.: sec.)	Altitude (feet)
Exit from the airplane	0:00	
Landing		0

### Graph your data:

1. Plot these two data points on the graph provided.
  - a. Make altitude the dependent variable and time the independent variable.
  - b. Use six divisions on the  $x$ -axis for each minute so the seconds can be plotted easily.
2. Draw a line connecting the points on your graph.

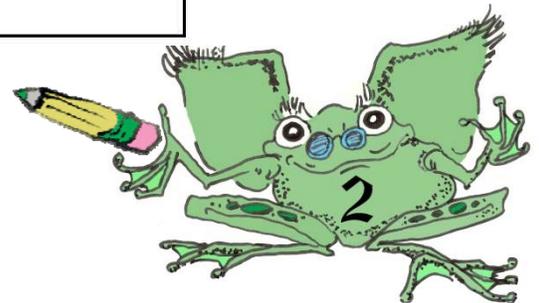


Empty rectangular box at the top of the page.

Large grid area for calculations or drawing.

Vertical empty rectangular box on the left side of the grid.

Empty rectangular box at the bottom of the grid.



3. Calculate the following values.

a. Find the difference between the exit altitude and the landing altitude (include units).

---

---

b. Find the difference between the exit time and the landing time (include units).

---

---

c. Divide the difference in altitude by the difference in time (include units).

---

---

d. What is the term used for change in location (difference in altitude) divided by the change in time?

---

e. Did the skydiver appear to fall at the same velocity during the entire skydive?

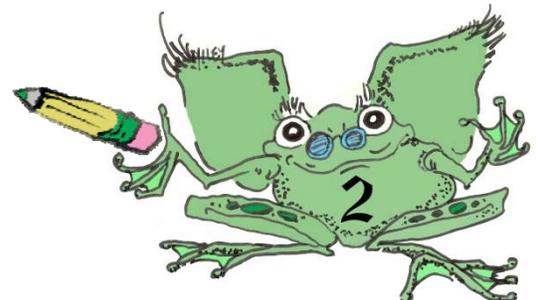
---

f. What is inaccurate about your graph and calculations?

---

---

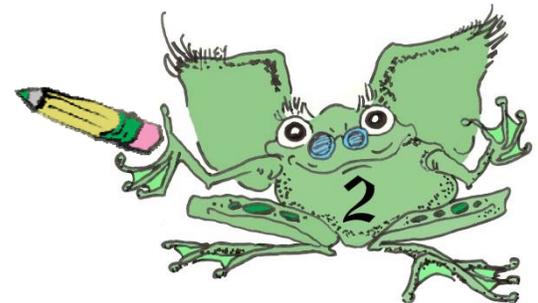
g. If the skydiver fell faster, would the line representing her average velocity be above or below the line on your graph? \_\_\_\_\_



- h. If the skydiver fell slower, would the line representing her average speed be above or below the line on your graph? \_\_\_\_\_
- i. View the video for a third time. This time record the time and altitude
1. when she exits the plane
  2. at 14 seconds into the skydive
  3. when she opens her parachute
  4. when she lands

Data Table 2	Time (min.: sec.)	Altitude (feet)
Exit from the airplane	0:00	
14 seconds into the skydive	0:14	
Opening of parachute		
Landing		0

- j. Add the new data points to your graph and draw three new lines:
1. Draw a line between the point representing the exit from the airplane and the point representing 14 seconds into free fall.
  2. Draw a line between the point representing 14 seconds into free fall and the point where the parachute opens. The first two lines together represent the free fall portion of the skydive.
  3. Draw a line between the point where the parachute opens and the point where the skydiver lands. This is the canopy portion of the skydive.



**Analysis:**

1. Calculate the unit rate of change (slope) for each of the three new lines you drew on your graph.

	Ordered Pair used for calculation $(x_1, y_1)$ $(x_2, y_2)$	$\Delta$ Altitude (ft) $\Delta y$	$\Delta$ Time (seconds) $\Delta x$	<b>Unit Rate of Change (slope)</b> $\Delta y / \Delta x$
Exit from airplane to 14 seconds				
14 seconds to opening of the parachute				
Opening of the parachute to landing				

2. What does the unit rate of change above represent? (What term is used to describe a change in location divided by a change in time?)

---

3. Are the unit rates of change (slopes) positive (+) or negative (-)? \_\_\_\_\_ What does this mean?

---



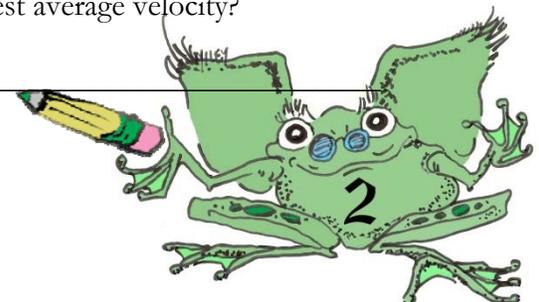
---

4. Which of the lines on your graph (the line representing which part of the skydive) had the greatest slope?

---

5. In which part of the skydive was the skydiver moving at the greatest average velocity?

---



6. Which of the lines on your graph (representing which part of the skydive) had the smallest slope?

---

7. In which part of the skydive was the skydiver moving at the slowest velocity?

---

8. Although you could not calculate it, the velocity during the first 14 seconds of free fall was changing constantly. Why? (Recall what you learned from the BASE jump lesson in Worksheet #2.)

---

---

9. Do you think the velocity changed during the second part of the free fall (14 seconds to the time when the skydiver opens the parachute)? \_\_\_\_\_ Why or why not?

---

---

10. How could you determine this more accurately?

---

---

11. What happens to the velocity when the parachute opens?

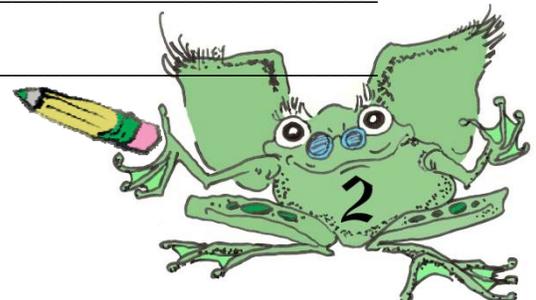
---

---

12. Why does this happen?

---

---



13. If the skydiver had opened her parachute 5 seconds later than she did, would her average velocity over the entire skydive have been greater or less than it was? Explain your answer.

---

---

---

