

Name:

Free Fall Worksheet

Consider an object that starts from rest, and is dropped from some height h . When $t=0$ the speed of the object is zero. But after one second the instantaneous speed of the object is around 32 feet per second. And after 2 seconds the instantaneous speed is 64 feet per second; and so on. The speed of the object is not constant, as the object falls the speed is constantly increasing. Answer the questions below:

1. An object is falling from rest:
 - a. Fill out the column for Table 1 that is labeled instantaneous speed. How fast is an object falling from rest after 5 seconds? (This should be easy)

 - b. Fill out the column for Table 1 that is labeled distance traveled. How far did the object travel for $t=5$ seconds? (Much harder. Explain your thinking, if you are on the right track this will help make it correct)

2. Generalize a formula for how far the object falls given t seconds.

3. Consider the object starting at height h feet, then falling. What is its height after t seconds? How is this different from the last question?

4. From the previous question, find an expression given any height h , that gives the amount of time it takes for an object to reach the ground. (day 2)

5. Ferris Wheel application: Remember the ferris wheel we worked with previously, it has a radius of 50ft, it is 65ft above the ground, and takes 40 seconds to complete one revolution. In these next problems, assume the ferris wheel turns for t seconds and then stops. Once stopped Greta jumps off...
- After riding the ferris wheel for 10 seconds, how far will Greta fall? How long will it take to hit the ground?
 - After riding the ferris wheel for 37 seconds, how far will Greta fall? How long will it take to hit the ground?
 - After riding the ferris wheel for 14 seconds, how far will Greta fall? How long will it take to hit the ground?
6. Use Desmos to sketch the graph of the following functions:

| | | |
|----------------|--------------|-------------|
| $p(t) = 16t^2$ | $v(t) = 32t$ | $a(t) = 32$ |
|----------------|--------------|-------------|

- Challenge Question: These three functions are related, how so, and what are the units?

7. Instead of the falling object starting at rest, assume it is thrown at an initial velocity of 7 feet per second. Complete Table 2.

Table 1: Initial velocity is zero, height is infinite

| Time (seconds) | Instantaneous Speed (ft/sec) | Distance Traveled (Feet) |
|----------------|------------------------------|--------------------------|
| 0-1 | | |
| 0-2 | | |
| 0-3 | | |
| 0-4 | | |
| 0-5 | | |
| 0- t | | |

Table 2: Initial velocity is 7 ft/sec, height is infinite

| Time (seconds) | Instantaneous Speed (ft/sec) | Distance Traveled (Feet) |
|----------------|------------------------------|--------------------------|
| 0-1 | | |
| 0-2 | | |
| 0-3 | | |
| 0- t | | |