Notes on Dropping a Car from a Helicopter

Car A is dropped from a height of 4,000 ft. The time it takes to strike the earth is given by:

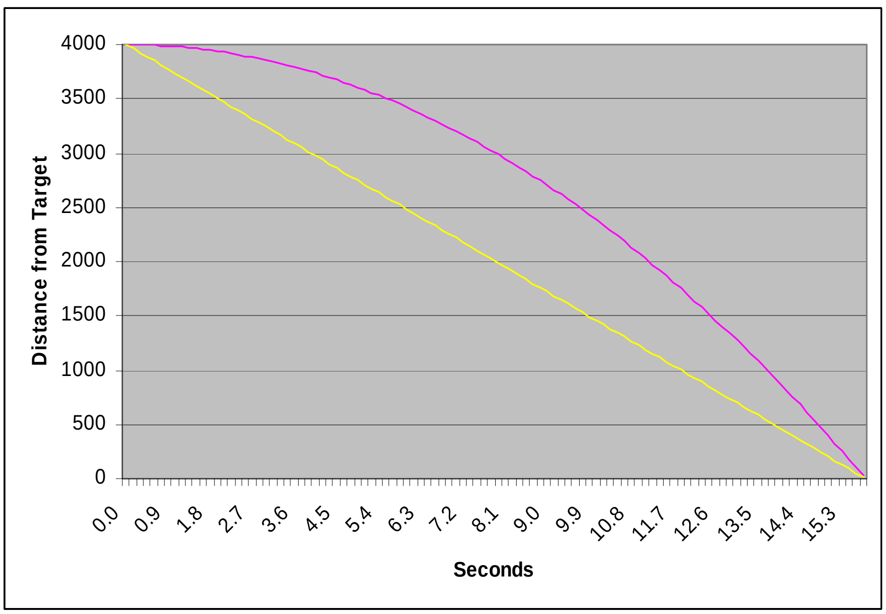
$$s = \frac{1}{2} g t^2$$

where g is the acceleration due to gravity, for the earth, 32 ft/sec^2. This formula is easy to remember because it is the integral of $v = g\,t$. Thus, $t = \sqrt{250} = 15.8$ sec.

Meanwhile, car B traverses 4,000 feet on a racetrack.

$$4{,}000/15.8 = 253 \text{ ft/sec} = 172.5 \text{ MPH}$$

This is B's average speed for the course. The chart below shows car B's constant velocity relative to the acceleration due to gravity of car A.



Car B competes with gravity only because it starts the trial having already attained its full velocity, while car A starts with a velocity of zero.

The time at which car A attains this velocity is given by:

$$v = g\,t$$
$$253 = 32\,t$$
$$t = 7.9 \text{ sec}$$

For car B to beat the falling car from a standing start, its acceleration would have to be greater than g:

$$32 \text{ ft/sec/sec} = 21.8 \text{ MPH/sec}$$

Such a car would be able to accelerate from zero to 60 MPH in 2.75 seconds. Car B would have to maintain this acceleration for the duration of the trial, and a top speed of:

$$v = g\,t$$
$$32 \times 15.8 = 506 \text{ ft/sec} = 345 \text{ MPH}$$

Indeed, the altitude of 4,000 feet was carefully chosen to be compatible with car B's maximum speed.

$$s/t = v$$
$$4s/\sqrt{s} = v$$
$$s = v^2/16$$

The table below gives the recommended altitude for dropping car A, based on the top speed of car B.

MPH	fps	alt.
100	147	1344
120	176	1936
140	205	2635
160	235	3442
180	264	4356
200	293	5378