Follow the “rules” for Motion in One Dimension problems to create your solutions

**Note:** Some information is given in non-standard units. You should convert these to SI units before starting the problem.

1. An F18 jet launched from the deck of the **USS Theodore Roosevelt** must achieve a speed of 170 mph in a distance of 96.0 meters. Find the acceleration of the jet, assuming it is constant, and the time it takes to achieve its maximum speed. *(Note: the aircraft carrier is visible in the current Google Earth image of Coronado Island in San Diego Harbor; I measured the length of the catapult directly from this image.)*

2. The Xcelerator roller coaster at Knott’s Berry Farm starts at rest and accelerates along a horizontal straight track 83.0 meters long. It attains its maximum speed in 1.92 seconds and continues at that speed for an additional 1.35 seconds to reach the end of the horizontal track (where it then turns straight upward.) Find the maximum speed of the roller coaster and its rate of acceleration for the first part of its motion.

3. We’ve all done this…

You are driving at a constant speed of 45.0 mph when the light at the intersection ahead changes yellow. You are 56.0 meters from the intersection and you know the light will turn red in 2.40 seconds. You accelerate as hard as you can and enter the intersection at the instant the light turns red. Find your rate of acceleration, assuming it is constant, and your speed as you enter the intersection.

4. You are at the train station, in downtown Riverside, when a Metrolink train arrives. You realize the train is slowing down, and you measure that the first car takes 1.29 seconds to pass you while the second car takes 1.76 seconds to pass you. The cars are each 85.0 feet long (including the gap between cars.) Assuming the train slows at a constant rate, find the:
   - (a) magnitude of its acceleration;
   - (b) total time, from when the front of the train was level with you, it takes the train to stop;
   - (c) distance from you to the front of the train when it has stopped.
   *(Hint: analyze the motion of the front of the first car.)*

5. A maintenance worker at the top of a tall building accidentally drops a screwdriver over the edge. The screwdriver falls directly to the ground. You measure that the final 8.40 m of the screwdriver’s fall takes 0.900 seconds. Find the height of the building and the speed of the screwdriver as it hits the ground.

6. The guy in Problem 5 seems a little upset over dropping his screwdriver, so you help him out by throwing it straight up to him with an initial speed of 14.2 m/s. The screwdriver goes past the worker on the roof, and he catches it on the way back down. Find:
   - (a) the speed of the screwdriver as it passes the guy on its way up;
   - (b) the maximum height the screwdriver attains;
   - (c) the speed of the screwdriver as the guy catches it;
   - (d) the total time the screwdriver is in the air.

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**Answers**

1. 30.1 m/s^2, 2.53 s  
2. 18.7 m/s^2, 35.9 m/s  
3. 2.68 m/s^2, 59.4 mph  
4. 3.52 m/s^2, 6.36 s, 71.0 m  
5. 9.64 m, 13.7 m/s  
6. 3.57 m/s, 10.3 m, 3.57 m/s, 1.81 s