Problem Set 3 – Kinematics

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Problem 1

A 500kg sports car accelerates uniformly from rest, reaching a speed of 30m/s in 6s. During these 6 seconds, what is the distance that the car travelled?

Problem 2

A body moving in the positive x direction passes the origin at $t = 0$. Between $t = 0$ and $t = 1s$, the body has a constant velocity of $24m/s$. At $t = 1s$, the body is given a sudden constant acceleration of $-6m/s^2$. What is the x position of the body at $t = 11s$?

Problem 3

A projectile is launched at 30° with an initial velocity of 10m/s. What is
a) the horizontal range of the projectile?
b) The maximum height of the projectile?

Problem 4

A sponge is launched vertically upwards from a cannon at $50m/s$. If a plane is moving at $150m/s$ in the positive x direction and starts at position $x_0 = 0$ at a height of 100m, at what x would you need to position the cannon for the sponge to hit the plane
a) on the way up?
b) on the way down?

Problem 5

A person drops a rock from a bridge, and he hears the sound of a splash 2.5 seconds later. How high is the bridge? The speed of sound is 340 m/s.

Problem 6

Two baseballs are thrown off the same cliff, but at different times. The second baseball is thrown 4 seconds after the first one. If the height of the cliff is 200 m, when will the baseballs be 6 m apart?

Problem 7

An airplane has a speed of 290 km/h and is diving at an angle of $\theta = 30$ degrees below the horizontal when the pilot releases a radar decoy. The horizontal distance between the release point and the point where the decoy strikes the ground is d= 700 m.
a) How long is the decoy in the air?
b) How high was the release point?