

## Kinematics practice problems

**Disclaimer:** The problems have been translated from the book: "Physics summary and problem book" by László Vannay.

1.

A cyclist leaves a city at 12:00 hour with constant 18 km/h velocity. At 14:00 a car goes after him, with constant velocity of 50 km/h (on the same path).

- a. When will they meet?
- b. How far from the starting city?

**Solutions:**

- a. At 15:07:30.
- b. 56,25 km-s away.

2.

A cyclist goes from town  $A$  to town  $B$  with 10 km/h and comes back with 20 km/h. What is the average velocity on the whole journey?

**Solution:**  $\bar{v} = 13,33$  km/h.

3.

A runner has to run up a hill, then come back. He does this in 45 minutes. He can run upwards with 8 km/h and downwards with 12 km/h. How much distance did he cover?

**Solution:** 7,2 km.

4.

When arriving at a road-sign, a car decreases its velocity from 120 km/h to 80 km/h in 2 seconds.

- a. What is the acceleration?
- b. How much distance did it cover during braking?

**Solutions:**

- a.  $-5,55$  m/s<sup>2</sup>.
- b. 55,56 m.

5.

A train of 3 carriages accelerates uniformly. A railwayman is standing at the station. The first carriage passes him under 2 seconds, the second in 1,5 seconds. The carriages are 18 m long. What is:

- a. The starting speed when the front of the first carriage is in front of the railwayman?
- b. The acceleration?
- c. The time it takes for the third carriage to pass?
- d. The final speed, when the end of the first carriage passes the r.w. man?

**Solutions:**

- a. 7,28 m/s.
- b. 1,71 m/s<sup>2</sup>.
- c. 1,26 s.
- d. 15,42 m/s.

6.

The distance between the stations "Bajza utca" and "Hősök tere" of the M1 metro is 446 m. The train covers this under the total of 49,4 seconds, as follows: Uniformly accelerating for 20,9 seconds, travelling with constant velocity (for some time) then uniformly decelerating for 19 seconds. What is the constant velocity?

**Solution:** 15,14 m/s.

7.

We are measuring the depth of a well by dropping a pebble in it (with 0 starting velocity). We hear the splash of it in the water after 3,7 seconds. The speed of sound (in air) is 340 m/s, the gravitational acceleration is 10 m/s<sup>2</sup>. How deep is the well?

**Solution:** 61,88 m.