Applying Systems of Linear Equations

Instructions: For each problem, define your variables, write two linear equations, and solve algebraically using substitution or elimination. Show your calculations and answer in context.

MILD

1. Coastal Water Sampling. An environmental team collects 58 water samples from an estuary (where a river meets the sea) and a nearby creek. The team collects 14 more samples from the estuary than from the creek. Determine how many samples were collected from each location.

2. Drone Wildlife Survey. A drone takes 120 photographs of an eelgrass bed (an underwater plant habitat) and a rocky shoreline. It takes three times as many photographs of the eelgrass habitat as of the rocky shoreline. Determine how many photographs were taken of each habitat.

MEDIUM

3. River Research Boat. A research boat travels 54 km downstream in 2 hours and 42 km upstream in 2 hours. The boat maintains the same speed relative to the water on both trips, and the current stays constant. The current increases the boat's speed downstream and decreases it upstream. Determine the boat's speed in still water and the speed of the current.

4. Leaking Water Tank. A tank begins leaking at a constant rate when an experiment starts. After 3 minutes, the tank contains 64 L of water; after 7 minutes, it contains 40 L. Determine the initial volume of water and the rate of leakage in liters per minute.

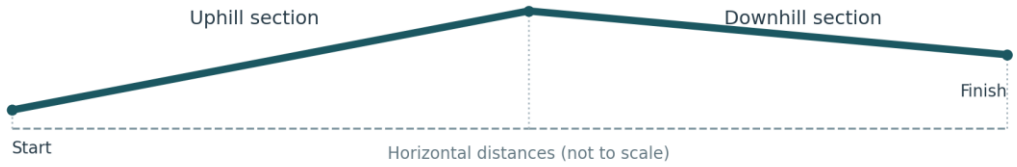
5. Boardwalk Construction. A crew builds wooden walkways from short and long sections. Each short section uses a fixed number of planks, and each long section uses a different fixed number. One project uses 2 short and 3 long sections, for a total of 78 planks. Another uses 4 short and 5 long sections, for a total of 138 planks. Determine the number of planks needed for one section of each type.

6. Emergency Supply Storage. A depot receives two types of crates. Each standard crate weighs 20 kg and requires 0.5 m of length along a shelf; each large crate weighs 32 kg and requires 1.5 m of shelf length. The shipment weighs 584 kg and needs a total of 23 m of shelf length. Determine how many crates of each type are in the shipment.

SPICY

7. Inspection Robots. Two robots travel toward each other along a straight, 60 m corridor. Each test begins with a robot at either end, and each robot maintains the same constant speed in both tests. In the first test, they start together and meet after 4 minutes. In the second test, Robot A starts immediately, while Robot B waits 3 minutes before starting. They meet 6 minutes after Robot A starts. Determine the speed of each robot in meters per minute.

8. Hiking Trail Elevation. A hiking trail has one uphill section and one downhill section. The uphill section gains 8 m of elevation for every 100 m of horizontal distance; the downhill section loses 5 m of elevation for every 100 m of horizontal distance. Together, the sections cover 5 km of horizontal distance. The trail finishes 140 m higher than it starts. Determine the horizontal distance of each section.



EXTRA-SPICY

9. Coastal Restoration Project. A restoration crew includes trained planters and new volunteers. All trained planters work at the same constant hourly rate, and all new volunteers work at another constant rate. On Monday, 4 trained planters and 3 volunteers work for the first hour. For the second hour, 1 trained planter leaves and 2 additional volunteers join. Together, the crew plants 184 seedlings. On Tuesday, 5 trained planters and 2 volunteers work for the first hour. For the second hour, 2 trained planters leave and 1 additional volunteer joins. Together, they plant 173 seedlings. Determine how many seedlings one trained planter and one volunteer can each plant per hour.

1 36 estuary 22 creek	**2** 90 eelgrass 30 shoreline	**3** 24 km/h boat 3 km/h current
4 82 L initially 6 L/min	**5** 12 planks short 18 long	**6** 10 standard 12 large
7 A: 5 m/min B: 10 m/min	**8** 3 km uphill 2 km downhill	**9** 16 seedlings/h trained 9 seedlings/h volunteer