Applications of compositions of functions

Example 1. Starting in the spring, a certain variety of tomato plant grows at a linear rate for $1 \leq t \leq 30$. Once it breaks the surface, it has a height of 1 inch after 2 days, and is 4 inches tall after 6 days.

(a) Find the daily rate of change in the height of a plant.

(b) Find a function for the height h of the plant in inches as a function of time t in days and state its domain.

(c) How tall will the plant be after 12 days?

(d) After how many days will the plant be 10 inches tall?

Example 2. The volume of a spherical balloon is increasing at a rate of 10 cm^3/min. Express the radius r of the balloon, in cm, as a function of time t in seconds.

Example 3. Two cars start at the same position. At 9:00 am, Car A is leaves traveling due west at 40 mph. At 11:00 am, Car B leaves traveling due north at 50 mph.

(a) Find an equation for the distance d, in miles, between the cars at any time t in hours for $t \geq 2$, letting $t = 0$ correspond to the time at which Car A leaves.

(b) How far apart will the cars be at 11:30 am?

Example 4. A conical tank of radius $R = 10$ ft and height $H = 7$ ft is being filled with water at a rate of 3 ft^3/min.

(a) Express the height h of the water in feet as a function of time t in minutes.

(b) What will the height of the water be after 3 minutes?

(c) How long will it take for the height of the water to reach 4 feet?