Applications of compositions of functions

Example 1. Starting in the spring, a certain variety of tomato plant grows at a linear rate for $1 \le t \le 30$. 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?

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Example 2. The volume of a spherical balloon is increasing at a rate of $10 \text{ cm}^3/\text{min}$. 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 $t \ge 2$, 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 ft³/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?