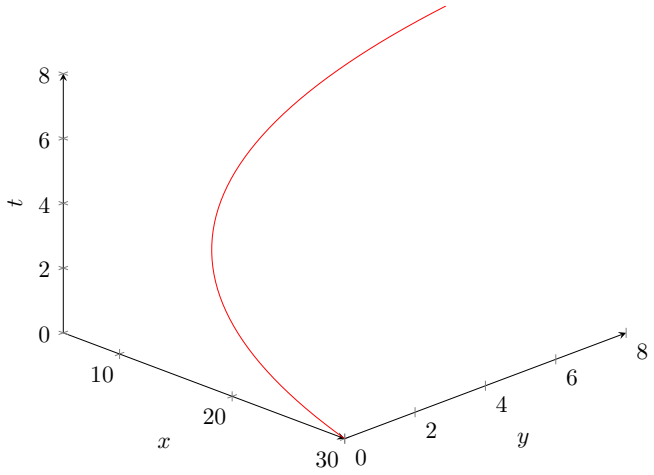
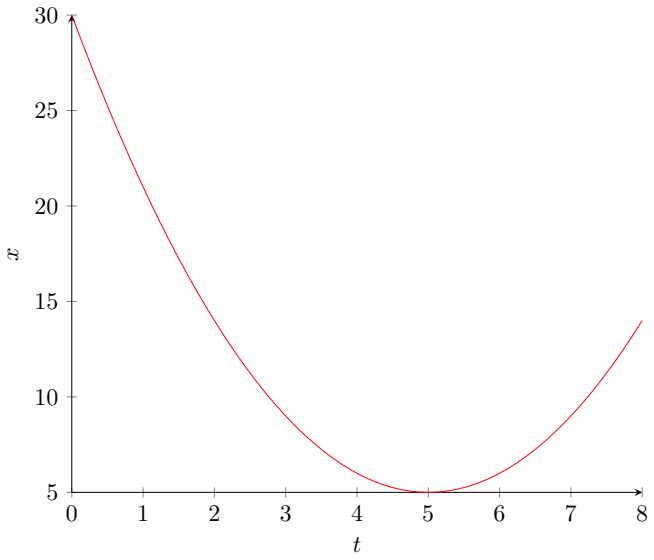
Example 1: The velocity of a particle moving along the x-axis is $V(t) = t^2 - 10t + 30$. What is the change in position from time $t = 0$ to $t = 7$?

The AP test has multiple problems where a particle is moving along the x-axis dependent on time t. Don't think of this as a 3-dimensional problem even though it seems like it. This is *not* how you should think about it:



Because they're only asking for the change in the x-coordinate with relation to time t. This is how you should approach the problem:



Now that the confusing wording is out of the way, the problem is pretty simple. All we need to do is find the net change in position given the velocity:

$$V(t) = t^2 - 10t + 30$$

$$\int_0^7 V(t)\,dt = \int_0^7 t^2 - 10t + 30\,dt$$

$$\int_0^7 V(t)\,dt = \frac{t^3}{3} - 5t^2 + 30t \Big|_0^7$$

$$\int_0^7 V(t)\,dt = \frac{343}{3} - 245 + 210$$

$$79\frac{1}{3}$$