

1. An object moving with constant velocity passes through the point $(1, 1, 1)$, then through the point $(2, -1, 3)$ five seconds later. What is its velocity vector? What is its acceleration vector?
2. Suppose $\vec{r}(t) = 3 \cos(t) \hat{i} + 3 \sin(t) \hat{j} + 4t \hat{k}$ represents the position of a particle on a curve after t seconds.
 - (a) Is the particle ever moving downward? If so, when?
 - (b) When does the particle reach a point 12 meters above the ground?
 - (c) What is the velocity of the particle when it is 12 meters above the ground? What is its speed?
 - (d) When it is 12 meters above the ground, the particle leaves the curve and moves along the tangent line to the curve. Find an equation for this tangent line.