

Motion - solutions

1. A particle is moving along a straight line with $v(t) = 3t^2 - 10t + 5$ where v is measured in feet per second.

- a) $v'(t) = a(t) = 6t - 10$ $v'(0) = -10 \text{ f/s}^2$. At $t = 0$ its velocity is decreasing by 10 ft/s every second.
- b) $d(t) = t^3 - 5t^2 + 5t + C$ where C is some constant. The $+ C$ makes sense because its derivative is zero. Also, just because you know the particle's velocity doesn't tell you anything about where it starts.
- c) You just found an antiderivative (or indefinite integral)
- d) Given the point $d(0)=7$; $d(t) = t^3 - 5t^2 + 5t + 7$
- e) See next slide

2. Unicycle ride:

- a) Sketch the graph of acceleration $a(t)$.
- b) What distance did the unicycle travel in the first 6 seconds?
definite integral (area under the curve) = 60 feet
- c) What happened between $t = 6$ and $t = 16$?
velocity is negative, so the unicycle is going backwards.
- d) When was the unicycle speeding up? (it happened twice)
the unicycle is speeding up from $t = 6$ to $t = 10$, and from $t = 16$ to $t = 20$. v and a are both the same sign here.
- e) Was the unicycle ever stopped?
Yes, $v = 0$ at $t = 6$ and $t = 16$
- f) What was her displacement at $t = 20$ seconds?
definite integral = 15 feet. She is 15 feet from her starting point.