

Lab 10: vectors in \mathbb{R}^2

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1. Let \mathbf{u}, \mathbf{v} be nonparallel vectors. What geometric fact is encoded in the inequality $|\mathbf{u} - \mathbf{v}| \leq |\mathbf{u}| + |\mathbf{v}|$? (Hint: draw a picture with \mathbf{u}, \mathbf{v} rooted at the origin and $\mathbf{u} - \mathbf{v}$ rooted at \mathbf{u} .)
2. Let $\mathbf{f}(t) = (1 + 2t, 3 + 3t) = (1, 3) + t \cdot (2, 3)$.
 - (a) Graph $(x, y) = \mathbf{f}(t)$ on $[-1, 1]$. Hints: your calculator has a parametric graphing function, and it might be a good idea to find it. Also note that this graph is a line.
 - (b) Compute $\mathbf{f}'(t)$, and graph $\mathbf{f}'(t)$ for $-1 \leq t \leq 1$.
 - (c) Compute the arc length of $\mathbf{f}(t)$ on the interval $[-1, 1]$.
3. Suppose that the motion of a particle is described by $(x, y) = (t^3 - 3t, t^2 - 2t)$.
 - (a) Does the particle ever come to a stop? If so, when and where?
 - (b) Is the particle every moving straight up or straight down? If so, when and where?
 - (c) Is the particle ever moving horizontally left or right? If so, when and where?
4. Suppose that $\mathbf{p}(t) = (x(t), y(t))$ describes the path of a projectile with $\mathbf{p}(0) = (0, 0)$, $\mathbf{p}''(t) = (0, -32)$, and $\mathbf{p}'(0) = (3, 4)$. (I.E. the particle satisfies Newton's laws, starts out at the origin, and has downward acceleration due to gravity of 32ft/s^2 .) Find the amount of time until the projectile hits the ground (i.e. the x -axis).