

Extension of problem 36, section 13.5 (This is homework to be handed in on Friday):
We consider the parametric curve

$$\mathbf{r}(t) = \langle t^2, t \rangle.$$

36a) Show this curve lies on the parabola with equation $x = y^2$.

36b) Compute the point with position vector $\mathbf{r}(1)$. Then Compute $\mathbf{r}'(1)$, $\mathbf{r}''(1)$. Plot the point and these vectors appropriately and carefully onto the picture of the range curve below.

36c) Using a ruler which you construct as we did on the earlier example, draw a picture which decomposes $\mathbf{r}''(1)$ into its tangential and normal pieces. Measure the length of each piece to determine numerical values of the tangential and normal components of acceleration.

36d) Find the unit tangent and normal vectors $\mathbf{T}(1)$, $\mathbf{N}(1)$, analytically. Then use the dot product to compute the components of acceleration in these two directions. Compare with the numerical values in (36c).

36e) Use the RCE equation to recompute the components in (36d), by computing $\kappa(1)$, $\mathbf{v}(1)$, $\mathbf{v}'(1)$. You should get the same answers!

