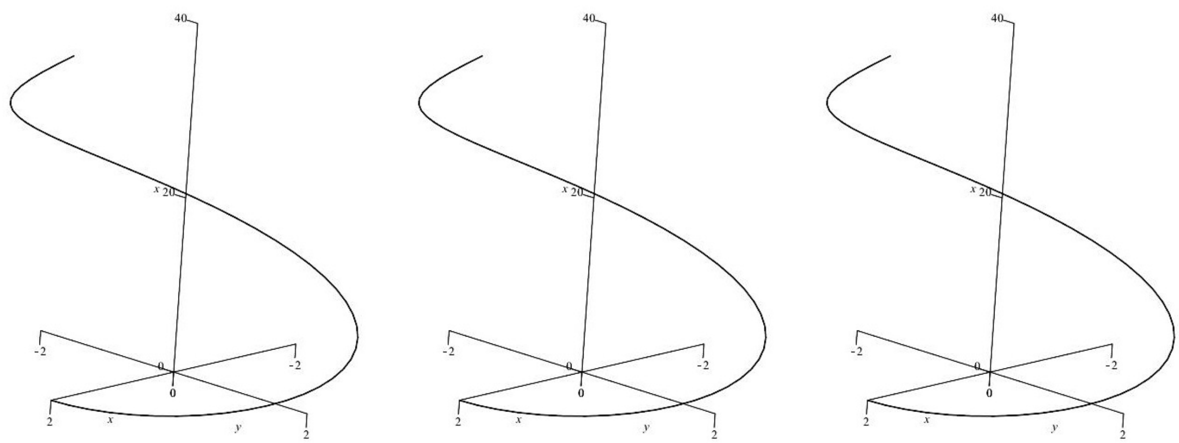
Math 135, Winter 2015, Homework 10

For practice - do not hand in

1. **Section 14.1**, Problems 7, 19, 31, 34, 39, 43, 48, 55.
2. **Section 14.2**, Problems 21, 26, 29.
3. **Section 14.3**, Problems 7, 11, 17, 19, 23, 33, 34, 41
4. **Section 14.4**, Problems 5, 23.
5. **Section 14.5**, Problems 2, 10, 33, 41.
6. For the curve traced by the vector function $\mathbf{r}(t) = \left(a\cos t, a\sin t, bt^2\right)$, compute the following at the point where $t = \frac{2\pi}{3}$:
   (a) The velocity, speed and acceleration.
   (b) The vectors $\mathbf{T}$, $\mathbf{N}$ and $\mathbf{B}$.
   (c) The normal and tangential components of acceleration.
   (d) The equations of the osculating and normal planes.
   (e) The equation of the tangent line.
   (f) The curvature of the curve and the radius of the osculating circle.
   (g) The (vector) equation of the osculating circle.
   (h) Check that the tangent line and the osculating circle lie on the Osculating plane and that the tangent line is normal to the tangent plane at the point where $t = \frac{\pi}{3}$.
   (i) Showing the quantities you computed on the graphs below . Put the vectors on the first one. The normal plane and tangent line on the second and the osculating plane and circle on the third.



To hand in

1. Problems 54 in Section 14.1.
2. Problems 58 in Section 14.1. Although this problem is in Section 14.1, use the differentiation formulas in 14.2 to give a clean proof, avoiding use of components of the vector function.
3. The curvature of the curve traced by the vector function $\mathbf{r}(t)$ is given by $\kappa = \dfrac{||\mathbf{T}'||}{||\mathbf{r}'||}$ where $\mathbf{T}$ is the unit tangent vector. Prove formula 14.5.9 using question 2 above and formula 13.4.11.
4. Project 14.5B.