## Reading

Read carefully Sections 3.1 "Some Examples" and Section 3.2 "Graphs and Level Sets" in our text *Multivariable Calculus: A Linear Algebra Based Approach.*

*Optional Reading:* Section 2.6.2: "Kepler's Laws of Planetary Motion"

## Writing

Write out careful and complete solutions of Exercises 35, 40, 42, 43 in Chapter 2 and Problem A below:

Problem A: Let $\mathbf{f}(t) = (a\cos t, a\sin t, bt)$ with $a$ and $b$ nonzero constants. Sketch the graph of this curve (a **helix**) for $0 \leq t \leq 5\pi$. Show that the speed is constant and the velocity vector is always orthogonal to the vector $\mathbf{r}(t) = (a\cos t, a\sin t, 0)$.

The choices $a = 1$, $b = \frac{1}{2}$ and $a = -1$, $b = \frac{1}{2}$ give the general configuration of the double helix portion of the DNA molecule shown here:
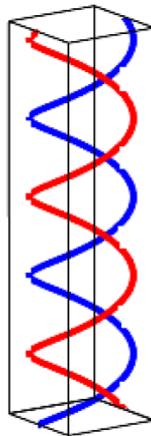


*Some Answers and Hints*

**40. Are any of these vectors orthogonal to other vectors? Point in the same direction as other vectors?**

**42. Integration by parts on $t\, e^t$, change of variable $u = 1 + t^2$ on third component. Among the constants of integration may be 1, 0, and -2/3.**

**43. To find $\int \tan t\, dt$, begin by writing tangent as sine/cosine. To find $\int \ln t\, dt$, integration by parts may be useful.**

**A. Speed is $\sqrt{a^2 + b^2}$. One way to show orthogonality is to show dot product is 0.**