MATH 223 Fall 2023

Assignment 4

Due: Wednesday September 20

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.*

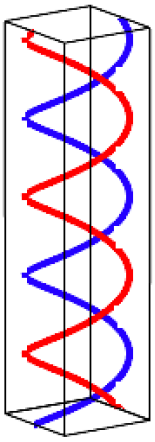
Optional Reading: Section 2.6.2: "Kepler's Laws of Planetary Motion"

Writing

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

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 $0 \le t \le 5\pi$. 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 $a = 1$, $b = ½$ and $a = -1$, $b = ½$ 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.