Vector Calculus

Homework Set 4   Due Monday, 9 February 2004

Course Web Site: `http://www.math.sfu.ca/~ralfw/math252/`

Problems from Davis and Snider "Introduction to Vector Analysis":

- Section 2.1   (pp.70–71):   1, 3, 4
- Section 2.2   (pp.85–86):   2, 4, 5, 8, 10
- Section 2.3   (pp.95–98):   **5**, **7**, 14, 15, 18, 19
- Section 2.4   (pp.102–103):   1, 3, 7, 8, 16

Please also plot the curves of problems **5** and **7** of section 2.3 using Maple. A Maple worksheet of sample commands is given on the course website, and also includes some more interesting space curves; you could have a look at these examples, and use them to motivate your own explorations. As an *additional exercise*, try to come up with your own (interesting and unique) space curve. Please print out your curves, together with the Maple commands used to generate them, and submit them with your assignment.

Extra problems

1. *Curvature of Plane Curves*

   (a) Show that the curvature of a plane curve in the x-y plane, $\mathbf{R}(t) = x(t)\mathbf{i} + y(t)\mathbf{j}$, is given by

   $$\kappa = \frac{|x'y'' - x''y'|}{[(x')^2 + (y')^2]^{3/2}}.$$

   (b) For the special case of a plane curve given by an explicit function of the form $y = f(x)$, show that the curvature is

   $$\kappa = \frac{|y''|}{[1 + (y')^2]^{3/2}} = \frac{|d^2y/dx^2|}{[1 + (dy/dx)^2]^{3/2}}.$$

   [Hint: Try a parametrization of the form $x = t$, $y = f(t)$.]