MATH 252-3 **Spring 2005**

Vector Calculus

Homework Set 2 Due Wednesday, 26 January 2005

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

Textbook: **Davis and Snider** "*Introduction to Vector Analysis*":

Reading: Sections 1.8 – 1.15

Problems to study (for practice; you do not need to hand these in):

- Section 1.8 (pp.29–30): 4, 8, 15
- Section 1.10 (pp.38–40): 5, 8, 19, 22, 27
- Section 1.12 (pp.51–53): 18, 24, 26
- Section 1.13 (pp.57–59): 5, 7, 10, 16, 19
- Section 1.14 (pp.60–61): **3**, 5, 10, 11

Problems to hand in:

- *Section 1.8 (pp.29–30): 7, 11, 12, 18*
- *Section 1.10 (pp.38–40): 9, 12, 18, 28*
- *Section 1.12 (pp.51–53): 27*
- *Section 1.13 (pp.57–59): 3, 11, 15, 17*
- *Section 1.14 (pp.60–61):* ***2****, 6,* ***7****, 9*
- *Section 1.15 (p.66): 2*

For problems **2** and **7** of section 1.14 (and the optional problem **3**), please derive the relevant identities *both* (i) using previously derived identities and properties, using the methods of section 1.14, and (ii) using the tensor notation conventions and methods of section 1.15. Also show problem **7** using the geometric definitions of the dot and cross products.

Notes:

- For section 1.8 problem 18, either find the point(s) of intersection of the lines, or show that none exist.
- Observe that section 1.13 problem 17 gives the expansion of a vector $\mathbf{V}$ in terms of any three *independent* vectors $\mathbf{A}$, $\mathbf{B}$ and $\mathbf{C}$ (they don't need to be orthogonal).
- Recall the Cauchy-Schwarz inequality

$$|\mathbf{A}\cdot\mathbf{B}| \le |\mathbf{A}||\mathbf{B}| \quad \Longrightarrow \quad |\mathbf{A}|^2|\mathbf{B}|^2 - (\ \mathbf{A}\cdot\mathbf{B})^2 \ge 0.$$

  The result of section 1.14 problem 7, $|\mathbf{A}\times\mathbf{B}|^2 = |\mathbf{A}|^2|\mathbf{B}|^2 - (\mathbf{A}\cdot\mathbf{B})^2$, provides a formula for the magnitude of the "error" in the Cauchy-Schwarz inequality. It also shows that the Cauchy-Schwarz inequality is an equality exactly when $\mathbf{A}\times\mathbf{B} = \mathbf{0}$, that is, if $\mathbf{A} = \mathbf{0}$ or $\mathbf{B} = \mathbf{0}$ or $\mathbf{A}$ and $\mathbf{B}$ are parallel.