

**University of Colorado**  
**Department of Computer Science**  
**Computer Graphics – CSCI 4229**  
**Spring 2003**

Problem Set 5 – Solutions

a. Given the vectors  $\vec{a} = (2, 3)$  and  $\vec{b} = (1, 4)$ , here are the calculations:

- $2\vec{a} = (4, 6)$
- $\vec{a} + \vec{b} = (3, 7)$
- $\vec{a} + 2\vec{b} = (4, 11)$
- $\vec{a} - \vec{b} = (1, -1)$
- $\hat{a} = \frac{(2,3)}{\sqrt{(2)^2+(3)^2}} = \frac{(2,3)}{\sqrt{13}} = (\frac{2}{\sqrt{13}}, \frac{3}{\sqrt{13}})$
- $\vec{b}^\perp = (4, -1)$  or  $(-4, 1)$  (CW and CCW, respectively)
- $\vec{a} \cdot \vec{b} = (2 \times 1 + 3 \times 4) = 14$ . Just a scalar — no drawing necessary.

Here are the drawings:

