Quiz 1 — MA261 — June 16, 2017

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1. (8 points) Let $\mathbf{u} = \langle 1, 0, 5\rangle$ and $\mathbf{v} = \langle -2, 6, 1\rangle$. Find:

   (a) $2\mathbf{u}$ (b) $\mathbf{u} - \mathbf{v}$ (c) $\mathbf{u} \cdot \mathbf{v}$ (d) $\mathbf{u} \times \mathbf{v}$

   (a) $\langle 2, 0, 10\rangle$
   (b) $\langle 3, -6, 4\rangle$
   (c) 3
   (d) $\langle -30, -11, 6\rangle$

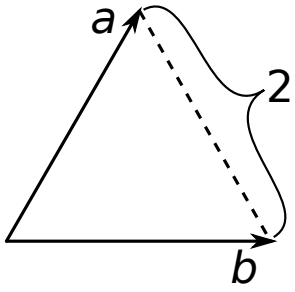
2. (6 points) Find a value for t such that the vectors $18\mathbf{i} + t\mathbf{j}$ and $2\mathbf{i} - 4t\mathbf{j}$ are perpendicular.

   If the vectors are perpendicular, their dot product will be zero.

   $$(18\mathbf{i} + t\mathbf{j}) \cdot (2\mathbf{i} - 4t\mathbf{j}) = 0$$
   $$36 - 4t^2 = 0$$
   $$(3 + t)(3 - t) = 0$$

   Hence, we must have $t = 3$ or $t = -3$.

3. (6 points) $\mathbf{a}$ and $\mathbf{b}$ form two sides of the equilateral triangle with side length 2 shown below. Find $|\mathbf{a} \times \mathbf{b}|$. Should $\mathbf{a} \times \mathbf{b}$ point into the page, or out of the page?



   Using the formula $|\mathbf{a} \times \mathbf{b}| = |\mathbf{a}||\mathbf{b}| \sin\theta$ with $\theta = \frac{\pi}{3}$ we find $|\mathbf{a} \times \mathbf{b}| = 2\sqrt{3}$. The right-hand rule tells us the vector will point into the page.