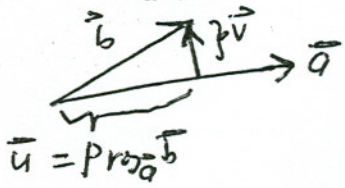
160 ~~40~~

7. **(There is no partial credit for this problem. Make sure your answer is correct.)** Let $\vec{a} = 2\vec{i} + 4\vec{j} + 6\vec{k}$ and $\vec{b} = 3\vec{i} + 4\vec{j} + \vec{k}$. Find vectors $\vec{u}$ and $\vec{v}$ with $\vec{b} = \vec{u} + \vec{v}$, $\vec{u}$ parallel to $\vec{a}$, and $\vec{v}$ perpendicular to $\vec{a}$.



$\vec{u} = \frac{\vec{a}\cdot\vec{b}}{\vec{a}\cdot\vec{a}}\vec{a} = \frac{6+16+6}{4+16+36}\vec{a} = \frac{28}{56}\vec{a} = \frac{1}{2}\vec{a} = \vec{i} + 2\vec{j} + 3\vec{k}$

$\vec{v} = \vec{b} - \vec{a} = 3\vec{i} + 4\vec{j} + \vec{k} - (\vec{i} + 2\vec{j} + 3\vec{k})$

$\vec{v} = 2\vec{i} + 2\vec{j} - 2\vec{k}$

$\vec{u} = \vec{i} + 2\vec{j} + 3\vec{k}$

check $\vec{u} + \vec{v} = 3\vec{i} + 4\vec{j} + \vec{k} = \vec{b}$ ✓

$2\vec{u} = \vec{a}$ ✓

$\vec{v}\cdot\vec{a} = 4 + 8 - 12 = 0$ ✓

8. Find the equations of **any** line which **intersects** and is **perpendicular** to $\frac{x-2}{1} = \frac{y-4}{3} = \frac{z-5}{6}$. Be sure to tell me where your line intersects my line.

I'll take the line through (2, 4, 5) (this is the point of intersection) which is ∥ to $-3\vec{i} + \vec{j}$

My line is

$x = 2 - 3t$

$y = 4 + t$

$z = 5$