6, 3, 1
6, 3, 1 N

#48 p. 627

Find coordinates of point Q that divides the segment between $P_1(x_1, y_1, z_1)$ and $P_2(x_2, y_2, z_2)$ into two lengths ~~woose~~ whose ratio is $p/q = r$. (Special case where $p=3$, $q=5$, and the distance between P_1 and P_2 is 16.)

To find the coordinates of point Q, we can modify the formula for the midpoint of a segment to fit the given parameters of this problem. Page 625 of the textbook shows both this formula and its proof.

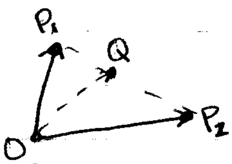

Figure 1

Figure 1 shows a diagram that is useful in using the given formula, showing ~~P_1~~ ~~and P_2 with~~ vectors with the same base and end points at P_1 and P_2, and another vector with tip at point Q. Good We start with the equation $\overrightarrow{OQ} = \overrightarrow{OP_1} + \frac{3}{8}(\overrightarrow{P_1P_2})$, because one segment of $\overline{P_1P_2}$ is 3k (where k is an unknown constant) and the other is 5k, so the ratio of the segment $\overline{P_1Q}$ to $\overline{P_1P_2}$ is 3/8. Following the book's proof, we simplify this equation to $\overrightarrow{OQ} = \frac{3}{8}\overrightarrow{OP_2} + \frac{5}{8}\overrightarrow{OP_1}$, which in turn is equal to $\frac{3}{8}\langle x_2, y_2, z_2\rangle + \frac{5}{8}\langle x_1, y_1, z_1\rangle$. Finally we combine these two vectors and get their endpoint ~~$Q(\frac{5}{8}x$~~ $Q(\frac{5}{8}x_1 + \frac{3}{8}x_2, \frac{5}{8}y_1 + \frac{3}{8}y_2, \frac{5}{8}z_1 + \frac{3}{8}z_2)$.

Excellent

#28 p.

If $\vec{u}\cdot\vec{v}_1 = \vec{u}\cdot\vec{v}_2$, can we then say that $\vec{v}_1 = \vec{v}_2$?

To begin, we know we can not simply "cancel" $\vec{u}$ (divide by $\vec{u}$) on both sides of the given equation because we have no definition for division of vectors. excellent.
Expanding the first equation, ~~we get~~ $\vec{u}\circ\vec{v}_1 = \vec{u}\circ\vec{v}_2$, we have $u_1(v_{11}) + u_2(v_{12}) + u_3(v_{13}) = u_1(v_{21}) + u_2(v_{22}) + u_3(v_{23})$. From here we can see that with nine variable values for each entry of the three vectors, there must be infinitely many vectors $\vec{v}_1$ and $\vec{v}_2$ that make this equation true, of which vectors $\vec{v}_1 = \vec{v}_2$ are only the most obvious. For example, if we have $\vec{u} = \langle 2,3,2\rangle$, $\vec{v}_1 = \langle 4,1,3\rangle$, $\vec{v}_2 = \langle 0,3,4\rangle$, ~~then~~ the dot product of $\vec{u}\cdot\vec{v}_1$ equals 17, as does the dot product $\vec{u}\cdot\vec{v}_2$, even though $\vec{v}_1$ is not equal to $\vec{v}_2$.

Good.