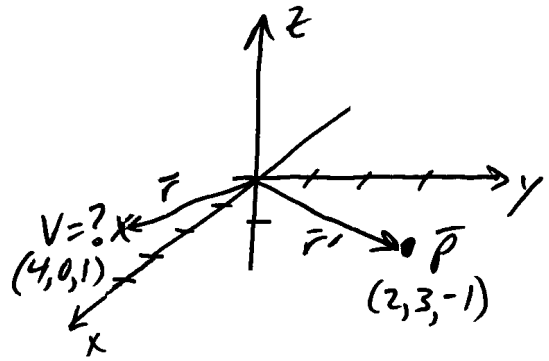
4.62 A dipole has dipole moment $p = 2\mathbf{a}_x + 6\mathbf{a}_y - 4\mathbf{a}_z \ \mu\text{C} \cdot \text{m}$. If the dipole is located in free space at (2, 3, −1), find the potential at (4, 0, 1).



$$\text{Per (4.81)}, \quad V(\bar{r}) = \frac{\bar{p} \cdot (\bar{r} - \bar{r}')}{4\pi\epsilon_0 |\bar{r} - \bar{r}'|^3}$$

$$\bar{r} = 4\hat{a}_x + 1\hat{a}_z \ (m) \quad \& \quad \bar{r}' = 2\hat{a}_x + 3\hat{a}_y - 1\hat{a}_z \ (m)$$

$$V(4,0,1) = \frac{(2\hat{a}_x + 6\hat{a}_y - 4\hat{a}_z)10^{-6} \cdot [(4-2)\hat{a}_x + (0-3)\hat{a}_y + (1+1)\hat{a}_z]}{4\pi\, 8.8541878 \times 10^{-12} \left[2^2 + (-3)^2 + 2^2\right]^{3/2}}$$

$$= \frac{10^{-6}[2(2) + 6(-3) + (-4)2]}{4\pi\, 8.8541878 \times 10^{-12} (17)^{3/2}}$$

$$= \frac{-22 \times 10^{-6}}{4\pi\, 8.8541878 \times 10^{-12} (17)^{3/2}}$$

$$\underline{\underline{V(4,0,1) = -2820.92 \text{ V}}}$$