2. (PRACTICE) Finding Charges from Potential Measurements

$k\frac{Q_1}{r_{1,1}} + k\frac{Q_2}{r_{2,1}} + k\frac{Q_3}{r_{3,1}} = U_1 = k\frac{4+3\sqrt{5}+\sqrt{10}}{2\sqrt{5}}$

$k\frac{Q_1}{r_{1,2}} + k\frac{Q_2}{r_{2,2}} + k\frac{Q_3}{r_{3,2}} = U_2 = k\frac{2+4\sqrt{2}}{\sqrt{2}}$

$k\frac{Q_1}{r_{1,3}} + k\frac{Q2}{r_{2,3}} + k\frac{Q3}{r_{3,3}} = U_3 = k\frac{4+\sqrt{5}+3\sqrt{10}}{2\sqrt{5}}$

Canceling k and calculating out the distances would give us:

$\frac{Q_1}{\sqrt{2}} + \frac{Q_2}{\sqrt{5}} + \frac{Q_3}{2} = \frac{4+3\sqrt{5}+\sqrt{10}}{2\sqrt{5}}$

$\frac{Q_1}{1} + \frac{Q_2}{\sqrt{2}} + \frac{Q_3}{1} = \frac{2+4\sqrt{2}}{\sqrt{2}}$

$\frac{Q_1}{2} + \frac{Q2}{\sqrt{5}} + \frac{Q3}{\sqrt{2}} = \frac{4+\sqrt{5}+3\sqrt{10}}{2\sqrt{5}}$

Using IPython to solve the linear equations,

$Q1 = -173.$

$Q2 = 490.$

$Q3 = -163.$