Ms. Paulson Halloween Problem Key

a) $\begin{pmatrix}0\\0.5\end{pmatrix}$ half a block North; $\begin{pmatrix}-0.5\\0\end{pmatrix}$ half a block West; $\begin{pmatrix}0\\-2\end{pmatrix}$ 2 blocks South; $\begin{pmatrix}1.75\\0\end{pmatrix}$ 1.75 blocks East; $\begin{pmatrix}1/3\\1/6\end{pmatrix}$ "b"; $\begin{pmatrix}0\\1/6\end{pmatrix}$ 1/6 blocks North

$\begin{pmatrix}-1.5\\0\end{pmatrix}$ 1.5 blocks West; $\begin{pmatrix}-1/3\\1/3\end{pmatrix}$ "a"; $\begin{pmatrix}0\\2/3\end{pmatrix}$ 2/3 block North; $\begin{pmatrix}1.5\\0\end{pmatrix}$ 1.5 blocks East; $\begin{pmatrix}1/3\\1/2\end{pmatrix}$ "c"; $\begin{pmatrix}0\\-1.5\end{pmatrix}$ 1.5 blocks South

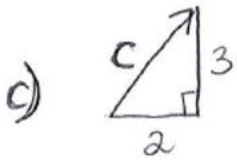
$\begin{pmatrix}-1.5\\0\end{pmatrix}$ 1.5 blocks West; $\begin{pmatrix}0\\-0.5\end{pmatrix}$ half a block South

b) (i) $0.5 + 0.5 + 2 + 1.75 + \sqrt{(\frac{1}{3})^2+(\frac{1}{6})^2} + \frac{11}{6} + 1.5 + \sqrt{(\frac{1}{3})^2+(\frac{1}{3})^2} + \frac{2}{3} + 1.5$

$+ \sqrt{(\frac{1}{3})^2 + (\frac{1}{2})^2} + 1.5 + 1.5 + 0.5 \approx 15.2$ blocks

($\frac{\sqrt{5}}{6}$, $\frac{\sqrt{2}}{3}$, $\frac{\sqrt{13}}{6}$)

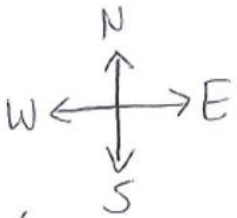
(ii) $\begin{pmatrix}0\\0\end{pmatrix}$

c) 

$2^2 + 3^2 = c^2$

$13 = c^2$

$c = \sqrt{13} \approx 3.6$



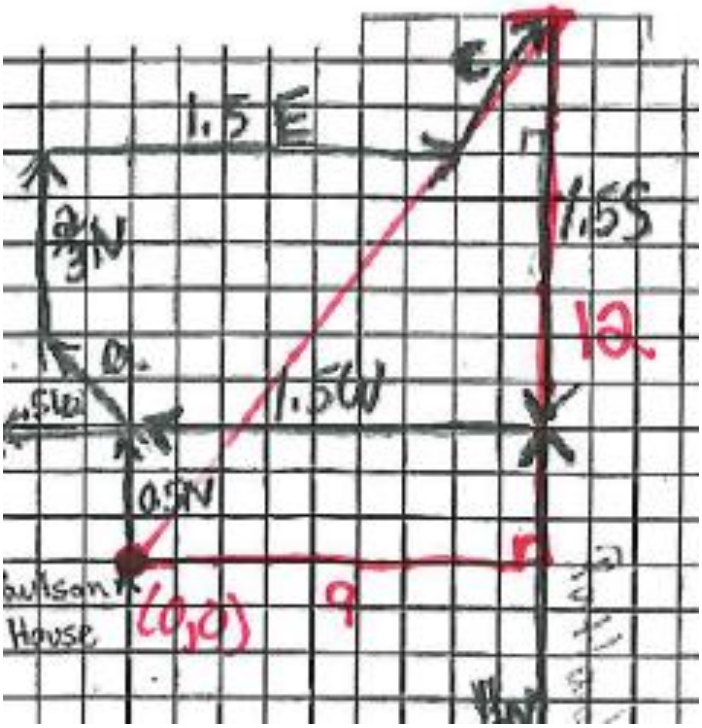
(6 spaces = 1 block)

[Mr. Paulson chased the dog $\frac{\sqrt{13}}{6}$ blocks, about .6 blocks SE]

d) $1^2+2^2=b^2$, $\sqrt{5}=b$ [$\frac{\sqrt{5}}{6}$ blocks SE, about .37 blocks SE]

$2^2+2^2=a^2$, $8=a^2$, $a=\sqrt{8}$, $a=2\sqrt{2}$ [$\frac{2\sqrt{2}}{6}=\frac{\sqrt{2}}{3}$ blocks NW, about .24 blocks NW]

e) BAT, $\sqrt{9^2+12^2}$ = BAT's flight was 15 blocks SE.



Justification for Pythagorean Theorem:

- The directions of North/South paired with East/West are perpendicular. By the definition of perpendicular, the directions form right angles. Using the lengths of the N, S, E, W vectors, we have right triangles. Hence we can use the Pythagorean Theorem.