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6. (10 points)

(a) **Answer:**

$$\begin{aligned}
 \det(L) &= \det \begin{pmatrix} 4 & -57 \\ 13 & -45 \end{pmatrix} \\
 &= 561, \\
 \sqrt{\frac{\det(L)}{\|\mathbf{v}_1\| \|\mathbf{v}_2\|}} &\approx \sqrt{\frac{561}{13.60 \cdot 72.6}} \\
 &\approx 0.75, \\
 \sqrt{\frac{\det(L)}{\|\mathbf{w}_1\| \|\mathbf{w}_2\|}} &\approx \sqrt{\frac{561}{27027.79 \cdot 17091.88}} \\
 &\approx 0.0011.
 \end{aligned}$$

(b) **Answer:**

$$\begin{aligned}
 \mathbf{e} &= \underbrace{-6823.12}_{t_1} \mathbf{v}_1 + \underbrace{-3204.08}_{t_2} \mathbf{v}_2 \\
 \Rightarrow \begin{cases} a_1 = \lfloor t_1 \rfloor = -6823 \\ a_2 = \lfloor t_2 \rfloor = -3204 \end{cases} \\
 \Rightarrow \mathbf{v} &= -6823 \mathbf{v}_1 - 3204 \mathbf{v}_2 \\
 &= (155336, 55481) \\
 &= 8 \mathbf{w}_1 + 3 \mathbf{w}_2, \\
 \Rightarrow \mathbf{m} &= (8, 3).
 \end{aligned}$$

(c) **Answer:**

$$\begin{aligned}
 \mathbf{e} &= \underbrace{-8.39}_{t_1} \mathbf{w}_1 + \underbrace{-22.92}_{t_2} \mathbf{w}_2 \\
 \Rightarrow \begin{cases} a_1 = \lfloor t_1 \rfloor = -8 \\ a_2 = \lfloor t_2 \rfloor = -23 \end{cases} \\
 \Rightarrow \mathbf{v} &= -8 \mathbf{w}_1 - 23 \mathbf{w}_2, \\
 \Rightarrow \mathbf{m} &= (-8, -23) \\
 &\neq (8, 3).
 \end{aligned}$$