M☐T☐W☐T☐F☐S H/W☐-C/W☐ *Dated:........./........./20.........*

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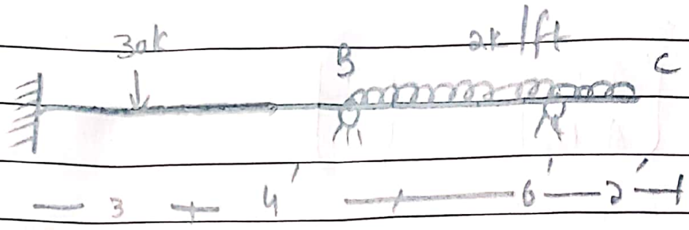
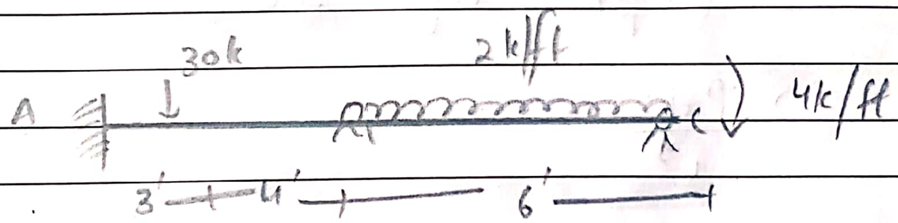



## Set 1.

**Determing Kinetic Intermodiatlely:**

K.I = 5''

So we have to reduce the extended position



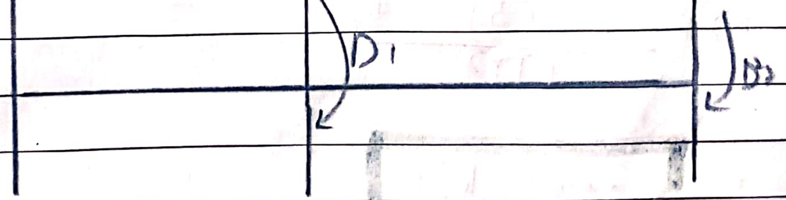

$$\rightarrow \frac{2(2)}{1}$$

$$= 4kft$$

Now- K.I = 2''

**Step: 2**

**Determine unknown Joint displacement:**

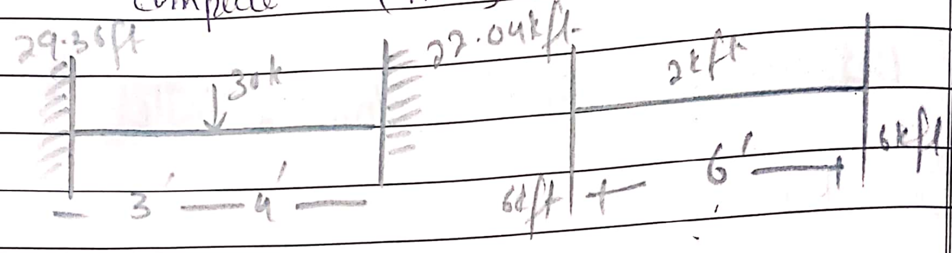


$$\begin{bmatrix} D_1 \\ D_2 \end{bmatrix} = \begin{bmatrix} ? \\ ? \end{bmatrix}$$

$$\begin{bmatrix} A\,D_1 \\ A\,D_2 \end{bmatrix} = \begin{bmatrix} 0 \\ 4 \end{bmatrix}$$

Step 3

Compute (ADL) Matrix




= fa pointed load (not at mid) for left end

$\Rightarrow \dfrac{Pab^2}{L^2}$

$\Rightarrow \dfrac{(30)(3)(4)^2}{(7)^2}$

$= \boxed{29.38 \text{ k.ft}}$

For Right End.

$\Rightarrow \dfrac{Pa^2b}{L^2}$

$\Rightarrow \dfrac{(30)(3)^2(4)}{(7)^2}$

$= \boxed{22.04 \text{ kft}}$

⇒ For UDL

$$\Rightarrow \frac{WL^2}{12} \rightarrow \frac{(2)\ (6)^2}{12} = 6\ kft$$

$ADL_1 = +22.04 - 6 = 16.04\ kft$

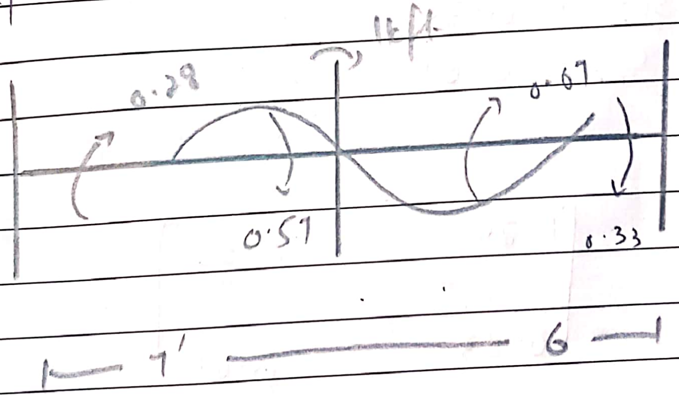
$ADL_2 \quad 6\ kft$

**step 4**

Compute (S) Matrix

$$S = \begin{bmatrix} S_{11} & S_{12} \\ S_{21} & S_{22} \end{bmatrix}$$

a) $D_1 = 1k, \quad D_2 = 0$




$$\frac{4EI}{7} = 0.57 \qquad \frac{2EI}{6} = 0.33$$

$$\frac{2EI}{7} = 0.28$$

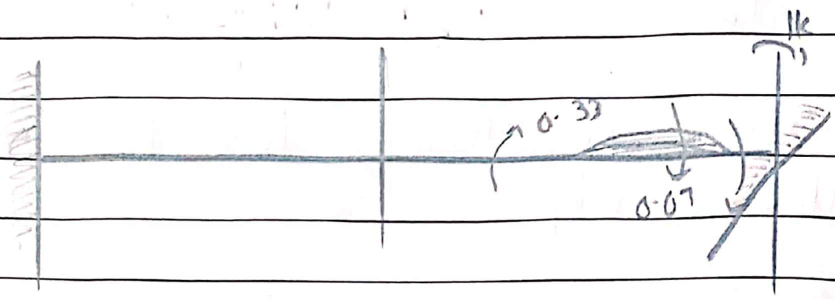
$$\frac{4EI}{6} = 0.67$$

$S_{11} = 0.57 + 0.67$

$= 12.4EA$

$S_{21} = 0.33EI$

b $D_1 = 0$ $D_2 = 1K$




$$\frac{4EI}{6} = 0.67$$

$$\frac{2EI}{6} = 0.33$$

$S_{12} = 0.33$

$S_{22} = 0.67$

$$S = \begin{bmatrix} 1.24 & 0.33 \\ 0.33 & 0.67 \end{bmatrix}$$

**Step: 5**

Compute (D) Matrix

$$\begin{bmatrix} D_1 \\ D_2 \end{bmatrix} = \begin{bmatrix} S_{11} & S_{12} \\ S_{21} & S_{22} \end{bmatrix}^{-1} \times \begin{bmatrix} AD_1 \\ A_2 \end{bmatrix} - \begin{bmatrix} ADL_1 \\ ADL_2 \end{bmatrix}$$

$$\frac{1}{\begin{bmatrix} 1.24 & 0.33 \\ 0.33 & 0.67 \end{bmatrix}} \times Adj\, A \times \begin{bmatrix} AD_1 \\ AD_2 \end{bmatrix} - \begin{bmatrix} ADL_1 \\ ADL_2 \end{bmatrix}$$

$$|S| = (1.24 \times 0.67) - (0.33 \times 0.33)$$
$$= 0.8308 - 0.1089$$
$$|S| = 0.7219$$

$$Adj\, A = \begin{bmatrix} 0.67 & -0.33 \\ -0.33 & 1.24 \end{bmatrix}$$

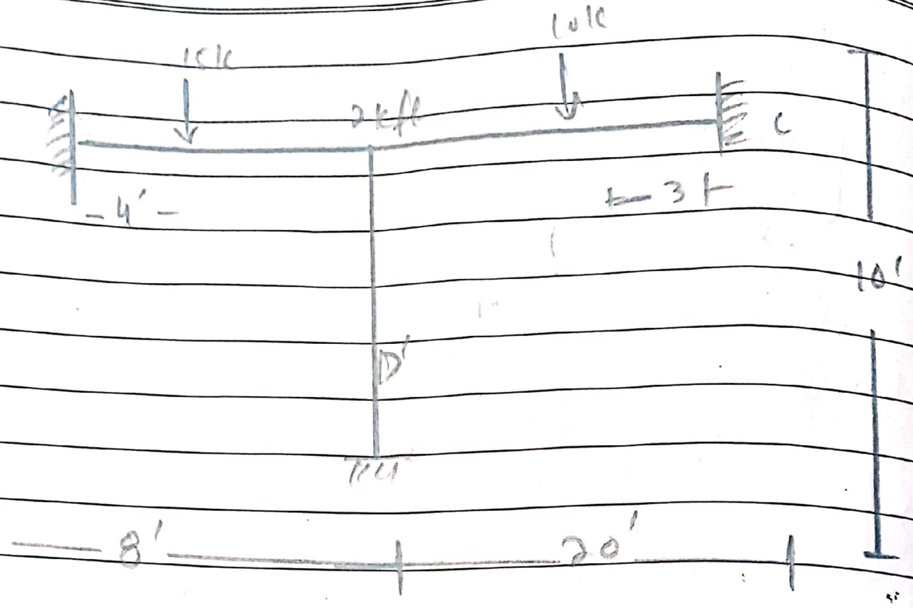
~~Adj~~ A =

Now

$$\begin{bmatrix} AD_1 \\ AD_2 \end{bmatrix} - \begin{bmatrix} ADL_1 \\ ADL_2 \end{bmatrix} = \begin{bmatrix} 0 - 16.04 \\ 4 - 6 \end{bmatrix}$$

$$= \begin{bmatrix} -16.04 \\ -2 \end{bmatrix} E$$

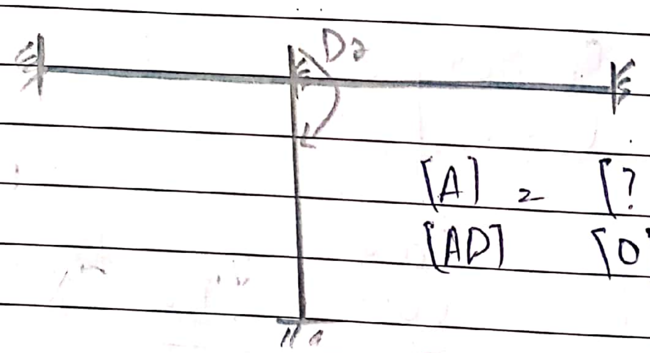
$$\begin{bmatrix} D_1 \\ D_2 \end{bmatrix} = \frac{\begin{bmatrix} 0.67 & -0.33 \\ -0.33 & 1.24 \end{bmatrix}}{0.7219} \times \begin{bmatrix} 16.04 \\ -2 \end{bmatrix}$$




Step .1

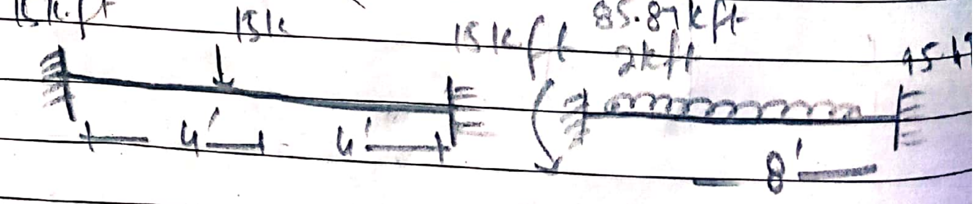
Determine Kinetic Indeterminancy
K.I = 1°

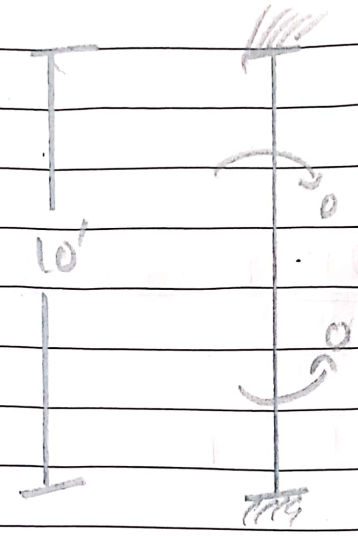
Step: 2
Determine unkown Joint
Displacement

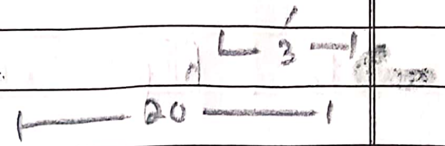



[A] = [? ]
[AD] [0]

Step .3
Compute (ADL) Matrix






→ Point load at center

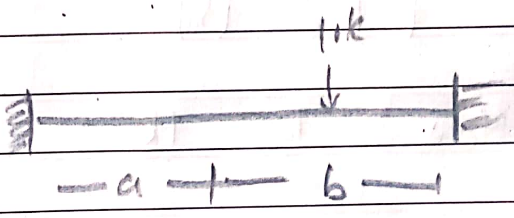
$$\frac{PL}{8} \qquad \frac{(15)(8)}{8} = 15 \text{ kip ft}$$

→ uniformly Disturbuted load

$$\frac{wL^2}{12} \rightarrow \frac{2(20)^2}{12} = 66.67 \text{ kft}$$

→ Point load (Not at Mid)

Suppose




→ For left end

→ $$\frac{Pab^2}{L^2} \Rightarrow \frac{10(12)(8)^2}{(20)^2} = 19.2 \text{ kft}$$

For Right end

$$\frac{Pa^2b}{L^2} = \frac{(10)(12)^2(8)}{(20)^2} = 28.8 \text{ kft}$$

So the total Moment at left end

$$19.2 + 66.67 = 85.87 \text{ kft}$$

Similary at Right end

$$28.8 + 66.67 = 95.47 \text{ kft}$$

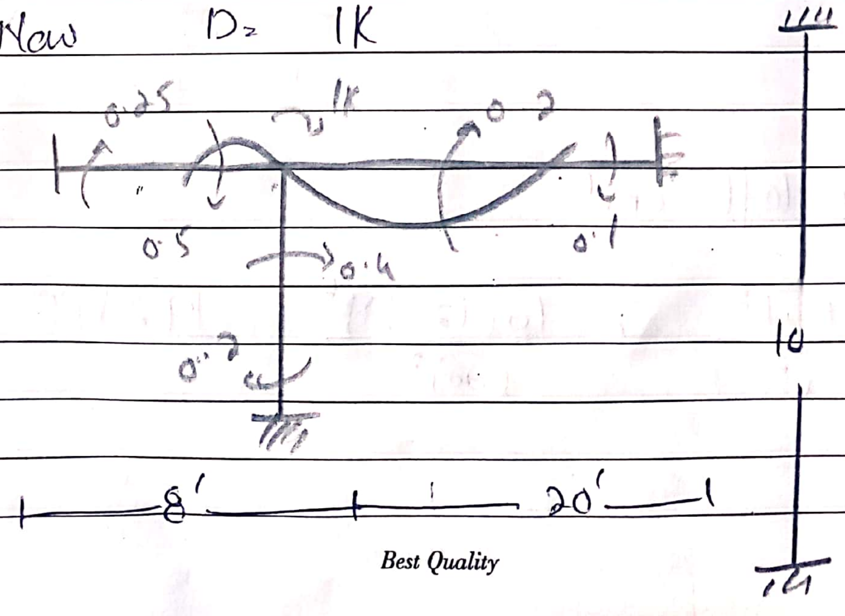
So $[ADL] = -85.87 + 15$

Step : 4

Determine $[S]$ matrix

$$[S] = [S_{11}]$$

Now $D = 1K$



$\frac{4EI}{8} = 0.5$

$\frac{4EI}{20} = 0.2$

$\frac{4EI}{10} = 0.4$

$[S] = (0.5 + 0.4 + 0.2)EI$

$= 1.1EI$

$[S] = 1.1 EI$

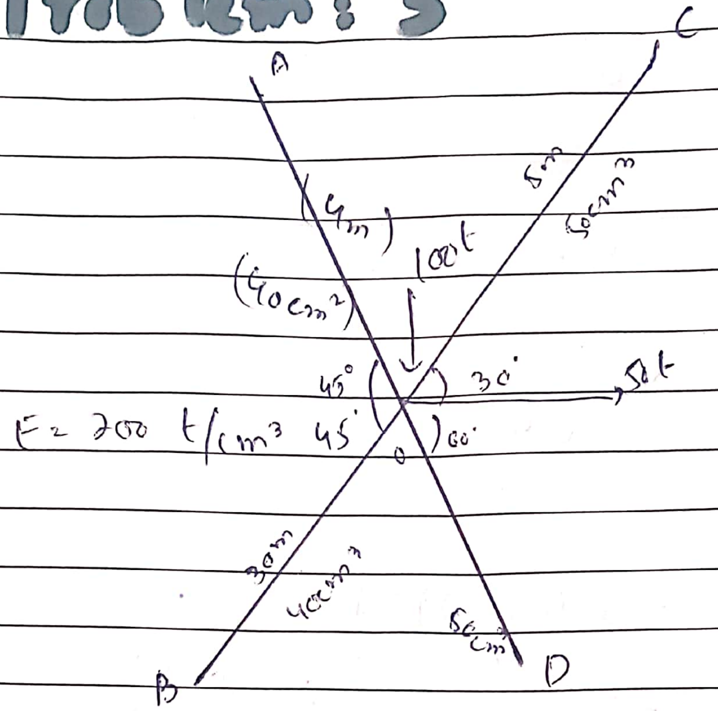
Step 5:
Compute (D) matrix

$[D] = [S]^{-1} \times [AD] - [ADL]$

$= \frac{1}{1.1} \times [0] - [-70.87]$

$= \frac{70.87}{1.1}$

# Problem: 3




Sol:

For A:

$$\sin 45° = \frac{p}{h} = \frac{P}{4}$$

$$P = 2.828 \text{ m}$$

$$\cos 45° = \frac{b}{4}$$

$$b = 2.828 \text{ m}$$

For. B:

~~Sin 45~~

$$\sin 30° = \frac{P}{h=5}$$

$$P = 2.5 \text{ m}$$

Scanned with CamScanner

$\cos 30^\circ = \frac{b}{5}$

$b = 4.33m$

Now

$EA_{(A)} = 2020 \times 40 = 80,000t$
$EA_{(B)} = 2020 \times 40 = 80,000t$
$EA_{(C)} = 2020 \times 50 = 100,000t$
$EA_{(D)} = 2020 \times 50 = 100,000t$

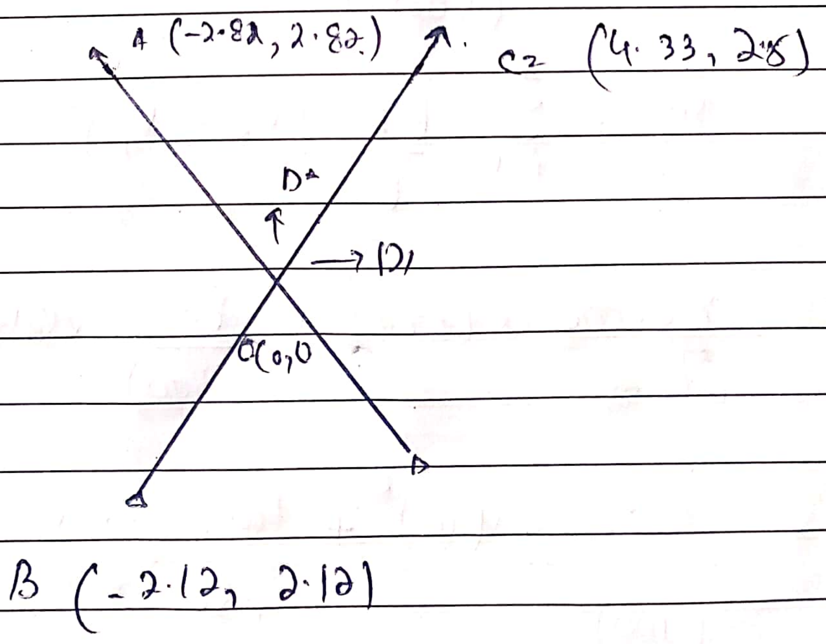
Step .1: K·I

$K.I = 2j - r$

$= 2(5) - 8 = 2^\circ$

Step 2:

Selet unknown joint displaumt



$$\begin{bmatrix} D_1 \\ D_2 \end{bmatrix} = \begin{bmatrix} ? \\ ? \end{bmatrix} , \begin{bmatrix} AD_1 \\ AD_1 \end{bmatrix} = \begin{bmatrix} 50 \\ -100 \end{bmatrix}$$

Step 03

$$[AMD]_{4\times 2} \quad \varepsilon_1 \quad [S]_{2\times 2}$$

i) $D_1 = 1 \quad , \quad D_2 = 0$

$$AMD_{11} = \frac{80000}{(400)^2} \times (0 + 282) = 141$$

$$AMD_{12} = \frac{80000}{(300)^2} \times (0 + 212) = 188.44$$

$$AMD_{21} \quad \frac{100,000}{(400)^2} \times (0 - 200) = -125$$

$$AMD_{31} = \frac{100,000}{(500)^2)} \times (0.433) = -1732$$

Now $s_{11} = \sum_{i=1}^{m} \frac{EA}{L^3} (x_\alpha - X_1)^2$

$$\rightarrow \frac{80,000}{(400)^3} \times (282)^2 + \frac{80,000}{(300)^3} \times (212)^2 +$$

$$\frac{100,000}{(400)^3} \times (400)^2 + \frac{100,000}{(500)^3} \times (-433)^2$$

$S_{11} = 99.405 + 133.107 + 149.991 + 62.5$

$$\boxed{S_{11} = 445.063}$$

$$S_{12} = S_{21} = \sum_{i=1}^{m} \frac{EA}{L^3} \times (X_a - X_j)(Y_\alpha - Y_i)$$

$$\rightarrow \frac{80,000}{(400)^3} \times (282)(-282) + \frac{80,000}{(300)^3} \times (212)(212)$$

$$+ \frac{100,000}{(500)^3} \times (-433)(0-250) + \frac{100,000}{(400)^3} \times (-200)(0+346)$$

$$\boxed{S_{12} = S_{21} = 12.837}$$

ii) $D_1 = 0$ $D_1 = 1k'$

$$AMD = \frac{EA}{L^2}(Y_k - Y_j)$$

$$AMD_{12} = \frac{80,000}{(400)^2}(-282) = -141$$

$$AMD_{22} = \frac{80,000}{(300)^2}(212) = 188.44$$

$$AMD_{32} = \frac{100,000}{500^2}(-250) = -100$$

$$AMD_{42} = \frac{100,000}{400^2}(346) = 216.25$$

$$S_{22} = \sum_{i=1}^{m} \frac{EA}{L^3}\left(Y_k - Y_i\right)^2$$

$$\frac{80,000}{(400)^3}(-282) + \frac{80,000}{(300)^3}(212)^2 +$$

$$\frac{100,000}{(500)^3}(-250)^2 + \frac{(100\,000)}{(400)^3}(346)^2$$

$$\boxed{S_{22} = 469.628}$$

Step: 4

$$[D] = [S]^{-1} \times [AD]$$

$$\begin{bmatrix} D_1 \\ D_2 \end{bmatrix} = \begin{bmatrix} 445.063 & 12.37 \\ 12.237 & 469.628 \end{bmatrix}^{-1} \times \begin{bmatrix} 50 \\ -100 \end{bmatrix}$$

$$\begin{bmatrix} D_1 \\ D_2 \end{bmatrix} = \begin{bmatrix} 0.1183 \\ -0.216 \end{bmatrix}$$

Step 6 [AM]

$$\begin{bmatrix} AM_1 \\ AM_2 \\ AM_3 \\ AM_4 \end{bmatrix} = \begin{bmatrix} 141 & -141 \\ 188.44 & 188.44 \\ -173.2 & -100 \\ -125 & 216.55 \end{bmatrix} \times \begin{bmatrix} 0.1183 \\ -0.210 \end{bmatrix}$$

$$= \begin{bmatrix} 141 \times 0.1183 + (-141) \times (-0.210) \\ 188.44 \times 0.1183 + 188.44 \times (-0.216) \\ -173.2 \times 0.1183 + (-100) \times (-0.216) \\ -125 \times 0.1183 + 216.25 \times (-0.216) \end{bmatrix}$$

$$\begin{bmatrix} AM_1 \\ AM_2 \\ MA_3 \\ AM_4 \end{bmatrix} \begin{bmatrix} 16.68 + 30.46 \\ 22.29 - 40.70 \\ -20.49 + 21.6 \\ -14.79 - -46.71 \end{bmatrix}$$

$$\begin{bmatrix} AM_1 \\ AM_2 \\ AM_3 \\ AM_4 \end{bmatrix} = \begin{bmatrix} 47.136t \\ -18.413t \\ 1.11t \\ -61.498t \end{bmatrix}$$