# Simultaneous Linear Equations



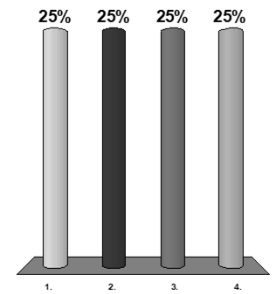
The size of matrix $\begin{bmatrix} 4 & 6 & 7 & 8 \\ 9 & 2 & 3 & 4 \\ 5 & 6 & 7 & 8 \end{bmatrix}$ is

A. $3 \times 4$

B. $4 \times 3$

C. $3 \times 3$

D. $4 \times 4$

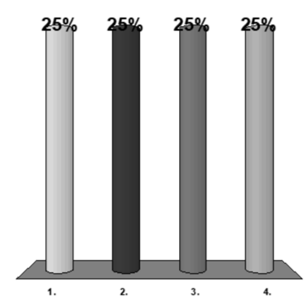





Given $[A] = \begin{bmatrix} 4 & -6 & 3 \\ 1 & 2 & -8 \\ 6 & -5 & -9 \end{bmatrix}, [B] = \begin{bmatrix} 4 & 3 \\ 9 & 7 \\ 4 & -5 \end{bmatrix}$

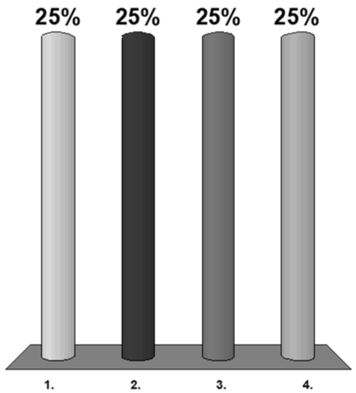
then if $[C]=[A][B]$, then $c_{31}$=_______.

A. -57
B. -45
C. 57
D. does not exist



A square matrix [A] is upper triangular if

1. $a_{ij} = 0, i > j$
2. $a_{ij} = 0, j > i$
3. $a_{ij} \neq 0, i > j$
4. $a_{ij} \neq 0, j > i$

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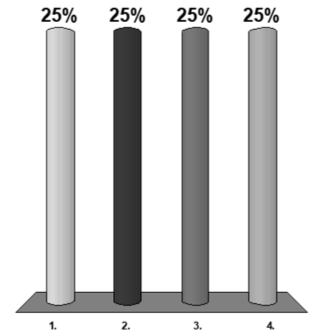
The following system of equations
$x + y=2$
$6x + 6y=12$
has __________solution(s).

1. no
2. one
3. more than one but a finite number of
4. infinite

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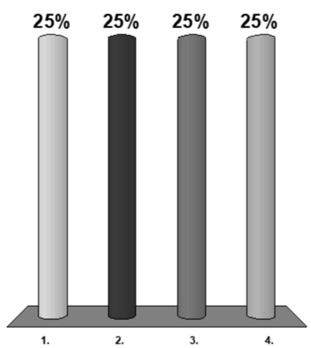
An identity matrix [*I*] needs to satisfy the following

A. $I_{ij} = 0, i \neq j$

B. $I_{ij} = 1, i = j$

C. matrix is square

D. all of the above

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**PHYSICAL PROBLEMS**

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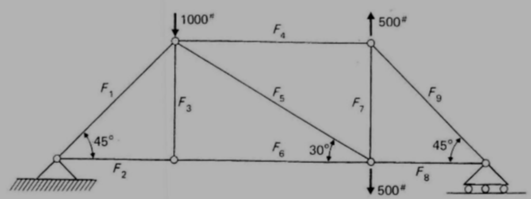
## Truss Problem

$$\begin{bmatrix} 0.7071 & 0 & 0 & -1 & -0.8660 & 0 & 0 & 0 & 0 \\ 0.7071 & 0 & 1 & 0 & 0.5 & 0 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 & 0 & -1 & 0 & 0 & 0 \\ 0 & 0 & -1 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 1 & 0 & 0.7071 \\ 0 & 0 & 0 & 1 & 0 & 0 & 0 & 0 & -0.7071 \\ 0 & 0 & 0 & 0 & 0.8660 & 1 & 0 & -1 & 0 \\ 0 & 0 & 0 & 0 & -0.5 & 0 & -1 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 1 & 0.7071 \end{bmatrix} F = \begin{bmatrix} 0 \\ -1000 \\ 0 \\ 0 \\ 500 \\ 0 \\ 0 \\ -500 \\ 0 \end{bmatrix}$$






## Polynomial Regression

We are to fit the data to the polynomial regression model

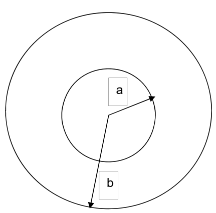
$$(T_1,\alpha_1),(T_2,\alpha_2),\ldots,(T_{n-1},\alpha_{n-1}),(T_n,\alpha_n)$$

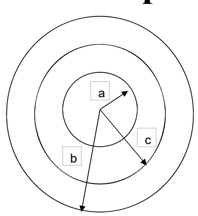
$$\alpha = a_0 + a_1 T + a_2 T^2$$

$$\begin{bmatrix} n & \left(\sum_{i=1}^{n} T_i\right) & \left(\sum_{i=1}^{n} T_i^2\right) \\ \left(\sum_{i=1}^{n} T_i\right) & \left(\sum_{i=1}^{n} T_i^2\right) & \left(\sum_{i=1}^{n} T_i^3\right) \\ \left(\sum_{i=1}^{n} T_i^2\right) & \left(\sum_{i=1}^{n} T_i^3\right) & \left(\sum_{i=1}^{n} T_i^4\right) \end{bmatrix} \begin{bmatrix} a_0 \\ a_1 \\ a_2 \end{bmatrix} = \begin{bmatrix} \sum_{i=1}^{n} \alpha_i \\ \sum_{i=1}^{n} T_i \, \alpha_i \\ \sum_{i=1}^{n} T_i^2 \alpha_i \end{bmatrix}$$



## Pressure vessel problem




$$u_1 = c_1 r + \frac{c_2}{r}$$

$$u_2 = c_3 r + \frac{c_4}{r}$$

$$\begin{bmatrix} 4.2857\times10^{7} & -9.2307\times10^{5} & 0 & 0 \\ 4.2857\times10^{7} & -5.4619\times10^{5} & -4.2857\times10^{7} & 5.4619\times10^{5} \\ -6.5 & -0.15384 & 6.5 & 0.15384 \\ 0 & 0 & 4.2857\times10^{7} & -3.6057\times10^{5} \end{bmatrix} \begin{bmatrix} c_1 \\ c_2 \\ c_3 \\ c_4 \end{bmatrix} = \begin{bmatrix} -7.887\times10^{3} \\ 0 \\ 0.007 \\ 0 \end{bmatrix}$$



# END