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Q:] if $X+Y=\begin{bmatrix}7 & 0\\ 2 & 5\end{bmatrix}$ and $X-Y=\begin{bmatrix}3 & 0\\ 0 & 3\end{bmatrix}$ find X and Y.

$$X+Y=\begin{bmatrix}7 & 0\\ 2 & 5\end{bmatrix} \quad \ldots \text{①}$$

$$X-Y=\begin{bmatrix}3 & 0\\ 0 & 3\end{bmatrix} \quad \ldots \text{②}$$

① + ② add equation ① and ②

$$(X+Y+X-Y)=\begin{bmatrix}7 & 0\\ 2 & 5\end{bmatrix}+\begin{bmatrix}3 & 0\\ 0 & 3\end{bmatrix}$$

$$2X=\begin{bmatrix}10 & 0\\ 2 & 8\end{bmatrix}$$

$$X=\frac{1}{2}\begin{bmatrix}10 & 0\\ 2 & 8\end{bmatrix}=\begin{bmatrix}5 & 0\\ 1 & 4\end{bmatrix}$$

$$\boxed{X=\begin{bmatrix}5 & 0\\ 1 & 4\end{bmatrix}}$$

① − ②

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(1)-(2) Subtract (1)-(2) equation

$$= (x+y-x-y) = \begin{bmatrix} 7 & 0 \\ 2 & 5 \end{bmatrix} - \begin{bmatrix} 3 & 0 \\ 0 & 3 \end{bmatrix}$$

$$= 2y = \begin{bmatrix} 4 & 0 \\ 2 & 2 \end{bmatrix}$$

$$y = \frac{1}{2} \begin{bmatrix} 4 & 0 \\ 2 & 2 \end{bmatrix}$$

$$\boxed{y = \begin{bmatrix} 2 & 0 \\ 1 & 1 \end{bmatrix}}$$

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Q:] $A = \begin{bmatrix} 2 & 3 & -5 \\ 1 & 2 & -1 \end{bmatrix}$ and $B = \begin{bmatrix} 0 & 5 & 1 \\ -2 & 7 & 3 \end{bmatrix}$

find $A+B$ and $A-B$

$$A+B = \begin{bmatrix} 2 & 3 & -5 \\ 1 & 2 & -1 \end{bmatrix} + \begin{bmatrix} 0 & 5 & 1 \\ -2 & 7 & 3 \end{bmatrix}$$

$$A+B = \begin{bmatrix} 2 & 8 & -4 \\ -1 & 9 & 2 \end{bmatrix}$$

$$A-B = \begin{bmatrix} 2 & 3 & -5 \\ 1 & 2 & -1 \end{bmatrix} - \begin{bmatrix} 0 & 5 & 1 \\ -2 & 7 & 3 \end{bmatrix}$$

$$= \begin{bmatrix} 2 & -2 & -6 \\ 3 & -5 & -4 \end{bmatrix}$$

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Q3] if $\begin{vmatrix} x-2 & -3 \\ 3x & 2x \end{vmatrix} = 3$ find x

$= (x-2)(2x) - (3x)(-3) = 3$

$= 2x^2 - 4x + 9x = 3$

$= 2x^2 + 5x = 3$ ... ①

divied x on Both side to equation ①

$= 2x + 5 = 3$

$= 2x = 8$

$= x = \frac{8}{2} = 4$ $\boxed{x = 4}$

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(Q4) Let $\begin{vmatrix} 3 & y \\ x & 1 \end{vmatrix} = \begin{vmatrix} 3 & 2 \\ 4 & 1 \end{vmatrix}$

find the possible value of x and y
x and y natural number

$= 3 - xy = 3 - 8$

$= 3 - xy = -5$

$= xy = -3 - 5$

$= xy = 3 - xy - 5 = 0$ ... (1)

put $x = 1$ in equation (1)

$= 3 - (1)y - 5 = 0$

$= 3 - y - 5$

$= 3 - 5 = y$

$y = 2$

put $y = 1$ in equation (1)

$= 3 - x - 5 = 0$

$= 3 + 5 = x$

$= x = 8$

Or as per equal matrix

$x = 4$ and $Y = 2$ as per equality.

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Q6] find $\vec{a}$ $\vec{b}$

$\vec{a} = 2i + 2j - k$

$\vec{b} = 6i - 3j + 2k$

$A \cdot B = |A||B| \cos\theta$

$A \cdot B = (2i + 2j - k)(6i - 3j + 2k)$

$= 12 - 6 - 2$

$A \cdot B = 12 - 8$

$\boxed{a \cdot b = 4}$

$|A| = \sqrt{4 + 4 + 1} = \sqrt{9}$

$|A| = 3$

$|B| = \sqrt{36 + 9 + 4} = \sqrt{49}$

$|B| = 7$

$A \cdot B \; |A||B| \cos\theta$

$\cos\theta = \frac{A \cdot B}{|A||B|} = \frac{4}{3 \times 7} \quad \cos\theta = \frac{4}{21}$

$\theta = \cos^{-1}(0.190) \Rightarrow \boxed{\theta = 79^\circ}$

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Q5] Find the distance between the points (2, 3, 1) and (-1, 2, -3)

$A = [2, 3, 1)$

$B = [-1, 2, -3)$

Vector Between two points

$= [(-1-2), (2-3), (-3-1)]$

$= [-3, -1, -4]$

Distance Between two Vector point

$A = (2, 3, 1)$

$B = (-1, 2, -3)$

$\text{Distance} = \sqrt{(-1-2)^2 + (2-3)^2 + (-3-1)^2}$

$= \sqrt{(-3)^2 + (-1)^2 + (-4^2)}$

$=$

Distance = 5.099

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(07) A Automobile having a mass of 2000 kg deflects its suspension Springs 0.02 m under Static Condition.
determine the natural frequency of automobile in Vertical direction by assuming damping to be negligible.

→ given

mass of automobile (m) = 2000 kg
Deflection of Suspension Springs (x) = 0.02 m

$k \times 0.02 = 2000 \times 9.81$
$k \times 0.02 = 19620$
$k = \frac{19620}{0.02} = 981000 \text{ N/m}$

$f_n = \frac{1}{2\pi}\sqrt{\frac{k}{m}} = \frac{1}{2\pi}\sqrt{\frac{981000}{2000}}$

$f_n = 3.52 \text{ Hz}$

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(Q8] The Natural frequency of Spring-mass System is found to be 2 Hz, when an additional mass of 1kg is added to the Original mass m. the neutral frequency 1Hz, find Costant k and mass m

→ Since
natural frequency is 2Hz

$$\omega_n = 4\pi = \sqrt{\frac{k}{m}} \quad \ldots (1)$$

(when 1kg added

$$\omega_n = 2\pi = \sqrt{\frac{k}{m+1}} \quad \ldots (2)$$

for Solve k and m

$$0 = \sqrt{k} - 4\pi\sqrt{m} \quad \ldots (3)$$

$$0 = \sqrt{k} - 2\pi\sqrt{m+1}$$

$$(1) \Rightarrow \sqrt{k} = 4\pi\sqrt{m}$$

replace this equation (2)

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$0 = 4\pi\sqrt{m} - 2\pi\sqrt{m+1} = 2\pi\sqrt{m+1} =$

i.e.,

$4\pi\sqrt{m} = \sqrt{m+1} = 2\sqrt{m} = (\sqrt{m+1})^2$

$= (2\sqrt{m})^2 = m+1 = 4m$

$\therefore m+1 = 4m$

$\therefore 3m = 1$

$\therefore m = \frac{1}{3} =$

$\boxed{m = \frac{1}{3}}$ $\boxed{m = 0.331 \text{ kg}}$

Replacing $\sqrt{F} = 4\pi\sqrt{m}$

$\sqrt{F} = 4\pi\sqrt{\frac{1}{3}} = (\sqrt{K})^2$

$= \left(4\pi\sqrt{\frac{1}{3}}\right)^2$

$= K = \frac{16}{3}\pi^2$

$\boxed{K = 52.63 \text{ N/m}}$

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(9) A Spring-mass System has a Neutral period 0.21 Sec
What will be the New period if the Spring is Constant
(a) Increased by 50 per Cent
(b) decreased by 50 percent

→ (A) if spring Constant increases by 50%

$$\text{New period} = \text{Original Time} \times \sqrt{\frac{1}{\text{Spring increase factor}}}$$

$$\text{New time (increase)} = 0.21 \times \sqrt{\frac{1}{1.5}} = \boxed{0.175 \text{ sec}}$$

(B) Spring Constant decreased by 50%

$$\text{New time} = \text{Original time} \times \sqrt{\frac{1}{\text{Spring decrease factor}}}$$

$$\text{New time (decrease)} = 0.21 \times \sqrt{\frac{1}{0.5}} = \boxed{0.305 \text{ sec}}$$