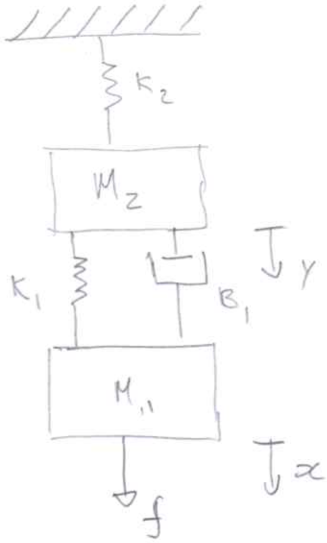
2 d)



its more important to know how do use the tools, then to memorize the answers!

$\boxed{FR = ma}$

$\dfrac{Y_{(s)}}{F_{(s)}} = ?$

functions

$y - y_{(t)}$
$x - x_{(t)}$
$f - f_{(t)}$
$Y - Y_{(s)}$
$X - X_{(s)}$
$F - F_{(s)}$

$$\begin{cases} M_1 \ddot{x} = f - K_1(x-y) - B_1(\dot{x}-\dot{y}) \\ M_2 \ddot{y} = -K_1(y-x) - B_1(\dot{y}-\dot{x}) - K_2 y \end{cases} \quad \begin{cases} s^2 M_1 X = F - K_1 X + K_1 Y - sB_1 X + sB_1 Y \\ s^2 M_2 Y = -K_1 Y + K_1 X - sB_1 Y + sB_1 X - K_2 Y \end{cases}$$

$$\begin{cases} F = (s^2 M_1 + K_1 + sB_1) X - (K_1 + sB_1) Y \\ 0 = (s^2 M_2 + K_1 + sB_1 + K_2) Y - (K_1 + sB_1) X \end{cases}$$

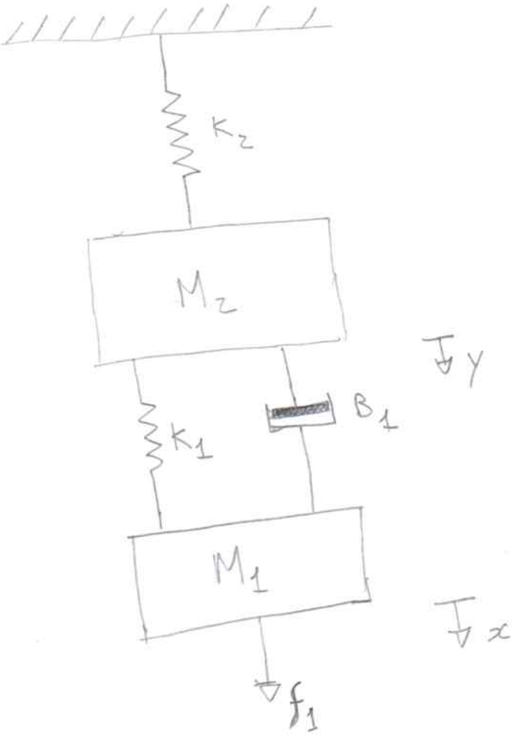
$$\begin{pmatrix} F \\ 0 \end{pmatrix} = \begin{bmatrix} s^2 M_1 + sB_1 + K_1 & -(K_1 + sB_1) \\ -(K_1 + sB_1) & s^2 M_2 + sB_1 + K_1 + K_2 \end{bmatrix} \begin{bmatrix} X \\ Y \end{bmatrix}$$

$$\frac{Y}{F} = \frac{\begin{bmatrix} s^2 M_1 + sB_1 + K_1 & F \\ -(K_1 + sB_1) & 0 \end{bmatrix}}{(s^2 M_1 + sB_1 + K_1)(s^2 M_2 + sB_1 + K_1 + K_2) - (K_1 + sB_1)^2} = \frac{(K_1 + sB_1)\cancel{F}}{\cdots\cdots}$$

Practice

2d)

$$\boxed{\sum F_R = M\,\ddot{x}_{(t)}}$$



$$G_{(s)} = \frac{Y_{(s)}}{F_{(s)}}$$

$x - x_{(t)}$
$y - y_{(t)}$
$f - f_{(t)}$

$$\begin{cases} f_{1(t)} - K_1(x-y) - B_1(\dot{x}-\dot{y}) = M_1\ddot{x} \\ -K_1(y-x) - B_1(\dot{y}-\dot{x}) - K_2(y) = M_2\ddot{y} \end{cases}$$

$$\begin{cases} f_1 - K_1x + K_1y - B_1\dot{x} + B_1\dot{y} = M_1\ddot{x} \\ -K_1y + K_1x - B_1\dot{y} + B_1\dot{x} - K_2y = M_2\ddot{y} \end{cases}$$

$\mathcal{L}$ valores iniciais nulos

$$\mathcal{L}\begin{cases} F_1 - K_1X_{(s)} + K_1Y_{(s)} - SB_1X_{(s)} + SB_1Y_{(s)} = S^2M_1X_{(s)} \\ -K_1Y_{(s)} + K_1X_{(s)} - SB_1Y_{(s)} + SB_1X_{(s)} - K_2Y_{(s)} = S^2M_2Y_{(s)} \end{cases}$$

$$(SB_1+K_1)X_{(s)} = (S^2M_2+K_1+SB_1+K_2)Y_{(s)}$$

$$X_{(s)} = \frac{(S^2M_2+SB_1+K_1+K_2)}{(SB_1+K_1)}Y_{(s)}$$

$$F_{(s)} + (SB_1+K_1)Y_{(s)} = (S^2M_1+K_1+SB_1)X_{(s)}$$

$$= \frac{(S^2M_1+SB_1+K_1)(S^2M_2+SB_1+K_1+K_2)}{(SB_1+K_1)}Y_{(s)}$$