- State the main differences between geometric modeling and physical modeling

a. physical modling is to general a mathmatical model describe the behavior of the system using simple phesics laws with Comprison to a simpler system. and we can test how the model will behave if we chang some Prumiters.

b. ~~gem~~ geometric modling is a 3-D design shows the details of the object and you can animate it but you cant ~~Cal~~ Calculat the forces or transhution of it just a picture without phesycs ~~behind~~ behind it.

- List why a designer needs a CAD or CAM or CIM

a. to help him in adding his imagination ~~and~~, ideas and knowledg in the design on the Computer.

b. manage, plan and control the production process with a direct or indirect interfearance.

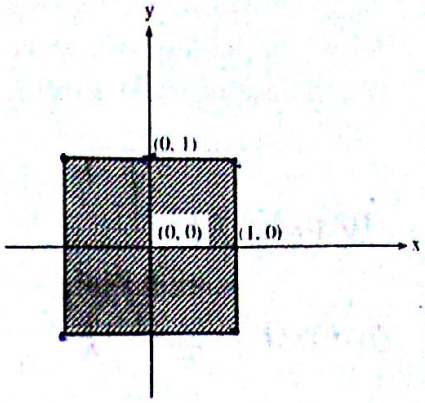
c. Improve the process by increas the quality, increas ~~communication~~ Comunication. and, increas the production.

- Define what is Modeling

- ~~It's using a phesics laws to creat mathmatical discriping for the system.~~

Using mathmatical and phesical equationsand laws to compair the system with a simpler one. and to make Changes to see what the results will be.

- Given the original shape and position of a square in following Figure.
  - Find the configuration matrix C that represents the geometry
  - Use uniform scaling (with respect to the origin) to magnify the object to three times its original size
  - Find the position of vertices of the square when rotated +45 degrees (CCW)



(1)

$$C = \begin{bmatrix} 1 & 1 & -1 & -1 \\ 1 & -1 & -1 & 1 \\ 1 & 1 & 1 & 1 \end{bmatrix}$$

Last row

(2)

$$Scal = \begin{bmatrix} 3 & 0 & 0 \\ 0 & 3 & 0 \\ 0 & 0 & 1 \end{bmatrix}$$

$$C^* = \begin{bmatrix} 3 & 0 & 0 \\ 0 & 3 & 0 \\ 0 & 0 & 1 \end{bmatrix} \begin{bmatrix} 1 & -1 & -1 & -1 \\ 1 & -1 & -1 & 1 \\ 1 & 1 & 1 & 1 \end{bmatrix}$$

$$C^* = \begin{bmatrix} 3 & 3 & -3 & -3 \\ 3 & -3 & -3 & 3 \\ 1 & 1 & 1 & 1 \end{bmatrix}$$

-2

(3)

$$C^* = \begin{bmatrix} \cos(45) & -\sin(45) & 0 \\ \sin(45) & \cos(45) & 0 \\ 0 & 0 & 1 \end{bmatrix} \begin{bmatrix} 1 & 1 & -1 & -1 \\ 1 & -1 & -1 & 1 \end{bmatrix}$$

$$C^* = \begin{bmatrix} 0 & +1 & 0 & -1 \\ 1 & 0 & -1 & 0 \end{bmatrix}$$

For C^* after scaling.

$$C^* = \begin{bmatrix} 0 & 3 & 0 & -3 \\ 3 & 0 & -3 & 0 \end{bmatrix}$$

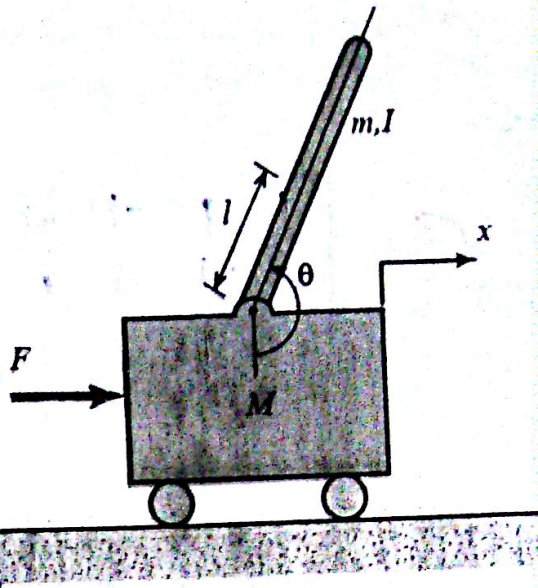
* where is rotation

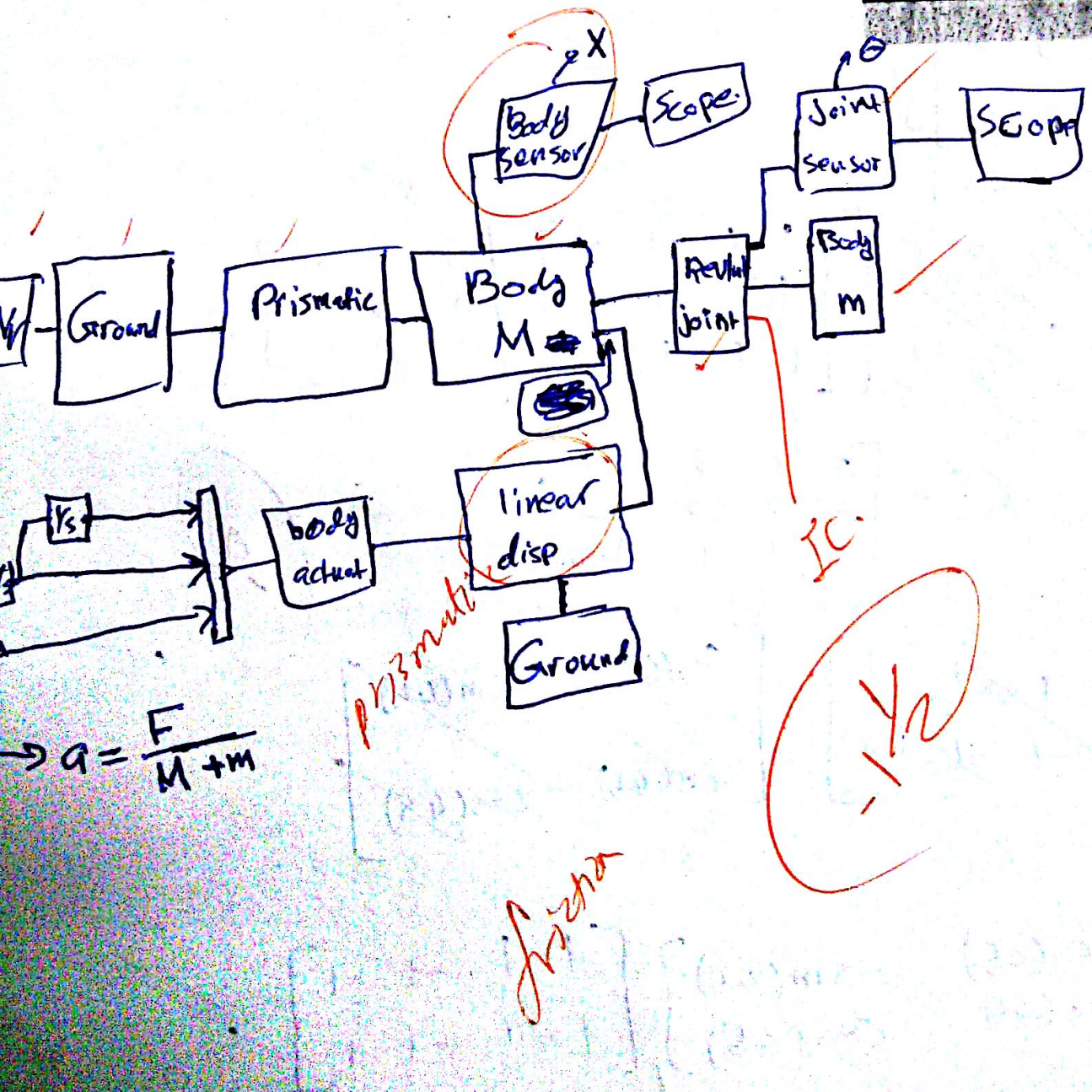
Problem-3 (6pts)

- Consider a two-dimensional version of the inverted pendulum system with cart where the pendulum is constrained to move in the vertical plane shown in the figure below. For this system, the control input is the force F that moves the cart horizontally and the outputs are the angular position of the pendulum Θ and the horizontal position of the cart x.

input F

output θ X.





$\Rightarrow a = \frac{F}{M+m}$